CBSE Test Paper 03

Chapter 03 Metal and Non Metals

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1. Which of the following has electrovalent bond(s)?

   A. CaF

   B. NaCl

   C. MgO

   D. CO_2

   a. A and C
   b. A, B and C
   c. All of these
   d. C and D

2. $2Fe_2O_3 + 3C \rightarrow 4Fe + 3CO$ In the above reaction 'C' acts as**: (1)**
   a. Dehydrating agent
   b. Reducing agent
   c. Oxidising agent
   d. Catalyst

3. During smelting, an additional substance is added which combines with impurities to form a fusible product known as**: (1)**
   a. Flux
   b. Slag
   c. Gangue
   d. Mud

4. $P_4 + NaOH + 3H_2O \rightarrow X + 3NaH_2PO_2$ What does 'X' indicate here? **(1)**
   a. PH_3
   b. P_2O_3
   c. P_2O_5
   d. H_3PO_4

5. The common method for extraction of metals from the oxide ore is**: (1)**
   a. Reduction with aluminium
   b. Reduction with hydrogen

c. Reduction with carbon
d. Electrolytic method

6. Why copper is used to make hot water tanks and not steel? **(1)**

7. Name the iron compound in haematite. Write its chemical formula. **(1)**

8. Why do some metals like, Na, K, Ca, Mg not occur in nature as free elements? **(1)**

9. Write chemical equation for reaction taking place when: Manganese dioxide is heated with aluminium powder. **(1)**

10. Royal water is prepared by mixing two acids A and B. It can dissolve gold and platinum. It is highly corrosive and fuming liquid. Identify A and B. What is the ratio in which A and B are mixed? **(3)**

11. i. Distinguish between 'roasting' and 'calcination'. Which of these two is used for sulphide ores and why?
    ii. Write a chemical equation to illustrate the use of aluminium for joining cracked railway lines.
    iii. Name the anode, the cathode and the electrolyte used in the electrolytic refining of impure copper. **(3)**

12. Why are noble gases unreactive? **(3)**

13. What is an alloy? Give the composition of an alloy? Give the composition of an alloy called magnalium. Give its two uses. **(3)**

14. i. Hydrogen is not a metal but it has been assigned a place in the reactivity series of metals. Explain.
    ii. How would you show that silver is chemically less reactive than copper? **(5)**

15. What is ionic or electrovalent bond? How is it formed? **(5)**

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Answers

1. b. A, B and C
   Explanation: Carbon is a tetravalent element and does not lose or gain electrons easily to form electrovalent bonds. It forms covalent bonds with other elements.
2. b. Reducing agent
   Explanation: Carbon acts as a reducing agent and gets oxidised in the process of reducing iron oxide to iron.
3. b. Slag
   Explanation: During the smelting of iron, limestone is added as a flux. The temperature inside the blast furnace decomposes limestone to calcium oxide which removes silicate impurity. Impurities like silicon are passed into the slag. The metal is separated from the molten slag.
   $CaCO_3$ à CaO + CO_2 ; CaO + SiO_2 à $CaSiO_3$ (Slag)
4. a. PH_3
   Explanation: Product X in the reaction indicates **phosphine** (IUPAC name: **phosphane**). The other product is sodium hypophosphite.
5. c. Reduction with carbon
   Explanation: The common method of reduction of a metal oxide to the metal involves heating the metal oxide with a reducing agent such as carbon. The reducing agent (C) combines with oxygen, gets oxidised (to CO) and reduces the metal oxide to its metal. The reaction is:
   $M_yO_z + zC \rightarrow yM + zCO$ (y and z are positive integers)
6. Copper is used to make hot water tanks because it is a good conductor of heat in comparison to steel.
7. Iron (III) oxide is the compound of iron in haematite. Its chemical formula is Fe_2O_3.

8. Metals like Na, K, etc (alkali metals) and Ca, Mg etc (alkaline earth metals) are very reactive and hence they react with atmosphere oxygen and carbon dioxide and also with other non-metals like sulphur present in the earth's crust to form compounds like oxides, carbonates, sulphides, sulphates and chlorides. So they do not occur in free state, but are found in the form of the above compounds.

9. $3MnO_2(s) + 2Al\ (s) \rightarrow 2Al_2O_3\ (s) + 3Mn\ (s)$

   Aluminium powder is a reducing agent. These displacement reactions are so exothermic that the metals are produced in the molten state.

10. The royal water called aqua regia is the mixture of 3 parts of HCl and 1 part of HNO_3.

    It is used by the jewellers to clean the gold ornaments.

