Chapter 3 Metals and Non-Metals

Very Short Answer Type Question [1 Mark]

Q. A green layer is gradually formed on a copper plate left exposed to air for a week in a bathroom. What could this green substance be?

Answer. It is due to the formation of basic copper carbonate [$CuC0_3.Cu(0H)_2$].

Q. A non-metal X exists in two different forms Y and Z. Y is the hardest natural substance, whereas Z is a good conductor of electricity. Identify X, Y and Z.

Answer. 'X' is carbon, 'Y' is diamond as it is the hardest natural substance and 'Z' is graphite as it is good conductor of electricity.

Q. Why does calcium float in water?

Answer. It is because hydrogen gas is formed which sticks to surface of calcium, therefore it floats. –

Q. Name a non-metal which is lustrous and a metal which is non-lustrous. Iodine is a non-metal which is lustrous,

Answer. lead is a non-lustrous metal.

Q. Which gas is liberated when a metal reacts with an acid? How will you test the presence of this gas?

Answer. Hydrogen gas is formed. Bring a burning matchstick near to it, H2 will burn explosively with 'pop' sound.

Q. Name the metal which reacts with a very dilute HNOs to evolve hydrogen gas.

Answer. Magnesium

Q. Name two metals which are found in nature in the free state.

Answer. (i) Gold (ii) Silver

Q. What is the valency of silicon with atomic number 14?

Answer. Its valency is equal to 4.

Q. What is the valency of phosphorus with atomic number 15?

Answer. Phosphorus has valency 3.

Q. What is the valency of an element with atomic number 35?

Answer. Its valency is 1.

Q. Arrange the following metals in the decreasing order of reactivity: Na, K, Cu, Ag.

Answer. K > Na > Cu > Ag

Short Answer Type Questions [2 Marks]

Q. Write one example of each of
(i) a metal which is so soft that, it can be cut with knife and a non-metal which is the hardest sustance.
(ii) a metal and a non-metal which exist as liquid at room temperature.

Answer.
(i) Sodium, carbon (diamond).
(ii)Mercury is liquid metal, bromine is liquid non-metal.

Q. Mention the names of the metals for the following:
(i) Two metals which are alloyed with iron to make stainless steel.
(ii) Two metals which are used to make jewellary.

Answer.
(i) Nickel and chromium.
(ii) Gold and platinum.

Q. Give reason for the following:
(a) School bells are made up of metals.
(b) Electric wires are made up of copper.

Answer.
(a) It is because metals are sonorous, i.e. they produce sound when struk with a hard substance.
(b) It-is because copper is good conductor of electricity.

Q. Name the following:
(a) A metal, which is preserved in kerosene.
(b) A lustrous coloured non-metal.
(c) A metal, which can melt while kept on palm.
(d) A metal, which is a poor conductor of heat.

Answer.
(a) Sodium is preserved in kerosene.
(b) Iodine is lustrous coloured non-metal.
(c) Gallium. `
(d) Lead.

Q. Explain why calcium metal after reacting with water starts floating on its * surface. Write the chemical equation for the reaction. Name one more metal that starts floating after some time when immersed in water.

Answer. Calcium starts floating because the bubbles of hydrogen gas formed stick to the surface of metal.

$$Ca(s) + 2H_2O(l) \longrightarrow Ca(OH)_2 + H_2(g)$$

Magnesium reacts with hot water and starts floating due to the bubbles of hydrogen gas sticking to its surface.

Q. Give reason for the following:
(a) Aluminium oxide is considered as an amphoteric oxide.
(b) Ionic compounds conduct electricity in molten state.

Answer.
(a) It is because it reacts with acids as well as bases to produce salts and water.'Al' is less electropositive metal. So, it forms amphoteric oxide which can react with acid as well as base.
(b) Ionic compounds can conduct electricity in molten state because ions ' become free to move in molten state.

Q. The way, metals like sodium, magnesium and iron react with air and water is an indication of their relative positions in the 'reactivity series'. Is this statement true ?

Justify your answer with examples.

Answer. Yes, sodium reacts explosively even with cold water, it is most reactive. Magnesium reacts with hot water, it is less reactive than Na. Iron reacts only with steam which shows it is least reactive among the three.

Q. $X + YSO_4$——-> $XSO_4 + Y$
$Y + XSO_4$ ——–> No reaction
Out of the two elements, 'X' and 'Y', which is more reactive and why?

Answer. 'X' is more reactive than 'Y' because it displaces 'Y' from its salt solution.

Q. What is an alloy? State the constituents of solder. Which property of solder makes it suitable for welding electrical wires?

Answer. Alloy is a homogeneous mixture of two or more metals. One of them can be a non-metal also. Solder consists of lead and tin. It has low melting point which makes it suitable for welding electrical wires.

Q. Using the electronic configurations, explain how magnesium atom combines with oxygen atom to form magnesium oxide by transfer of electrons.

Answer.

$Mg(12) = 2, 8, 2$

$$Mg \longrightarrow Mg^{2+} + 2e^-$$

$2, 8, 2 \qquad 2, 8$

$O(8) = 2, 6$

$$O + 2e^- \longrightarrow O^{2-}$$

$2, 6 \qquad 2, 8$

$(Mg)^{2+}$ $(\ddot{O})^{2-}$

Q. When a metal X is treated with cold water, it gives a base Y with molecular formula XOH (Molecular mass = 40) and liberates a gas Z which easily catches fire. Identify X, Y and Z.

Answer.

$$2Na + 2H_2O \longrightarrow 2NaOH + H_2(g)$$

'X' 'Y' 'Z'

'X' is sodium, 'Y' is sodium hydroxide, 'Z' is H_2 (g).

Q. Write chemical equations that shows aluminium oxide reacts with acid as well as base.

Answer.

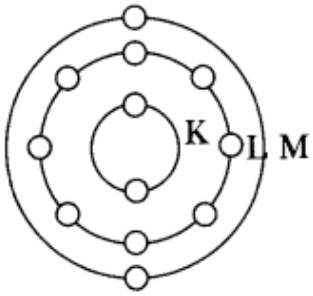
$$Al_2O_3 + 6HCl \longrightarrow 2AlCl_3 + 3H_2O$$

$$Al_2O_3 + 2NaOH \longrightarrow 2NaAlO_2 + H_2O$$

Q. Elements magnesium and oxygen respectively belong to group 2 and group 16 of the Modern Periodic Table. If the atomic numbers of magnesium and oxygen are 12 and 8 respectively, draw their electronic configurations and show the process of formation of their compound by transfer of electrons.

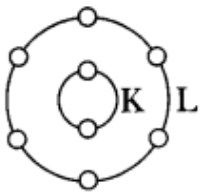
Answer.

(Mg)=2,8,2



K = 2, L = 8, M = 2

O(8) = 2, 6



K = 2, L = 6

$Mg \rightleftharpoons \dot{\underset{\times}{\underset{\times}{O}}}: (Mg^{2+})\ (\dot{\underset{\times}{\underset{\times}{O}}}:^{2-})$

Short Answer Type Questions [3 Marks]

Q. State three reasons for the following facts

(i) Sulphur is a non-metal
(ii)Magnesium is a metal
One of the reasons must be supported with a chemical equation.

Answer.

Sulphur is a non-metal	Magnesium is a metal
(*i*) Poor conductor of heat and electricity.	(*i*) Good conductor heat and electricity.
(*ii*) Neither malleable nor ductile.	(*ii*) Malleable and ductile.
(*iii*) $S + O_2 \longrightarrow SO_2$ $SO_2 + H_2O \longrightarrow H_2SO_3$ (Sulphurous acid) Sulphur dioxide is acidic oxide.	(*iii*) $2Mg + O_2 \longrightarrow 2MgO$ $MgO + H_2O \longrightarrow Mg(OH)_2$ (Magnesium hydroxide) Magnesium oxide is basic in nature.

Q. What is cinnabar? How is metal extracted from cinnabar? Explain briefly.

Answer. Cinnabar is HgS.
Mercury is obtained by roasting cinnabar. HgO formed is thermally unstable and gives mercury.

$$2HgS(s) + O_2(g) \longrightarrow HgO(s) + SO_2(g)$$

$$2HgO(s) \xrightarrow{\text{heat}} Hg(l) + O_2(g)$$

or

$$HgS + O_2 \longrightarrow Hg + SO_2$$

Mercury can be purified by distillation.

Q. (a) Write the electron dot structures for potassium and chlorine.
(b) Show the formation of KCl by the transfer of electrons.
(c) Name the ions present in the compound, KCl.

Answer.

(*a*) K· :Cl:

2, 8, 8, 1 2, 8, 7

(*b*) $K \longrightarrow K^+ + e^-$

$Cl + e^- \longrightarrow Cl^-$

 $(K^+)(:Cl:^-)$ or KCl

(*c*) KCl has K^+ and Cl^-.

Q. (a)State the electron-dot structure for calcium and sulphur.
(b) Show the formation of CaS by the transfer of electrons.
(c) Name the ions present in this compound CaS. Atomic number of Ca = 20, O = 16.

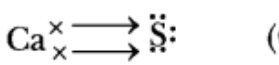
Answer.

(*a*) Ca: :S:

2, 8, 8, 2 2, 8, 6

(*b*) $Ca \longrightarrow Ca^{2+} + 2e^-$

$S + 2e^- \longrightarrow S^{2-}$

 (Ca^{2+}) $(:S:^{2-})$

(*c*) Ca^{2+} and S^{2-} ions are present in CaS.

Q. You are given samples of three metals. Sodium, magnesium and copper. Suggest any two activities to arrange them in order of decreasing activity.

Answer. Activity 1: Sodium reacts with cold water vigorously to form sodium hydroxide and hydrogen gas

$$2Na\ (s) + 2H_2O\ (l) \xrightarrow[\text{cold}]{} 2NaOH\ (aq) + H_2\ (g)$$

Magnesium does not react with cold water but with hot water to form magnesium ! hydroxide and hydrogen gas.

$$Mg\ (s) + 2H_2O \xrightarrow[(\text{hot})]{} Mg(OH)_2\ (aq) + H_2\ (g)$$

Hence sodium is more reactive than magnesium.

Activity 2: $Mg\ (s) + CuSO_4\ (aq) \longrightarrow MgSO_4\ (aq) + Cu\ (s)$

$Cu\ (s) + MgSO_4\ (aq) \longrightarrow$ No reaction

Q. You are provided with magnesium ribbon and sulpher powder. Explain with the help of an activity that metal oxides are basic and non-metal oxide are acidic in nature.

Answer.
Aim: To test the nature of oxides formed by metals and non-metals. Materials Required: Sulphur powder, Mg ribbon, water, blue litmus paper, red litmus paper.
Procedure:
1.Take magnesium ribbon with a pair of tongs and
burn it in flame in the presence of air.
2.Collect the product formed and dissolve it in warm water.
3.Add red litmus paper into it.
4.Observe the change in colour and decide the nature of the oxide formed.

5.Burn sulphur in a deflagrating spoon in the presence of air and dissolve the oxide formed in water.
6.Dip blue litmus paper into the solution and observe the changein the colour and decide the nature of the oxide formed.
Observation: The oxide formed by metal turns red litmus blue whereas oxide of non-metal turns blue litmus red.

Chemical Reactions :

$$2Mg(s) + O_2(g) \xrightarrow{\text{burning}} 2MgO(s)$$

$$MgO(s) + H_2O(\text{hot}) \longrightarrow Mg(OH)_2(aq)$$

Magnesium oxide (Basic oxide) — Water — Magnesium hydroxide

$$S(s) + O_2(g) \longrightarrow SO_2(g)$$

$$SO_2(g) + H_2O(l) \longrightarrow H_2SO_3(aq)$$

Sulphur dioxide (Acidic oxide) — Water — Sulphurous acid

Conclusion: Most of the metallic oxides are basic in nature whereas most of the non-metallic oxides are acidic in nature.

Q. Suggest a method of reduction for the following metals during their metallurgical processes:
(i) metal 'A' which is one of the last, second or third position in the reactivity.
(ii) metal 'B' which gives vigorous reaction even with water and air.
(iii) metal 'C' which is kept in the middle df activity series.

Answer.
(i) 'A' can be obtained by chemical reduction using carbon or carbon monoxide as reducing agent.
(ii) 'B' can be obtained by electrolytic reduction.
(iii) 'C' can be reduced by reducing agent like 'Al'.

Q. (a) Explain the formation of ionic compound CaO with electron dot structure. Atomic number of calcium and oxygen are 20 and 8 respectively.
(b) Name the constituent metals of bronze.

Answer.

(a) $Ca \longrightarrow Ca^{2+} + 2e^-$

2, 8, 8, 2 — 2, 8, 8

$O + 2e^- \longrightarrow O^{2-}$

2, 6 — 2, 8

(Ca^{2+}) $(\ddot{\underset{\times}{\underset{\times}{O}}}:^{2-})$

(b) Bronze is made up of copper and tin.

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Q. A metal 'X' acquires a green colour coating on its surface on exposure to air.
(i) Identify the metal 'X' and name the process responsible for this change.
(ii)Name and write chemical formula of the green coating formed on the metal.
(iii) List two important methods to prevent the process.

Answer.
(i) Metal is copper. The process is corrosion.
(ii)Basic copper carbonate [$CuCO_3.Cu(0H)_2$].
(iii)

• It should be coated with tin
• It should be mixed with other metals to form alloys.

Q. Write balanced equations for the reaction of:
(i) aluminium when heated in air. Write the name of the product.
(ii) iron with steam. Name the product obtained.
(iii) calcium with water. Why does calcium start floating in water?

Answer.

(*i*) $4Al + 3O_2 \xrightarrow{heat} 2Al_2O_3$.

The product formed is aluminium oxide.

(*ii*) $3Fe + 4H_2O$ (steam) $\longrightarrow Fe_3O_4 + 4H_2$

The product obtained is iron(II) iron (III) oxide.

(*iii*) $Ca + 2H_2O \longrightarrow Ca(OH)_2 + H_2$

The bubbles of hydrogen stick to the surface of metal that is why it floats.

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Q. Write balanced chemical equations for the following reactions:
(a) Dilute sulphuric acid reacts with aluminium powder.
(b) Dilute hydrochloric acid reacts with sodium carbonate.
(c) Carbon dioxide is passed through lime water.

Answer.

(*a*) $2Al(s) + 3H_2SO_4(dil.) \longrightarrow Al_2(SO_4)_3\ (aq) + 3H_2(g)$

(*b*) $Na_2CO_3(s) + 2HCl(dil.) \longrightarrow 2NaCl(aq) + H_2O(l) + CO_2(g)$

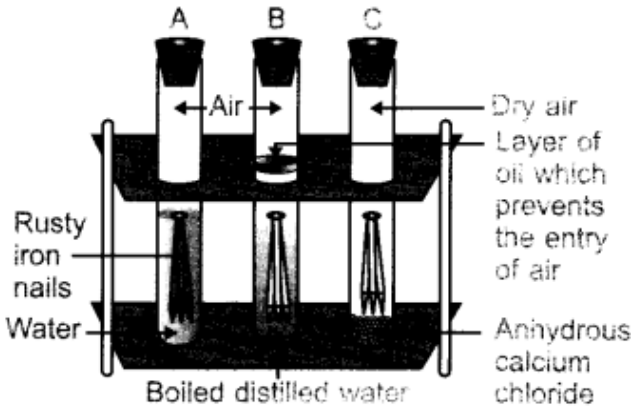
(*c*) $Ca(OH)_2(aq.) + CO_2(g) \longrightarrow CaCO_3(s) + H_2O(l)$

Lime water (white ppt)

Q. What is meant by 'rusting'? With labelled diagrams, describe an activity to find out the conditions under which iron rusts.

Answer. The process in which iron reacts with oxygen in the presence of moisture to form reddish brown coating of hydrated ferric oxide [Iron (III) oxide].$Fe2O_3$ xH_20

Activity:
(i) Take three boiling tubes A, B and C.
(ii) Pour some water in test tube A Put iron nails in it and cork it.
(iii) Pour boiled distilled water in another test tube B and put iron nails in it. Add 1 ml of ojl over it such that oil flo'ats over it and prevents the air from entering.
(iv) Take some iron nails in test tube C and put some anhydrous calcium chloride in it and cork it.
(v) Leave all the three test tubes for one day and then observe.



Observation: Iron nails get rusted in test tube A because both air and water are present in it. Iron nails do not get rusted in B because there is water but no air. In C, rusting will not take place because there is neither air nor water. Conclusion: Iron gets rusted in the presence of air and water.

Q. (a) Show the formation of Na_2O by the transfer of electrons between the combining atoms.
(b) Why are ionic compounds usually hard?
(c) How is it that ionic compounds in the solid state do not conduct electricity but they do so when in molten state?

Answer.

(a) $Na^{\times} \rightarrow \dot{\underset{\cdot\cdot}{O}}: \longleftarrow Na^{\times} \longrightarrow (Na^+)_2 (\dot{\underset{\cdot\cdot}{\overset{\times}{O}}}:)^{2-}$

(b) It is due to strong force of attraction between oppositely charged ions.
(c) In solid state, ions are not free to move whereas in molten state ions are free to move, therefore, they conduct electricity in molten state.

Q. (a) Show on a diagram the transfer of electrons between the atoms in the formation of MgO. Write symbols of cation and anion present in MgO.
(b) Name the solvent in which ionic compounds are generally soluble.
(c) Why are aqueous solutions of ionic compounds able to conduct electricity?

Answer.

(a) $Mg \overset{\times}{\underset{\times}{\rightarrow}} \dot{\underset{\cdot\cdot}{O}}: \longrightarrow (Mg)^{2+} (\dot{\underset{\cdot\cdot}{\overset{\times}{O}}}:)^{2-}$

MgO contains Mg^{2+} as cation and O^{2-} as anion.

(b) Ionic compounds are soluble in water.

(c) It is because aqueous solutions consist of ions which can move freely in them and carry current.

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(c) It is because aqueous solutions consist of ions which can move freely in them and carry current.

Q. What are amphoteric oxides? Choose the amphoteric oxides from amongst the following oxides:
Na_2O, ZnO, Al_2O_3, CO_2, H_2O

Answer. Those oxides which reacts with acids as well as bases to produce salts and water are called amphoteric oxides, e.g. Na_2O, ZnO, are amphoteric oxides among given oxides.

Q. Define the terms:
(i) mineral

(ii) ore, and
(iii) gangue.

Answer.
(i) Mineral: It is a naturally occurring substance from which metal may or may not be extracted profitably or economically, e.g. A1 cannot be extracted profitably from mica.
(ii)Ore: It is a rocky material which contains sufficient quantity of mineral so that metal can be extracted profitably, e.g. zinc blende is an ore of zinc from which zinc can be extracted profitably.
(iii) Gangue: It is a rocky material which is present along with the mineral in the ore, e.g. FeO is gangue in extraction of copper.

Q. An ore on heating in air produces sulphur dioxide. Which process would you suggest for its concentration? Describe briefly any two steps involved in the conversion of this concentrated ore into related metal.

Answer. It is concentrated by froth-floatation process.
(i) Roasting: The concentrated sulphide ore is heated strongly in the presence of oxygen to convert it into its oxide.

$$2ZnS(s) + 3O_2(g) \longrightarrow 2ZnO(s) + 2SO_2(g)$$

(ii)Reduction : This oxide of metal is reduced with suitable reducing agent to get free metal.

$$ZnO(s) + C(s) \xrightarrow{\text{heat}} Zn(s) + CO(g)$$

Q. Give reasons for the following observations:
(i) Ionic compounds in general have high melting and boiling points.
(ii) Highly reactive metals cannot be obtained from their oxides by heating them with carbon.
(iii) Copper vessels get a green coat when left exposed to air in the rainy season.

Answer. (i) Ionic compounds have high melting and boiling points due to strong force of attraction between oppositely charged ions.
(ii) It is because these metals themselves are strong reducing agents. Therefore, cannot be reduced by reducing agent like carbon.
(iii) Copper vessels react with CO_2, O_2 and moisture to form green-coloured basic copper carbonate [$CuCO_3.Cu(OH)_2$].

Q. State reasons for the following observations:
(i) The shining surface of some metals becomes dull when exposed to air for a long time.
(ii) Zinc fails to evolve hydrogen gas on reacting with dilute nitric acid.
(iii) Metal sulphides occur mainly in rocks but metal halides occur mostly in sea and lake waters.

Answer.
(i) It is because metal reacts with substances present in atmosphere to form surface compounds which make it dull.
(ii) It is because dil. HNOs is an oxidising agent therefore zinc gives NO and notH_2 with dil. HNOs.
(iii) It is because sea water contains sodium chloride due to which metal halides are formed, whereas sulphur is found below rocks. Therefore, metal – sulphides are formed in rocks.

Q. State reasons for the following:
(i) Electric wires are covered with rubber like material.
(ii)From dilute hydrochloric acid, zinc can liberate hydrogen gas but copper cannot.
(iii) Sulphide ore of a metal is first converted to its oxide to extract the metal from it.

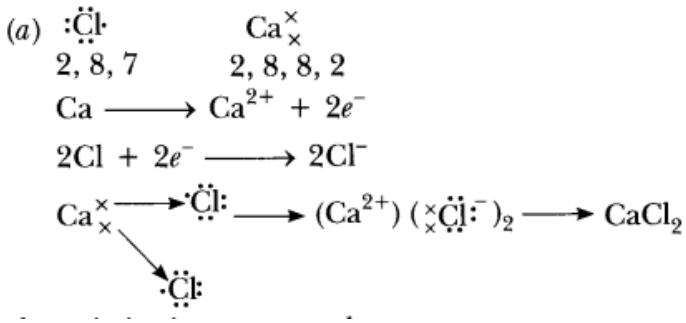
Answer.
(i) It is because rubber is an insulator and does not allow current to flow through it.
(ii) Zinc is more reactive than hydrogen. Therefore, it can displace hydrogen from dilute HCl whereas

copper cannot, because it is less reactive than hydrogen. ,
(iii) It is because it is easier to reduce oxide ore as compared to sulphide ore.

Long Answer Type Question [5 Marks]

Q. (a) Write electron dot diagram for chlorine (At No. 17) and calcium (At No. 20). Show the formation of calcium chloride by transfer of electrons.
(b) Identify the nature of above compound'and explain three physical properties of such compound.

Answer.



(b) It is ionic compound.
Physical properties
1.It is hard and solid.
2.It has high melting and boiling point.
3.It soluble in water.

Q. (a) An ore on treatment with dilute hydrochloric acid produces brisk effervesces. What type of ore is this? What steps will be required to obtain metal from the enriched ore. ,
(b) Copper coin is kept immersed in silver nitrate solution for some time. What change will take place in coin and colour of the solution ? Write balanced chemical equation of the reaction involved.

Answer.
(a) Carbonate ore:
(i) Calcination: Carbonate ore is heated in limited supply of air and oxide is obtained, e.g.

$$ZnCO_3\ (s) \xrightarrow{\text{heat}} ZnO\ (s) + CO_2\ (g)$$

(ii) **Reduction with carbon:** Oxide ore is heated with carbon

$$ZnO\ (s) + C\ (s) \longrightarrow Zn\ (s) + CO\ (g)$$

(b) Copper, being more reactive than silver will displace silver from silver nitrate solution and there will be deposition of silver on copper coin. The colour of solution will turn to blue.

$$Cu\ (s) + 2AgNO_3\ (aq) \longrightarrow Cu(NO_3)_2\ (aq) + 2Ag\ (s)$$

Q. (a) Define activity series of metals. Arrange the metals gold, copper, iron and magnesium in order of their increase in reactivity.
(b) What will you observe when:
(i) Some zinc pieces are put in copper sulphate solution.
(ii) Some silver pieces are put into green coloured ferrous sulphate solution.

Answer.
(a) The series of metals in which metals are arranged in decreasing order of their reactivity.
Au < Cu < Fe < Mg is increasing order of reactivity.
(b) (i) The blue solution will become colourless and reddish brown copper metal will be deposited.

$$Zn\ (s) + \underset{\text{Blue}}{CuSO_4\ (aq)} \longrightarrow \underset{\text{colourless}}{ZnSO_4\ (aq)} + \underset{\text{(reddish brown)}}{Cu\ (s)}$$

(*ii*) $Ag\ (s) + FeSO_4\ (aq) \longrightarrow$ No reaction

Reaction will not take place because 'Ag' is less reactive than iron.

Reaction will not take place because Ag' is less reactive than iron.

Q. (a) Write the chemical name of the coating that forms on silver and copper articles when these are left exposed to moist air.
(b) Explain what is galvanisation. What purpose is served by it?
(c) Define an alloy. How are alloys prepared? How do the properties of iron change when:
(i) small quantity of carbon,
(ii) nickel and chromium are mixed with it.

Answer.
(a) Ag_2S (silver sulphide) is formed on silver, basic copper carbonate $CuCO_3$. $CU(OH)_2$ is formed on copper.
(b) The process of coating zinc over iron is called galvanisation. It is used to prevent rusting of iron.
(c) Alloy is a homogeneous mixture of two or more metals. One of them can be non-metal. Alloys are prepared by melting two or more metals together.
(?) Iron does not rust on adding small,quantity of carbon.
(ii) When we form alloy of iron with nickel and chromium, we get stainless steel which is malleable and does not get rusted.

Q. (a) Differentiate between roasting and calcination. Explain the two with the help of suitable chemical equations. How is zinc extracted from its ore?
(b) Name two metals that can be used to reduce metal oxides to metals.

Answer.
(a) Roasting: It is a process in which sulphide ore is heated in the presence of oxygen to convert into oxide.

$$2ZnS + 3O_2 \longrightarrow 2ZnO + 2SO_2$$

Cali ination: It is a process in which carbonate ore is heated in the absence of air to form oxide.

$$ZnCO_3(s) \xrightarrow{\text{heat}} ZnO(s) + CO_2(g)$$

By reduction process, Zn can be extracted from its ore.

$$\text{Reduction: } ZnO + C \longrightarrow \underset{\text{zinc}}{Zn} + CO_2$$

(b) Aluminium, Magnesium.

Q. (a) In the formation of compound between two atoms A and B, A loses two electrons and B gains one electron.
(i) What is the nature of bond between A and B?
(ii) Suggest the formula of the compound formed between A and B.
(b) On similar lines explain the formation of $MgCl_2$ molecule.
(c) Common salt conducts electricity only in the molten state. Why?
(d) Why is melting point of NaCl high?

Answer.

(a) (i) Ionic bond

(ii) $(A^{2+})(:\ddot{B}:^{-})_2$, *i.e.* AB_2

(b) $Mg \longrightarrow Mg^{2+} + 2e^-$

$2Cl + 2e^- \longrightarrow 2Cl^-$

$(Mg^{2+})\ (:\ddot{\underset{\times}{Cl}}:^{-})_2$

(c) Na^+ and Cl^- are free to move in molten state but not in solid state.

(d) It is due to strong force of attraction between Na^+ and Cl^-.

Q. (a) Carbon cannot be used as reducing agent to obtain Mg from MgO. Why?
(b) How is sodium obtained from molten sodium chloride? Give equation of the reactions.
(c) How is copper obtained from its sulphide ore? Give equations of the reactions.

Answer.
(a) It is because 'Mg' is stronger reducing agent than carbon.
(b) Sodium is obtained from molten NaCl by electrolysis.

$$\underset{\text{(Molten)}}{2NaCl} \xrightarrow{\text{electrolysis}} 2Na(s) + Cl_2(g)$$

(c) Copper ore is concentrated by froth-floatation process.

Roasting: $2Cu_2S + 3O_2 \longrightarrow 2Cu_2O + 2SO_2$

Bassemerisation: Copper oxide reacts with Cu_2S on heating to form Blister copper and SO_2.

$$Cu_2S + 2Cu_2O \longrightarrow 6Cu + SO_2$$

Blister Copper is purified by electrolytic refining.

Q. How is the method of extraction of metals high up in the reactivity series different from that for metals in the middle ? Why the same process cannot be applied for them? Explain giving equations, the extraction of sodium.

Answer. Metals high up in the series are obtained by electrolytic reduction because these metals are strong reducing agents and therefore, cannot be obtained by chemical reduction.
Metals in middle of series are less reactive and can be obtained by chemical reduction. The same process can not be used for both of them as highly reactive metals can not be obtained by chemical reduction.
Extraction of sodium is done by electrolysis of molten sodium chloride.

$$\underset{\text{(Molten)}}{2NaCl} \xrightarrow{\text{electrolysis}} 2Na(s) + Cl_2(g)$$

Q. Write the names and symbols of two most reactive metals. Explain by drawing electronic structure how any one of the two metals react with a halogen. State any four physical properties of the compound formed.

Answer. K(Potassium) and Na(Sodium) are the two most reactive metals. K' and Na' are electronic structures as they have one valence electron.

$$K^{\bullet} + :\ddot{\underset{\times}{F}}: \longrightarrow K^+[:\ddot{\underset{\times}{F}}:]^{\ominus}$$

or

$$Na^{\bullet} + :\ddot{\underset{\times}{F}}: \longrightarrow [Na]^+\ [:\ddot{\underset{\times}{F}}:]^{\ominus}$$

where 'F' is a halogen.
Four physical properties of the compounds formed by these elements and

halogens are:
(i) They have high melting point.
(ii)They are soluble in water.
(iii) They conduct electricity in molten state not in solid state.
(iv) They are solid and somewhat hard.

Q. A metal 'M' which is one of the best conductor of heat and electricity used in making electric wires is found in nature as sulphide ore M2S?
(i) Name the metal 'M'
(ii) Which process will be suitable for extraction of this metal M from its ore M2S? Write the balanced chemical reactions involved in the process of ' extraction.
(iii) With the help of a labelled diagram, explain the process of electrolytic refining of the metal.

Answer.
(i) Copper

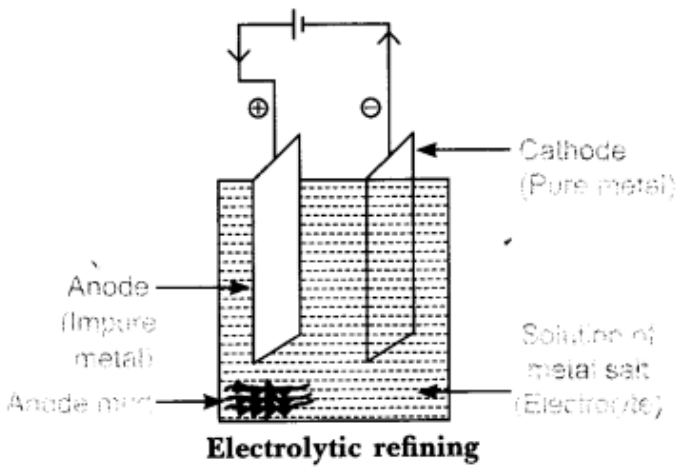
Roasting: $2Cu_2S + 3O_2 \longrightarrow 2Cu_2O + 2SO_2$

Bassemerisation: $Cu_2S + 2Cu_2O \longrightarrow 6Cu + SO_2$

(ii) It is concentrated by froth-floatation process.
Impure copper is purified by electrolytic refining.
(iii) Impure metal is taken as anode whereas pure metal is taken as cathode.iSoluble salt of metal is taken as electrolyte. When electric current is ipassed, impure metal changes to ions which gain electrons at cathode
iand change into pure metal. Impurities are left behind as anode mud.

At anode: $M(s) \longrightarrow M^{n+}(aq) + ne^-$
Impure

At cathode: $M^{n+}(aq) + ne^- \longrightarrow M(s)$
Pure



Electrolytic refining

Q. Give reasons for the following:
(i) Silver and copper lose their shine when they are exposed to air. Name the substance formed on their surface in each case.
(ii) Tarnished copper vessels are cleaned with tamarind juice.
(iii) Aluminium is more reactive than iron yet there is less corrosion of aluminium as compared to iron when both are exposed to air.

Answer.
(i) These metals get corroded. Silver forms black Ag2S (silver sulphide) and copper form greenish layer of basic copper carbonate $CuCO_3$. $CU(OH)_2$.
(ii) Tamarind contains acid which reacts with basic copper carbonate and product gets dissolved and

removed from copper vessel.
(in) Aluminium forms oxide layer on its surface which does not further react with air.

Q. (a) Write the electron dot structures of sodium, oxygen and magnesium.
(b) Show the formation of Na_2O and MgO by transfer of electrons. Name the ions present in these compound.
(c) List three properties of ionic compounds.

Answer.

