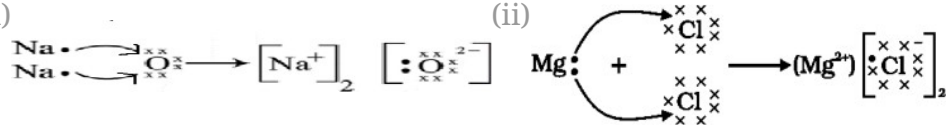
3. Metals and Non-metals - Board Exam Questions

2 Mark Questions

1) *Show the formation of the following ionic compounds by transfer of electrons between the combining atoms: (i) Sodium oxide (Na_2O) (ii) Magnesium chloride ($MgCl_2$) (Given: Atomic number: Na = 11, Mg = 12, O = 8, Cl = 17)*

(i) (ii)



2) *Show the formation of magnesium chloride by electron transfer. Write the name of the cation and anion present in the compound formed. (Atomic Number of Mg = 12, Cl = 17)*

(refer 1st 2 mark question, part (ii))

Cation: magnesium ion (Mg^{2+}) Anion: chloride ion (Cl^-)

3) *(a) What are amphoteric oxides? (b) Categorise the following based on their nature: ZnO, Na_2O, CO_2*

(a) Metal oxides that react with both acids and bases to give salt and water.

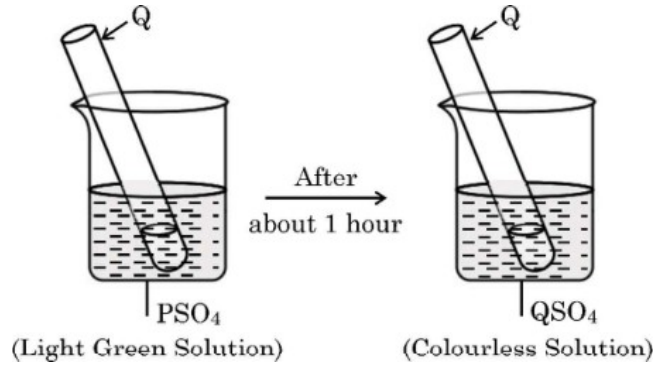
(b) ZnO: amphoteric oxide Na_2O: basic oxide CO_2: acidic oxide

4) *One student was comparing the reactivity of different metals for his science project. He added iron filings in four test tubes A, B, C and D containing aqueous solutions of $ZnSO_4$, $CuSO_4$, $FeSO_4$ and $Al_2(SO_4)_3$. (i) In which of the test tubes will he observe the reaction to be the most vigorous and why? (ii) Write a balanced equation for the reaction involved.*

(i) Test tube B. Iron is more reactive than copper, so iron pushes copper out of copper sulphate solution.

(ii) $Fe(s) + CuSO_4(aq) \rightarrow FeSO_4(aq) + Cu(s)$

5) *A light green coloured solution of sulphate salt of metal 'P' is taken in a beaker, a rod of another metal 'Q' is put in this solution as shown the following figures. Identify the metals 'P' and 'Q' and write its chemical equation for the reaction that occurs. State the conclusion of this reaction in terms of reactivity series of metals.*



P: iron (Fe) Q: zinc (Zn)

$FeSO_4 + Zn \rightarrow ZnSO_4 + Fe$

Conclusion: A more reactive metal pushes out a less reactive metal from its salt solution.

6) *Keerti added dilute Hydrochloric acid to four metals and recorded her observations as shown in the table given below. Select the correct observation(s) and give chemical equation(s) of the reaction involved.*

Metal	Gas Evolved
Copper	Yes
Iron	Yes
Magnesium	No
Zinc	Yes

The observations for iron and zinc are correct.