11. i. Roasting: It is the process in which sulphide ores of the metals are converted into oxides by heating them in the presence of excess air. For example, zinc sulphide is converted into zinc oxide by roasting.

    $$2ZnS\,(s) + 3O_2(g) \underset{Roasting}{\overset{Heat}{\longrightarrow}} 2ZnO\,(s) + 2SO_2\,(g)$$

    Calcination: It is the process in which carbonate ores of the metals are decomposed into oxides by heating them in the absence or limited air. For example, zinc carbonate is decomposed into zinc oxide and carbon dioxide by calcination.

    $$ZnCO_2\,(s) \underset{Calcination}{\overset{Heat}{\longrightarrow}} ZnO\,(s) + CO_2\,(g)$$

    ii. Out of roasting and calcination, only roasting is used for sulphide ores. This is because it is easier to obtain metal from its oxide as compared to its sulphide.

    $$\underset{Iron(III)\ Oxide}{Fe_2O_3\,(s)} + \underset{\text{Aluminium}}{2AI\,(s)} \overset{\Delta}{\longrightarrow} \underset{Molten\ iron}{2Fe\,(l)} + \underset{\text{AluminiumOxide}}{A_2O_3\,(s)}$$

    iii. Anode - Impure copper

    Cathode - Strip of pure copper

    Electrolyte - Acidified copper sulphate solution.

12. Elements of group 0 are called noble gases. These elements have stable arrangements of electrons in their outermost shell. The chemical reactivity of a group highly depends on the number of electrons in the outermost shell. A stable element generally has 8 electrons in their outermost shell with some exceptions of elements with higher

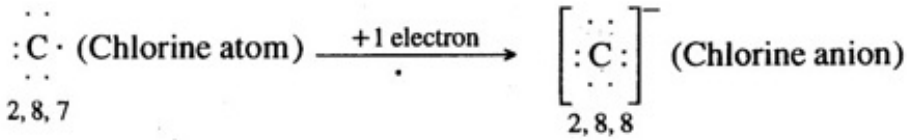
atomic masses and helium. If the element has less than 8 and greater than 4 electrons in their outermost shell of the valence shell it will undergo a chemical reaction to gain some electrons from a different element whereas if it has less than four electrons in the valence shell it tends to lose them all in order to gain a stable state.
However, in case of noble gases or group 0 elements the outermost shell contains 8 electrons (2 in case of Helium) which is a stable state configuration. Hence, they are chemically unreactive or inert.

13. An alloy is a homogeneous mixture of two or more metals or a metal and non-metal. For example, brass is an alloy of copper and zinc.
Composition of magnalium: Al : 85 - 99%
Mg : 15-1%
Uses.
    i. Being light and hard, it is used in making light instruments.
    ii. It is used in making parts of automobiles, pressure cooker etc.
14. i. Though hydrogen is not a metal but even then it has been assigned a place in the activity series. The reason is that like metals, hydrogen also has a tendency to lose electron and forms a positive ion H^+.
    The metals which lose electrons less readily than hydrogen are placed below it and the metals which lose electrons more readily than hydrogen are placed above it in the reactivity series of metals.
    ii. By displacement reaction silver can be shown to be chemically less reactive than copper or copper is more reactive than silver. If a piece of silver is immersed in a solution of copper sulphate, no reaction will take place because silver is less reactive than copper and will not displace copper from the copper sulphate solution.
    $CuSO_4(aq) + Ag(s) \rightarrow No reaction$
    On the other hand, if a copper plate is placed in a solution of silver nitrate, copper will slowly displace silver from the solution and blue solution of copper nitrate is formed.
    $\underset{Colourless}{2AgNO_3(aq)} + Cu(s) \rightarrow \underset{Blue}{Cu(NO_3)_2(aq)} + 2Ag(s)$
    This shows that copper is more reactive than silver.

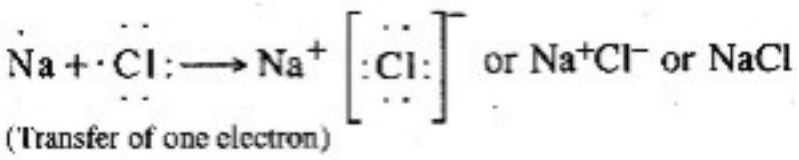
15. Ionic or Electrovalent bond may be defined as:
A bond which is formed between two different atoms by the transfer of one ore more electrons from one atom to the other atom.
Formation of Ionic Bond. We have stated that the ionic bond is formed by the transfer of electrons from one atom to the other atom. Actually, both the atoms taking part in the bond formation have incomplete outermost energy shells. For example, let us take the example of Na and Cl atoms. Na atom has one valence electron (2, 8, 1). Similarly, Cl atom has seven valence electrons (2, 8, 7). Both these atoms take part in bond formation to have eight electrons in the valence shell. Sodium loses the only electron present in the valence shell and forms a cation:

Na (sodium atom) $2,8,1 \xrightarrow{-1\ electron}$ Na^+ (sodium cation) $2,8$

The electron released by sodium atom is taken up by the chlorine atom which has already seven valence electrons. Chlorine changes to an anion as follows



Both the Na^+ ion and Cl^- ion have stable electronic configuration.Na^+ ion has the configuration of the noble gas neon. Similarly, Cl^- ion has the configuration of noble gas argon. The oppositely charged ions are attracted towards each other. The attraction leads to the formation of ionic bond which is also called electrovalent bond. The formation of NaCl may be represented as follows:



The formation of ionic bond can also be shown as follows: