2. CHEMICAL BONDING

✱ Exercise questions

① Define co-ordinate bond and give the conditions for its formation.

→ The bond formed between two atoms by sharing lone pair of electrons which is entirely shared by one of the combining atoms but shared by both the atoms is called co-ordinate bond.

Conditions for formation of co-ordination bond are

(i) One of the two atoms must have at least one lone pair of electrons.

(ii) Another atom should be short of lone pair atleast one.

② What do you understand by lone pair of electrons?

→ ~~Extra pair of electrons present on an atom which can be shared with other atom~~

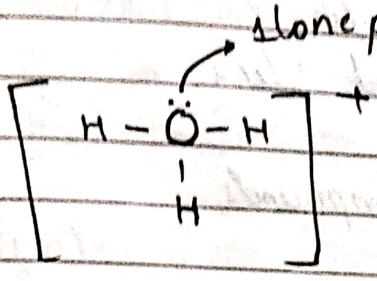
→ Lone pair of electrons are valence pair electron pair which are not exchanged in a covalent bond. These are pair of extra electrons.

③ State the type of bonding in the following molecules
(a) water (b) calcium oxide (c) hydroxyl ion
(d) Methane (e) ammonium ion
(f) ammonium chloride

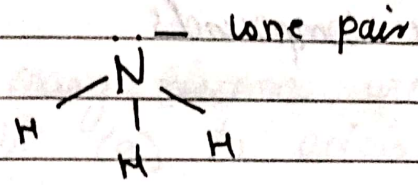
→ (a) covalent bond (b) electrovalent bond (c) co-ordinate bond
(d) covalent bond (e) co-ordinate ion
(f) four covalent bonds between nitrogen and electrovalent bond between ammonium and chloride.

(4) (a) Draw electron dot structure in the following.

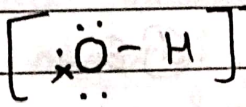
(i) Hydronium ion



(ii) Ammonium ion



(iii) Hydroxyl ion



All these structures show co-ordinate bonding.

(b) State the type of bonding present in them for (a) - Ans: They show co-ordinate bonding

(b) Give two examples in each of the following cases.

— Covalent

(i) Coordinate bond compounds
→ Hydroxyl ion, ammonium chloride, hydronium ion.

(ii) Solid covalent bonds
→ ~~diamond~~ diamond; and silica

(iii) Gaseous polar compounds
→ SO_2, ammonia

(iv) Gaseous non-polar compounds
→ carbon dioxide, Butane

(v) Liquid non-polar compounds
→ toluene, benzene

(5) Element M forms a chloride with the formula MCl_2 which is a solid with high melting point. M would most likely be in the group in which Mg is placed.
(a) Na (b) Mg (c) Al (d) Si

(6) Complete the following

	Sodium	Phosphorus	Carbon
Formula of chloride	NaCl	PCl_5	CCl_4
Nature of bonding	Ionic	Covalent	Covalent
Physical state of chloride	Solid	Solid	Liquid

7. (a) How many atoms of each kind are present in the following molecule: calcium oxide, chlorine, water, carbon tetrachloride?

→ (i) Calcium oxide (CaO) → 1 calcium, 1 oxygen

(ii) Chlorine (Cl_2) - Two ## chlorine atoms

(iii) Water (H_2O) - Two hydrogen and one oxygen atom

(v) Carbon tetrachloride (CCl_4): One carbon and four chlorine atoms

(b) How many electrons are required by each atom mentioned is (a) to attain nearest noble gas configuration

→ Calcium - 2 electrons, oxygen - 2 electrons, Chlorine - 1 electron Hydrogen - 1 electron.

8. Complete the following:

(a) When the nuclei of two different reacting atoms are of unequal mass then the bond formed is called Polar covalent bond. (equal, unequal, polar, non-polar)

(b) In case of non-polar covalent bond, the covalent bond is formed in the middle of atoms and shared electrons are equally distributed (corner, middle, equally, unequally)

(c) Ionic or electrovalent compounds do not conduct electricity in their solid state. (fused, solid)

(d) The ions in electrovalent compounds are held very strongly due to strong electrostatic forces (electrovalent, covalent, electromagnetic, electrostatic).