$Fe + 2HCl \rightarrow FeCl_2 + H_2$

$Zn + 2HCl \rightarrow ZnCl_2 + H_2$

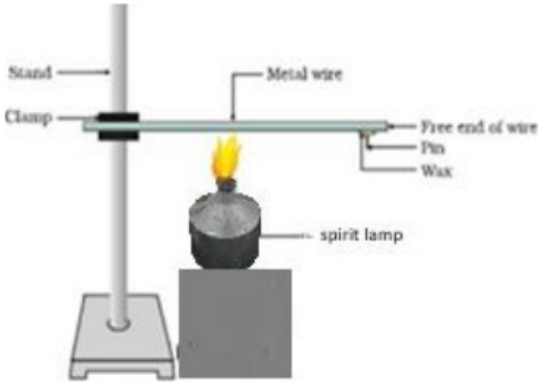
7) *(a) In common practice silver is recovered from silver nitrate solution by the use of copper metal. Name the type of reaction that takes place in this process and give the chemical equation of the reaction involved. (b) Name the method used for refining silver.*

(a) Displacement reaction.

$2AgNO_3 + Cu \rightarrow 2Ag + Cu(NO_3)_2$

(b) Electrolytic refining

8) *The following activity is set-up in the science lab by the teacher. He clamped an aluminium wire on a stand and fixed a pin to the free end of the wire using wax. Then he heated the wire with a burner from the end where the wire is clamped. Students observed the pin fall off. A. If the teacher replaces aluminium wire by silver wire, will the students' observation change? Justify your answer. B. Will the aluminium wire melt? Give reason for your answer.*



A. The pin will still fall, but faster, because silver conducts heat better than aluminium.

B. No. Metals have high melting points, so the wire will not melt.

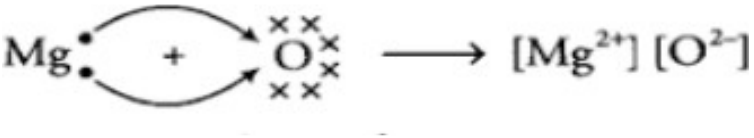
3 Mark Questions

1) *(i) Write one example each of one metal that is so soft that it can be cut with a knife, and one non-metal that is a good conductor of electricity. (ii) Using the electronic configuration, explain how Mg atom combines with oxygen to form magnesium oxide by transfer of electrons. [Atomic number: Mg = 12, O = 8]*

(i) Metal: lithium Non-metal: graphite

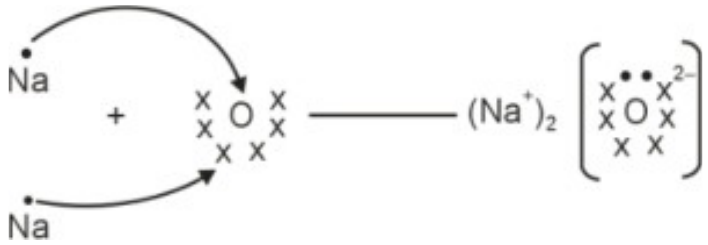
(ii) Magnesium loses 2 electrons: Mg (2, 8, 2) → Mg^{2+} (2, 8) + $2e^-$

Oxygen gains these 2 electrons: O (2, 6) + $2e^-$ → O^{2-} (2, 8)



2) *Write the electron-dot structures of (i) sodium, and (ii) oxygen. Using these structures, show the formation of sodium oxide. Mark the anion and cation present in this compound. (At. No. – Sodium = 11 and Oxygen = 8)*

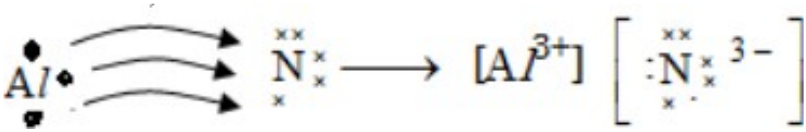
Na: 2, 8, 1 (one dot) O: 2, 6 (six dots)



Anion: O^{2-} Cation: Na^+

3) *(a) Show the formation of Aluminium Nitride (AlN) by the transfer of electrons. [At. no. of Al = 13; At. no. of N = 7] (b) "Ionic compounds are solids and are generally brittle and break into pieces when pressure is applied." Give reason to justify the statement.*

(a) Al = 2, 8, 3 N = 2, 5



(b) The positive and negative ions attract each other very strongly, so they form hard solids. Under pressure, the ions shift, and like charges come close and push apart, so the solid breaks.

4) *An element 'M' with electronic configuration 2 8 3 combines separately with Cl^-, SO_4^{2-} anions. Write the chemical formulae of the compounds formed. Predict with the suitable reason the nature of the bond formed by element 'M' in general. How will the electrical conductivity of the compounds formed vary with respect to 'M'?*

Formulae: MCl_3 and $M_2(SO_4)_3$

M forms ionic bonds. It loses its three outer electrons to become M^{3+} and gets the stable configuration of neon (2, 8).

'M' (a metal) conducts electricity as a solid. Its compounds conduct only when melted (molten), not as solids.

5) *(i) Name two metals which react violently with cold water. List any three observations which a student notes when these metal are dropped in a beaker containing water. (ii) Write a test to identify the gas evolved (if any) during the reaction of these metals with water.*

(i) Sodium and potassium.

Observations: The reaction is violent. A lot of heat is given out. The gas formed may catch fire.

(ii) The gas (hydrogen) burns with a pop sound.

6) *It is observed that Calcium on reaction with water floats on its surface. Explain why it happens. Also write a balanced chemical equation for the reaction that occurs. What happens when the aqueous solution of the product of this reaction reacts with Carbon dioxide gas? Write a balanced chemical equation for the reaction.*

Bubbles of hydrogen gas stick to the calcium and make it lighter, so it floats.

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

With carbon dioxide, the solution turns milky.

$Ca(OH)_2(aq) + CO_2(g) \rightarrow CaCO_3(s) + H_2O(l)$

7) *An element 'X' is stored in kerosene, and cannot be extracted from its ore using a reducing agent. 'X' forms an ionic compound on reaction with chlorine. (i) Can we store 'X' in water? Give reason to support your answer. (ii) Identify element 'X'. Name the process used and write the equation for extraction of 'X' from its ore.*

(i) No. 'X' is very reactive and will catch fire in water.

(ii) Sodium. It is obtained by electrolytic reduction of molten sodium chloride.

At the cathode: $Na^+ + e^- \rightarrow Na$

At the anode: $2Cl^- \rightarrow Cl_2 + 2e^-$

8) *State reasons for the following: (a) Zinc oxide is an amphoteric oxide. (b) Sodium metal is stored in bottle filled with kerosene oil. (c) In the reactions of nitric acid with metals, generally hydrogen gas is not evolved.*

(a) Zinc oxide reacts with both acids and bases to give salt and water.

(b) In open air, sodium reacts strongly and catches fire.

(c) Nitric acid is a strong oxidising agent. It changes the hydrogen formed into water.

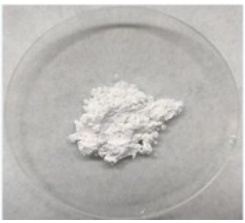
9) *Give reasons: (i) Metal sulphides and carbonates should be converted to their metal oxides in the process of extraction of metals. (ii) Aluminium oxide is considered as an amphoteric oxide. (iii) Metals like Na, K, Ca and Mg are never found in their free state in nature.*

(i) It is easier to get a metal from its oxide.

(ii) Aluminium oxide reacts with both acids and bases to give salt and water.

(iii) They are very reactive, so they are always found joined with other elements.

10) *A. Anirudh took two metal oxides; aluminium oxide and magnesium oxide as shown in the pictures given below. But he forgot to label them. How will you guide/ help Anirudh to identify the oxides and label them? B. In an activity Aishu was given two substances; Copper Sulphide (Cu_2S) and Copper Oxide (Cu_2O) to obtain copper from these compounds. She was able to extract Copper successfully. Illustrate with the help of chemical equations how Aishu might have completed the activity.*





A. Add water to each and test with litmus. Magnesium oxide dissolves and turns red litmus blue. Aluminium oxide is amphoteric and does not dissolve in water, so it does not change red or blue litmus.

B. $2Cu_2S + 3O_2(g) \xrightarrow{\text{(heat)}} 2Cu_2O(s) + 2SO_2(g)$

$2Cu_2O + Cu_2S \xrightarrow{\text{(heat)}} 6Cu(s) + SO_2(g)$

11) *(a) What is a reactivity series of elements? How is it developed? Arrange the following elements as they are arranged in the reactivity series: Aluminum, Calcium, Copper, Lead (b) Write balanced chemical equation to show the reaction of iron (III) oxide (Fe_2O_3) with aluminium.*

(a) A list of metals arranged from the most reactive to the least reactive.

It is made by doing displacement reactions.

Order: Calcium, Aluminium, Lead, Copper

(b) $Fe_2O_3 + 2Al \rightarrow Al_2O_3 + 2Fe + Heat$

12) *(a) "Displacement reactions also play a key role in extracting metals in the middle of the reactivity series." Justify this statement with two examples. (b) Why can metals high up in the reactivity series not be obtained by reduction of their oxides by carbon?*

(a) $3MnO_2(s) + 4Al(s) \rightarrow 3Mn(l) + 2Al_2O_3(s) + Heat$

$Fe_2O_3(s) + 2Al(s) \rightarrow 2Fe(l) + Al_2O_3(s) + Heat$

(b) Metals at the top (Na, Mg, Ca) hold oxygen more strongly than carbon does, so carbon cannot take the oxygen away.

13) *The given reaction shows one of the processes to extract the metals like Iron and Manganese. $MnO_2(s) + Al(s) \rightarrow Mn(l) + Al_2O_3(s) + Heat$ a) Give reason why the above reaction is known as a thermite reaction. b) Identify the substance oxidised and reduced in the above reaction. c) Give a reason why Aluminium is preferably used in thermite reactions.*

a) It gives out a very large amount of heat.

b) Oxidised: Al Reduced: MnO_2

c) Aluminium is above iron and manganese in the reactivity series, so it can push them out of their oxides.

14) *(i) Which method will be used to convert each of them to their respective metal oxides? (a) Carbonate ore (b) Sulphide ore (ii) Write a chemical reaction to illustrate the use of aluminium for joining cracked railway tracks. (iii) During extraction of metals, electrolytic refining is used to obtain pure metals. Which material will be used as anode and cathode for the refining of copper metal by this process?*

(i) (a) Calcination (b) Roasting

(ii) $Fe_2O_3(s) + 2Al(s) \rightarrow 2Fe(l) + Al_2O_3(s) + Heat$

(iii) Anode: impure copper rod Cathode: thin strip of pure copper

15) *With the help of suitable chemical equations, list the two main differences between roasting and calcination. How is metal reduced from the product obtained after roasting/calcination of the ore? Write the chemical equation for the reaction involved.*

Roasting	Calcination
Used for sulphide ores.	Used for carbonate ores.
The ore is heated in plenty of air.	The ore is heated with no air or very little air.
$2ZnS + 3O_2$ '$2ZnO + 2SO_2$	$ZnCO_3$ —(heat)'$ZnO + CO_2$

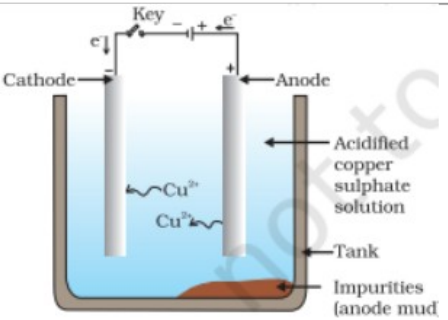
The metal oxide is then reduced with carbon.
$ZnO + C$ —(heat)→ $Zn + CO$

16) *(i) Write all the reactions involved in the extraction of Zn from ZnS. (ii) Hydrogen gas is not evolved when most of the metals react with nitric acid. Give reason.*
(i) Roasting: $2ZnS(s) + 3O_2(g)$ —(heat)→ $2ZnO(s) + 2SO_2(g)$
Reduction: $ZnO(s) + C(s) \rightarrow Zn(s) + CO(g)$
(ii) Nitric acid is a strong oxidising agent. It changes the hydrogen formed into water.

17) *Name the ore of mercury and state the form in which it is found in nature. Write the chemical equations along with the condition required for the reactions involved in the extraction of mercury from its ore.*
Ore: cinnabar. Mercury is found in it as a sulphide (HgS).
Cinnabar is heated in air: $2HgS + 3O_2$ —(heat)→ $2HgO + 2SO_2$
The oxide is heated further: $2HgO$ —(heat)→ $2Hg + O_2$

18) *State giving reason the reduction process to obtain the following metals from their compounds: (i) Mercury, (ii) Copper and (iii) Sodium*
(i) Mercury: roasting (heating), because it is a metal of low reactivity.
(ii) Copper: roasting (heating), because it is a metal of low reactivity.
(iii) Sodium: electrolytic reduction, because it is very reactive.

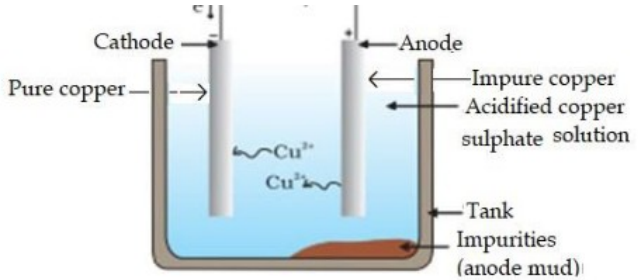
19) *Draw a labelled diagram to show electrolytic refining of copper. State what happens when electric current is passed through the electrolyte taken in this case.*



When current passes through the copper sulphate solution, copper from the impure anode dissolves into the solution. The same amount of pure copper from the solution is deposited on the cathode.

20) *A reddish-brown metal 'X', when heated in air, gives a black compound 'Y', which when heated in presence of H_2 gas gives 'X' back. 'X' is refined by the process of electrolysis; this refined form of 'X' is used in electrical wiring. Identify 'X' and 'Y'. Draw a well-labeled diagram to represent the process of refining 'X'.*

X: copper Y: copper oxide (CuO)



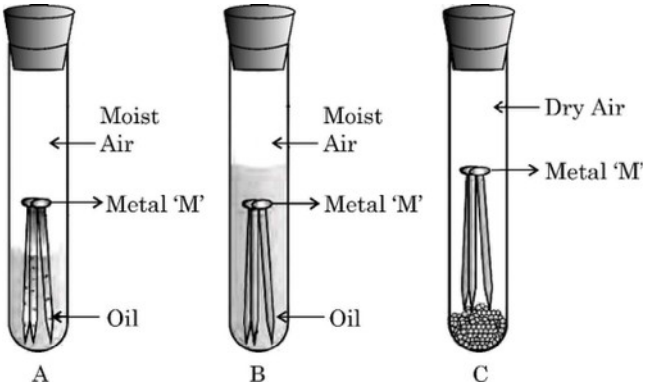
21) *With the help of an activity, explain the conditions under which iron articles get rusted.*

• Take three test tubes, A, B and C, and put clean iron nails in each.

• A: Pour some water and cork it.
• B: Pour boiled distilled water, add about 1 mL of oil, and cork it. The oil floats and stops air from dissolving in the water.
• C: Put some anhydrous calcium chloride and cork it. It takes away any moisture from the air.

The nails rust only in test tube A, not in B and C. So iron rusts only when both air and water are present.

22) *Observe the following diagram showing an experiment to determine the conditions under which a metal 'M' corrodes. List your observations in each of the three cases A, B and C with reason, if the metal 'M' is generally protected against corrosion by the method of galvanisation.*



A: The part of M outside the oil corrodes. The part inside the oil does not, because moist air cannot reach it.

B: M does not corrode, because it is under oil and not in contact with moist air.

C: M does not corrode, because there is no moisture in the tube.

23) *State giving reason for the change in appearance observed when each of the following metal is exposed to atmospheric air for some time: (i) Silver, (ii) Copper and (iii) Iron*

(i) Silver: white turns black, because silver sulphide forms.

(ii) Copper: reddish brown turns green, because basic copper carbonate forms.
(iii) Iron: grey turns brown, because rust (iron oxide) forms.

24) *The domes of many building in Europe are made of copper. These domes now appear greenish in colour. (i) Why do the domes appear greenish though copper is orange-red in colour? (ii) In your opinion, should the copper domes be replaced by iron domes to overcome the problem of change of colour of copper domes? (iii) Domes used to be made from thin sheets of metals. Why did the ancient architects use copper to make domes?*
(i) Copper slowly forms a green coating of basic copper carbonate.
(ii) No. Iron would rust, and the rust layer would flake off, so the iron would keep wearing away. The green coating on copper protects it from further corrosion.
(iii) Copper is very malleable. Thin copper sheets can be shaped easily into a dome.

25) *Design an activity to show that metals are good conductors of heat and have high melting points.*
• Clamp an aluminium or copper wire on a stand.
• Fix a pin to the free end of the wire with wax.
• Heat the wire with a burner near the clamped end.
• The wax melts and the pin falls, but the wire does not melt.

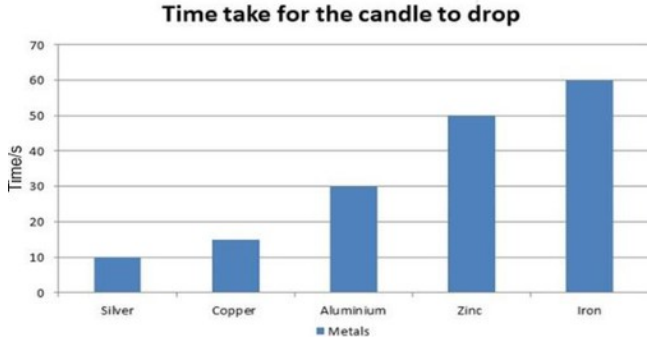
This shows that metals conduct heat well and have high melting points.

<u>4 Mark Questions (Case Study)</u>

1) *Aavya and Vihan are studying the properties of metals in school. They decide to design and conduct an experiment to test the relative conduction of heat by metals. They use the apparatus (Figure) with rods of five different metals aluminium, silver, copper, iron and zinc attached to a*

central point. This central point is heated using a burner. The metal rods are of equal length and thickness. They observe that the candles at the end of the rods fall at different times. (Study the graph)





A. On the basis of the graph obtained, which metal is the best conductor of heat? (1)

Silver

B. Gold is a better conductor of heat than aluminium but it is not as good as copper. The time taken for the candle to drop if one of the rods were made of gold would have been: (i) 15 s (ii) 20 s (iii) 35 s (iv) 10 s (1)

(ii) 20 s

C. The length of all the metal rods is increased by 20% without any change in the thickness. Will the time required for the candles to drop be affected? How and why? (2)

Yes. The candles will take longer to fall for all the metals, but the order of falling will stay the same.

In conduction, heat passes from particle to particle, so it takes longer to travel a longer rod.

OR D. Mayank tries the experiment with an apparatus similar to figure (1). He ensures the length of all metal rods is the same. However, the thickness

of rods is not the same in his apparatus. Will the inference he draws on the basis of his experiment be correct? Justify your answer.

No. All the rods must be of the same size. A thicker rod takes more time to conduct heat, so the test is not fair.

2) *Three metal samples of magnesium, aluminium and iron were taken and rubbed with sand paper. These samples were then put separately in test tubes containing dilute hydrochloric acid. Thermometers were also suspended in each test tube so that their bulbs dipped in the acid. The rate of formation of bubbles was observed. The above activity was repeated with dilute nitric acid and the observations were recorded.*
(a) When activity was done with dilute hydrochloric acid, then in which one of the test tubes was the rate of formation of bubbles the fastest and the thermometer showed the highest temperature? (1)

In the test tube with magnesium.

(b) Which metal did not react with dilute hydrochloric acid? Give reason. (1)

All three metals react with HCl, because they are all more reactive than hydrogen.

(c) (i) Why is hydrogen gas not evolved when a metal reacts with dilute nitric acid? Name the ultimate products formed in the reaction. (2)

Nitric acid is a strong oxidising agent. It changes the hydrogen formed into water.

The final products are water and oxides of nitrogen.

OR (c) (ii) Name the type of reaction on the basis of which reactivity of metals is decided. You have two metals X and Y. How would you decide which is more reactive than the other?

Displacement reaction.

Put X into a salt solution of Y. If X pushes out Y, then X is more reactive. If not, Y is more reactive.

3) *Almost all metals combine with oxygen to form metal oxides. Metal oxides are generally basic in nature. But some metal oxides show both basic as well as acidic behaviour. Different metals show different reactivities towards oxygen. Some react vigorously while some do not react at all.*

(a) What happens when copper is heated in air? (Give the equation of the reaction involved). (1)

It forms black copper oxide: $2Cu + O_2 \rightarrow 2CuO$

(b) Why are some metal oxides categorized as amphoteric? Give one example. (1)

They react with both acids and bases to give salt and water.

Example: Al_2O_3

(c) Complete the following equations: (i) $Na_2O(s) + H_2O(l) \rightarrow$ (ii) $Al_2O_3 + 2NaOH \rightarrow$ (2)

(i) $Na_2O(s) + H_2O(l) \rightarrow 2NaOH(aq)$

(ii) $Al_2O_3 + 2NaOH \rightarrow 2NaAlO_2 + H_2O$

OR (c) On burning Sulphur in oxygen a colourless gas is produced. (i) Write chemical equation for the reaction. (ii) Name the gas formed. (iii) State the nature of the gas. (iv) What will be the action of this on a dry litmus paper?

(i) $S + O_2 \rightarrow SO_2$ (ii) Sulphur dioxide (iii) Acidic (iv) No change

4) *The melting points and boiling points of some ionic compounds are given below:*

Compound	Melting Point (K)	Boiling Point (K)
NaCl	1074	1686
LiCl	887	1600
$CaCl_2$	1045	1900
CaO	2850	3120
$MgCl_2$	981	1685

These compounds are termed ionic because they are formed by the transfer of electrons from a metal to a non-metal. The electron transfer in such compounds is controlled by the electronic configuration of the elements involved. Every element tends to attain a completely filled valence shell of its nearest noble gas or a stable octet.

(i) Show the electron transfer in the formation of magnesium chloride. (1)

(refer 1st 2 mark question, part (ii))

(ii) List two properties of ionic compounds other than their high melting and boiling points. (1)

They are hard solids. They dissolve in water.

(iii) (A) While forming an ionic compound say sodium chloride how does sodium atom attain its stable configuration? (2)

A sodium atom has one electron in its outermost shell.

It loses this electron and becomes Na^+, with the configuration of the nearest noble gas (neon): Na (2, 8, 1) → Na^+ (2, 8) + e^-

OR (iii) (B) Give reasons: (i) Why do ionic compounds in the solid state not conduct electricity? (ii) What happens at the cathode when electricity is passed through an aqueous solution of sodium chloride?

(i) In the solid, the ions are fixed in place and cannot move.

(ii) Hydrogen gas is given out at the cathode.

5) *On the basis of reactivity metals are grouped into three categories – (i) Metals of low reactivity (ii) Metals of medium reactivity (iii) Metals of high reactivity. Therefore metals are extracted in pure form from their ores on the basis of their chemical properties. Metals of high reactivity are extracted from their ores by electrolysis of the molten ore. Metals of low reactivity are extracted from their sulphide ores, which are converted into their oxides. The oxides of these metals are reduced to metals by simple heating.*

(a) Name the process of reduction used for a metal that gives vigorous reaction with air and water both. (1)

Electrolytic reduction

(b) Carbon cannot be used as a reducing agent to obtain aluminium from its oxide? Why? (1)

(refer 12th 3 mark question)

(c) Describe briefly the method to obtain mercury from cinnabar. Write the chemical equation for the reactions involved in the process. (2)

(refer 17th 3 mark question)

OR (c) Differentiate between roasting and calcination giving chemical equation for each.