(a) $Na^{\cdot}$, $:\ddot{O}:$, $Mg:$

(b) $Na^{\times} \searrow$
$Na^{\times} \nearrow \ddot{O}: \longrightarrow (Na^+)_2 (\overset{\times}{\underset{\times}{\ddot{O}}}:^{2-})$

$Mg^{\times}_{\times} \rightrightarrows \ddot{O}: \longrightarrow (Mg^{2+})(\overset{\times}{\underset{\times}{\ddot{O}}}:^{2-})$

Na_2O contains Na^+ and O^{2-} ions.

MgO contains Mg^{2+} and O^{2-} ions.

(i) They are solids having high melting point.
(ii) They are soluble in water.
(iii) They conduct electricity in molten state as well as in aqueous solution.

Q. What are alloys? How are they made? Name the constituents and uses of brass, bronze and solder.

Answer. Alloys are homogeneous mixtures of two or more metals. One of them can be a non-metal also. They are made by melting a metal which is in large amount first and then adding the other metal. ,
Brass contains copper and zinc. It is used for making decorative articles. Bronze contains copper and tin. It is used for making statues and medals. Solder contains lead and tin. It is used for soldering purposes.

Q. A metal (E) is stored under kerosene. When a small piece of it is left open in the air, it catches fire. When the product formed is dissolved in water, it turns red litmus to blue.
(i) Name the metal (E).
(ii)Write the chemical equation for the reaction when it is exposed to air and when the product is dissolved in water.
(iii) Explain the process by which the metal is obtained from its molten chloride.

Answer.
(i) 'E' is sodium which catches fire in presence of moisture.

(*i*) 'E' is sodium which catches fire in presence of moisture.

(*ii*) $4Na + O_2 \longrightarrow 2Na_2O$

$Na_2O + H_2O \longrightarrow 2NaOH$

(*iii*) Electrolytic reduction: Electric current is passed through molten NaCl. Sodium is formed at cathode and chlorine gas is liberated at anode.

$$2NaCl \underset{\text{Molten}}{\xrightarrow{\text{electrolysis}}} 2Na + Cl_2$$

(iii) Electrolytic reduction: Electric current is passed through molten NaCl. Sodium is formed at cathode and chlorine gas is liberated at anode.

Q. Write two differences between calcination and roasting.

Answer.

Calcination	Roasting
(*i*) It is carried out by heating ore in the absence of air. (*ii*) It converts carbonate ores into oxides.	(*i*) It is carried out by heating ore in the presence of air. (*ii*) It converts sulphide ores into oxides.

Q. (a) Name the main ore of mercury. How is mercury obtained from its ore? Give balanced chemical equation.
(b) What is thermite reaction? How is it used to join the railway tracks or cracked machine parts?
(c) Name the method used to extract metals of high reactivity.

Answer.
(a) Cinnabar
Mercury is obtained from its ore by roasting.

$$HgS + O_2 \longrightarrow Hg + SO_2$$

(b) When aluminium is heated with Fe203 to get molten iron, it is called thermite reaction.

$$Fe_2O_3 + 2Al \longrightarrow Al_2O_3 + 2Fe$$

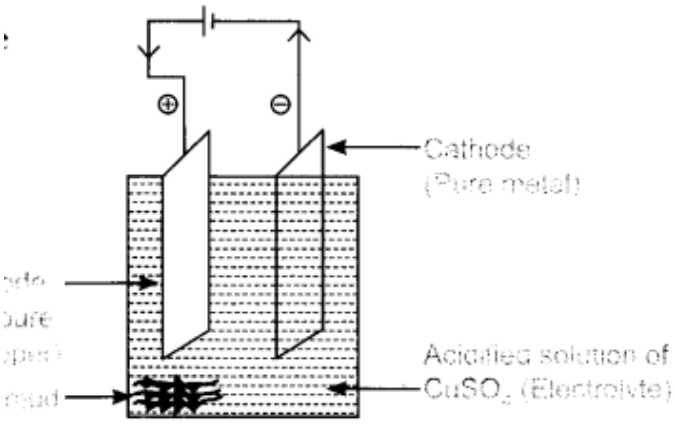
Molten iron is used to weld broken railway tracks.
(c) Electrolytic reduction

Q. (a) How can the metals at the top of the reactivity series be extracted from their ores? Explain with an example.
(b) Name any one alloy made from
(i) a metal and a non-metal, and
(ii) two metals.

Answer.
(a) These metals are extracted by electrolytic reduction, e.g. aluminium is obtained from bauxite by electrolytic reduction.
(b) (i) Steel is made up of iron and carbon.
(ii) Brass is made up of copper and zinc.

Q. (a) Give two methods to prevent the rusting of iron.
(b) Name the ores of the following metals:
(i) mercury, and
(ii) zinc
(c) Explain with the help of a diagram, how copper metal can be refined? Label the important arrangements in the experimental set up.

Answer.
(a)(i) Painting (ii) Galvanisation
(b)(i) Cinnabar (ii) Zinc Blende



Electrolytic refining

(c) Impure copper is taken as anode whereas pure copper is taken as cathode. Copper sulphate solution (CuS04) is taken as electrolyte. When electric current is passed, impure copper changes to ions which gain electrons at cathode and change into pure copper. Impurities are left behind as anode mud.

At anode: $\underset{\text{Impure}}{Cu(s)} \longrightarrow Cu^{2+}(aq) + 2e^-$

At Cathode: $Cu^{2+}(aq) + 2e^- \longrightarrow \underset{\text{Pure}}{Cu(s)}$

Q. With the help of a suitable example, explain how ionic compounds are formed. State any three general properties of ionic compounds.