(g) Compound X consists of molecules.
Choose the letter corresponding to the correct answer from the option A, B, C, D given below:
(i) The type of bonding in X will be
(A) ionic (B) electrovalent
(C) covalent (D) molecular
→ covalent bond is formed between molecules

(ii) X is likely to have a:
(A) low melting point and high boiling point.
(B) high melting point and low boiling point.
(C) low melting point and low boiling point
(D) high melting point and high boiling point
→ low melting and boiling point

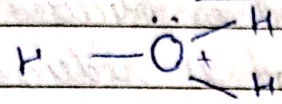
(iii) In the liquid state, X will
(A) become ionic
(B) be an electrolyte
(C) conduct electricity
(D) not conduct electricity.
→ not conduct electricity

(h) (D) a. Electrons are getting added to an element Y:
(i) Is Y oxidised or reduced.
→ Reduced. gain of electrons reduction occurs

(ii) What charge will Y migrate to during the process of electrolysis?
Y will migrate positive charge during electrolysis as it acquires negative charge

(iii) Acids dissolve in water and produce positively charged ions. Draw structure of these positive ions.
Acids give H^+ ions in water e.g HCl forms H^+ ion in water as follows

$$HCl + H_2O \rightarrow H_3O^+ + Cl^-$$



H^+ further forms hydronium ion.

(c) Explain why carbon tetrachloride does not dissolve in water?
Carbon tetrachloride is a non-polar compound and water is polar compound. Water dissolves only polar compounds. Therefore carbon tetrachloride does not dissolve in water

(d) (a) Elements Q and S react together to form an ionic compound. Under normal conditions which physical state will the compound QS exist in?
Solid State, because usually ionic compounds exists in solid states

(b) Can Q and S both be metals? Justify your answer.
Ionic bonds are formed when one element loose electrons and other gains electron i.e. bond is formed between metal and non metal. Therefore Q & S both cannot be metals.

(c) The property which is characteristic of an electrovalent compound is that:
A. it is easily vaporized
B. it has a high melting point
C. it is a weak electrolyte
D. it often exist as a liquid.
→ It has high melting point

(d) When a metal atom becomes an ion:
A. It looses electrons and is oxidized.
B. It gains electrons and is reduced
C. It gains electrons and is oxidized
D. It looses electrons and is reduced
→ It looses electrons and is oxidised

(2) (a) In the formation of magnesium chloride (by direct combination between magnesium and chlorine) name the substance that oxidised and substance that is reduced.
→ Substance oxidised is Magnesium as it looses electrons and chlorine molecule undergoes reduction due to gain of electrons.

(b) What are the terms defined below?
(i) A bond formed by a shared pair of electrons, each bonding atom contributing one electron to the pair.
→ Covalent bond

(ii) A bond formed by a shared pair of electrons with both electrons coming from same atom.
→ Co-ordinate bond.

$Be = Be$

$:\ddot{N}: \quad \ddot{N} \quad N \equiv N \quad \ddot{N} \equiv N$

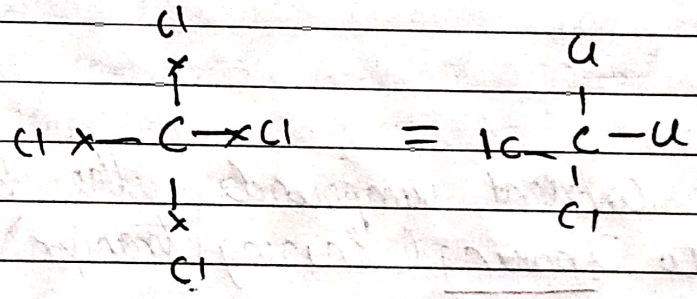
2009

(a) The one which is composed of all three kinds of bond [ionic, covalent and coordinate bond]

A. Sodium chloride B. Ammonia C) Carbon-tetrachloride D. Ammonium chloride

→ Ammonium chloride.

(b) Draw the structural formula of carbon tetrachloride and state the type of bond present in it



Four covalent bonds are formed between carbon and chlorine by sharing of one electron each.

2010

(a) Select the correct answer from A, B, C, D, metals lose electrons during ionization. this change is called.

A) Oxidation B) Reduction C) Redox

D) Displacement

→ Oxidation

(b) Select the right answer –

(i) Sodium chloride – covalent bond / ionic bond / covalent and coordinate bond.

→ Ionic bond

(ii) Ammonium ion – covalent bond / ionic bond / covalent and co-ordinate bond)

→ Co-ordinate bond

(iii) Carbon tetrachloride – covalent bond / ionic bond / covalent and coordinate bond.

→ Covalent bond

2011

(a) (i) In covalent compounds, the bond is formed due to sharing (sharing / transfer) of electrons

(ii) Electrovalent compounds have a high (high / low) melting point.

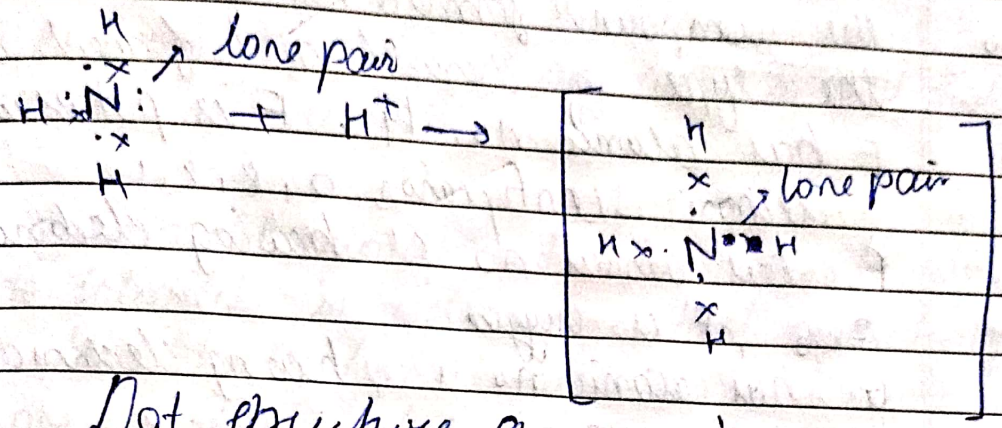
(iii) A molecule of nitrogen has triple bond (hydrogen, ammonia, nitrogen)

(b) By drawing an electron dot diagram, show the lone pair effect leading to the formation of ammonium ion from ammonia gas and hydrogen ion.

—— continue

NH_4^+

Ammonium ion

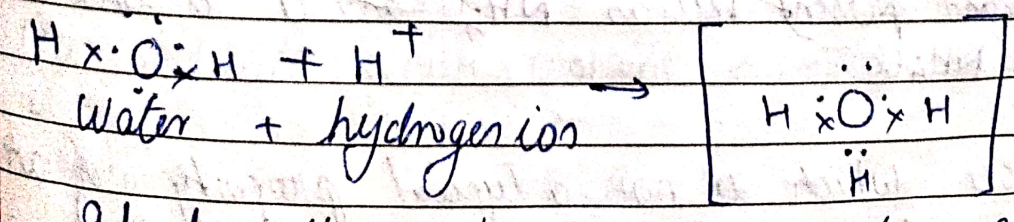


Dot structure of ammonium ion

Give reason- Hydrogen chloride can be termed as a polar ~~compound~~ covalent compound
Chlorine has more electronegativity as compared to hydrogen. Therfore chlorine pulls bonded pair of electron towards itself. This results in the formation of polar covalent compound between hydrogen and chlorine

2012

Draw an electron dot diagram of hydronium ion. State the type of bonding present in it.



It has three bond and one lone pair.

(b) There are three elements E, F, G with atomic number 19, 8, 7. Give molecular formula of the compound formed between E and G and state the type of chemical bond formed in it.

→ E has atomic no. 19, E is potassium having electronic configration 2, 8, 8, 1
F has atomic no 8 having electronic configration 2, 6, F is oxygen
G has atomic no 7, having electronic configration 2, 5, G is nitrogen
Molecular formula between E and G is K_3N
Bond formed between E & G will be ionic bond.

2013

(a) A chemical term for. A bond formed by a shared pair of electrons with both electrons coming from same atom.

→ Coordinate bond

(b) Among the compound, identify the compound that has three bonds [ionic, covalent and coordinate bond]
A. Ammonia ✓B. Ammonium chloride
C. Sodium hydroxide D. Calcium chloride

→ Ammonium chloride, nitrogen is covalently bond with three hydrogens and forms coordinate bond with fourth hydrogen bond present between NH_4^+ and Cl^- is ionic bond.
NH_4Cl

(c) State which is not a typical property of an ionic compound.

— Solution

A. High M.P
B. Conducts electricity in molten and aqueous state
C. Are insoluble in water
D. But oppositely charged ions even in solid state are insoluble in water.

3) Compare carbon tetrachloride and sodium chloride with regard to solubility in water and electrical conductivity.
Carbon tetrachloride form covalent bond therfore it does not conduct electricity whereas sodium chloride forms ionic bond and conducts electricity.
Carbon tetrachloride (CCl_4) is insoluble in water because water is polar compound and carbon ~~tetrachloride~~ tetrachloride is non-polar compound and it cannot dissolve in polar solvent. Whereas Sodium chloride is soluble in water being a polar compound.

2014
(a) Compound 'X' consist of only molecules. 'X' will have -
A) Crystalline hard structure
B) A low m.p and low b.p
C) An ionic bond
D) A strong force of attraction between its molecules.

4) The molecule which contains a triple covalent bond is.
A ammonia
B methane
C water
✓D. nitrogen
Nitrogen.

c. Give one word or phrase for the following
formation of ions from molecule
→ Ionization

d. Give a reason why covalent compound exist as gases, liquid or soft solids.
→ Covalent compounds have weak force of attraction between their molecules. Therefore they exist in liquid, gas or soft solid forms

2016

a) The following table shows the electronic configration of the elements W, X, Y, Z.