Answer. Ionic compounds are formed by transfer of electrons from metal to non-metals, e.g.

$$Na \longrightarrow Na^+ + e^- \qquad Cl + e^- \longrightarrow Cl^-$$

$$Na + Cl \longrightarrow Na^+ (Cl^-)$$

General Properties:
(i) They are the solids having high melting point.
(ii) They are soluble in water.
(iii) They conduct electricity in molten state as well as in aqueous solution.

Q. (a) Explain with an example how the metal (X) which is low in reactivity series and metal (Y) which is high in the reactivity series are obtained from their compounds by reduction process.
(b) Write the electronic configurations of sodium and chlorine. Show the formation of sodium chloride from sodium and chlorine by the transfer of electrons.
(c) List any two observations when a highly reactive metal is dropped in water.

Answer.
(a) 'X' is obtained by chemical reduction.
'Y' is obtained by electrolytic reduction.

(b) Na (2, 8, 1)
Cl (2, 8, 7)

$$Na \longrightarrow Na^+ + e^-$$

$$Cl + e^- \longrightarrow Cl^-$$

$$Na + Cl \longrightarrow Na^+ (Cl^-)$$

(c) (i) Metal will catch fire.
(ii) Alkali solution is formed which turns red litmus blue.

Q. (a) The reaction of metal (X) with ferric oxide is highly exothermic. Metal (X) is obtained from its oxides by electrolytic reduction. Identify (X) and write its reaction with ferric oxide.
(b) Give reason to justify that aluminium oxide is an amphoteric oxide. Also, give another example of amphoteric oxide.
(c) Mention constituent metals present in bronze.

Answer. (a) 'X' is 'Al'

$$2Al + Fe_2O_3 \longrightarrow Al_2O_3 + 2Fe$$

(b) AI_2O_3 reacts with acid as well as base therefore it is amphoteric oxide.

$$Al_2O_3 + 2NaOH \longrightarrow 2NaAlO_2 + H_2O$$

$$Al_2O_3 + 6HCl \longrightarrow 2AlCl_3 + 3H_2$$

Zinc oxide is also an amphoteric oxide.
(c) Bronze contains' copper and tin.

Q. No reaction takes place when granules of a solid 'A' are mixed with a powder of solid 'B\ However when the mixture is heated, a reaction starts with evolution of much heat. Product 'C' of the reaction settles down as a liquid metal and solid product 'D' keeps floating over the liquid 'C\ This reaction is sometimes used for making metals for ready use in odd places.
(i) Based on this information, make assumptions about 'A' and 'B' and corresponding deductions about 'C' and 'D' and write a balanced chemical equation for the reaction. Include in the chemical equation about physical states of the reactants and products, need of heating for starting the reaction and the reaction being exothermic.
(ii) Name two types of chemical reactions to which this reaction can belong.

Answer.
(i) 'A' is aluminum, 'B' is ferric oxide [Iron(III) oxide],

$$\underset{\text{'A'}}{2Al(s)} + \underset{\text{'B'}}{Fe_2O_3(s)} \xrightarrow{\text{heat}} \underset{\text{'D'}}{Al_2O_3(s)} + \underset{\text{'C'}}{2Fe(l)} + \text{heat}$$

(ii)This reaction is displacement reaction because AT is displacing 'Fe'. It is also a redox reaction because AT is reducing agent and $Fe2O_3$is oxidising agent.

Q. (a) What is meant by corrosion? Name any two methods used for the prevention of corrosion.
(b) Suppose you have to extract metal M from its enriched sulphide ore. If M is in the middle of the reactivity series, write various steps used in extracting this metal.

Answer. (a) Corrosion is a process in which metal reacts with substances present in the environment to form surface compounds.

Prevention:
(i) Galvanisation is a process to prevent corrosion of iron.
(ii)Electroplating is also used to prevent corrosion.
(b)(i) Concentration of ores: Sulphide ore will be concentrated by froth- floatation process. Sulphide ore will be collected in froth whereas gangue will be left behind.
(ii) Roasslng: Sulphide ore is heated strongly in the presence of O_2 to form metal oxide and sulphur dioxide.
$2MS + 3O_2$ ———- ► $2MO + 2SO_2$
(iii) Reduction: MO reacts with carbon (acts as reducing agent) to form metal and CO.
MO + C —-> M + CO
(iv) Electrolytic refining: Impure metal 'M' is purified by electrolytic refining. Impure metal is taken as anode, pure metal is taken as cathode, soluble salt of metal is taken as electrolyte. Impure metal forms metal ions which gain electrons and form pure metal at cathode.

Q. (a) Distinguish between ionic and covalent compounds under the following properties:
(i) Strength of forces between constituent elements.
(ii) Solubility of compounds in water.
(iii) Electrical conduction in substances.
(b) Explain how the following metals are obtained from their compounds by the reduction process:
(i) Metal M which is in the middle of the reactivity series.
(ii) Metal N which is high up in the reactivity series.
Give one example of each type.

Answer.

Ionic Compounds	Covalent Compounds
(*i*) **Strength:** They have strong forces of attraction.	(*i*) They have weak forces of attraction.
(*ii*) **Solubility:** They are soluble in water.	(*ii*) They are insoluble in water.
(*iii*) **Conduction:** They conduct electricity in aqueous solution.	(*iii*) They do not conduct electricity in aqueous solution.

(b) (i) Metal M which is in the middle of the reactivity series is reduced by aluminium, e.g.
$3MnO_2(s) + 4Al(s) \longrightarrow 2Al_{2O3}(s) + 3Mn(l)$
(ii) Metal N will be obtained by electrolytic reduction, e.g. A1 is obtained by electrolytic reduction.