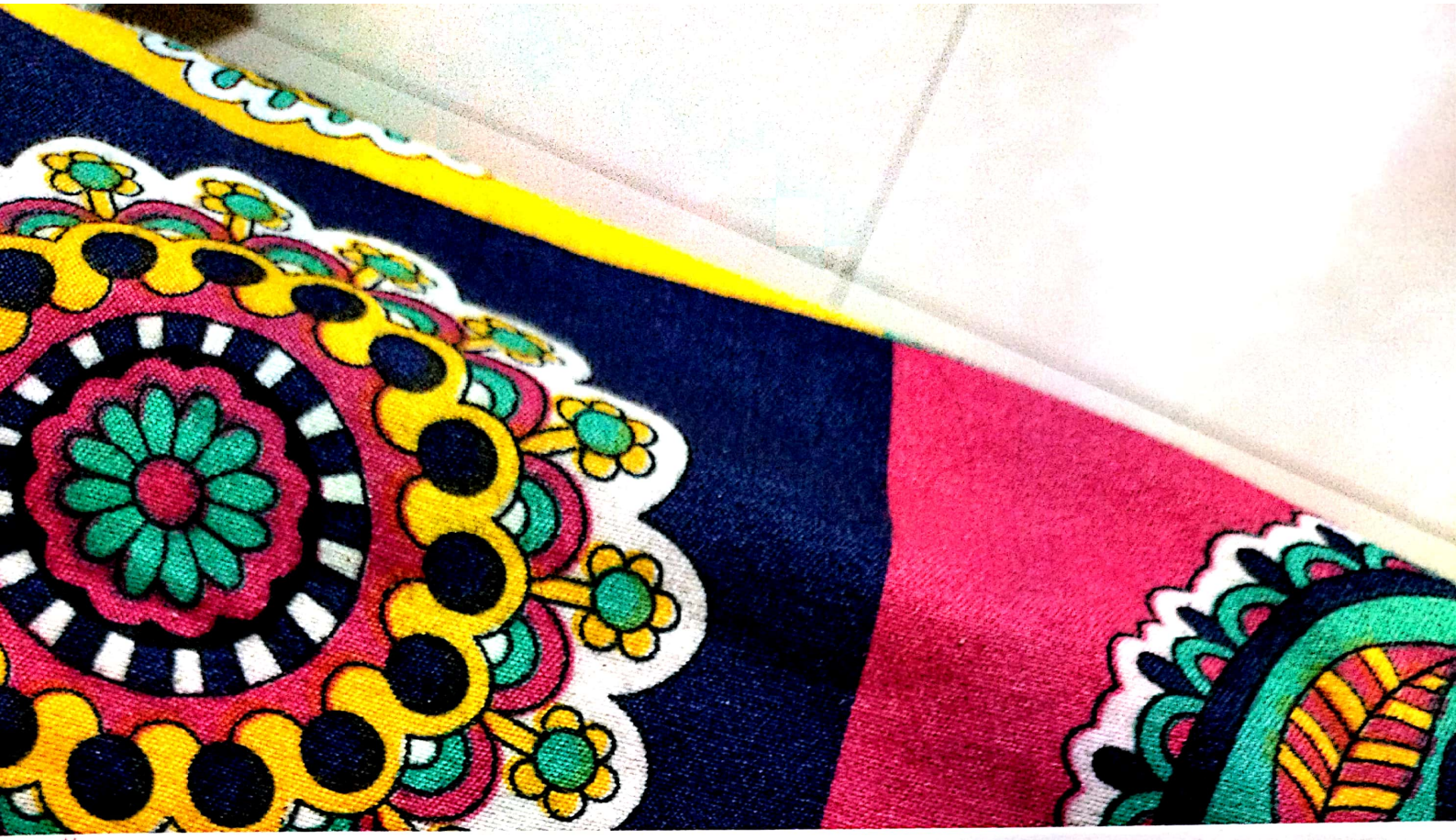
Element	W	X	Y	Z
Electronic configration	2,8,1	2,8,7	2,5	1

Answer the following questions based on the table above

(i) What type of Bond is formed between
1) W and X. 2. Y and Z
→ (i) Electrovalent bond (ii) Covalent bond
→ W = Sodium Y - Nitrogen
X - Chlorine Z = Hydrogen
electrons shared by both.

(ii) What is the formula of the compound formed between
(1) X and Z 2. W & X

— continue



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XZ_3
NF_3

Na^+Cl^-
~~XZ~~ WX