(refer 15th 3 mark question)

6) *Metals are required for a variety of purposes. For this we need their extraction from their ores. Ores mined from the earth are usually contaminated with many impurities which must be removed prior to the extraction of metals. The extraction of pure metal involves the following steps: (1) Concentration of ore (2) Extraction of the metal from the concentrated ore (3) Refining of the metal*

(a) Name an ore of Mercury and state the form in which Mercury is present in it. (1)

(refer 17th 3 mark question)

(b) What happens to zinc carbonate when it is heated strongly in a limited supply of air? (1)

It changes into zinc oxide (calcination): $ZnCO_3 \rightarrow ZnO + CO_2$

(c) The reaction of a metal A with Fe_2O_3 is highly exothermic and is used to join railway tracks. (I) Identify the metal A and name the reaction taking place. (II) Write the chemical equation for the reaction of metal A with Fe_2O_3. (2)

(I) A: aluminium. It is a thermit reaction.

(II) $Fe_2O_3 + 2Al \rightarrow 2Fe + Al_2O_3 + Heat$

OR (c) We cannot use carbon to obtain sodium from sodium oxide. Why? State the reactions taking place at cathode and anode during electrolytic reduction of sodium chloride.

Sodium holds oxygen more strongly than carbon does, so carbon cannot take the oxygen away.

At the cathode: $Na^+ + e^- \rightarrow Na$

At the anode: $2Cl^- \rightarrow Cl_2 + 2e^-$

7) *Most of metals occur in combined state in form of ores. Carbonate ores are converted into oxides by calcination and sulphide ores by roasting. Oxides are reduced with suitable reducing agent like carbon to get free metal. Highly reactive metals like – Al, Mg are also used as reducing agents to obtain metal from their oxides. Most reactive metals are obtained by electrolytic reduction of their molten ores. Alloying is a very good method of improving the properties of a metal. We can get desired properties by this method. The electrical conductivity and melting point of an alloy is less than that of pure metals.*

(a) Why carbonate or sulphide ores are converted to oxides before extraction of metal from it? (1)

(refer 9th 3 mark question)

(b) Write a reaction in which Aluminium is used as a reducing agent to obtain metal from its oxide. (1)

(refer 14th 3 mark question)

(c) (i) How is copper obtained from its ore (Cu_2S)? Give equations of the reactions. (2)

(refer 10th 3 mark question)
OR (c) (ii) (I) Why highly reactive metals cannot be obtained from their oxides by using carbon as a reducing agent? (II) Why solder, an alloy of lead and tin, is used for welding electrical wires together?
(I) These metals hold oxygen more strongly than carbon does.
(II) Solder has a low melting point.

8) *An electrochemical process is used for refining metals by selectively dissolving and depositing them through electrolysis. Electrolytic refining is used for metals like Copper, Zinc, Tin, Nickel, Silver and Gold.*
(a) Define anode mud. (1)
The insoluble impurities that settle at the bottom, below the anode, during electrolytic refining.
(b) In electrolytic refining of copper, name the anode and the cathode. (1)
(refer 14th 3 mark question)
(c) (i) With the help of chemical equations, show the extraction of copper from its ore Cu_2S. (2)
(refer 10th 3 mark question)
OR (c) (ii) Draw a neat and labelled diagram showing electrolytic refining of copper.
(refer 19th 3 mark question)

9) *The metals produced by various reduction processes are not very pure. They contain impurities, which must be removed to obtain pure metals. The most widely used method for refining impure metals is electrolytic refining.*
(i) What is the cathode and anode made of in the refining of copper by this process? (1)
(refer 14th 3 mark question)
(ii) Name the solution used in the above process and write its formula. (1)
Acidified copper sulphate solution, $CuSO_4$

(iii) (A) How copper gets refined when electric current is passed in the electrolytic cell? (2)
(refer 19th 3 mark question)

The soluble impurities go into the solution. The insoluble impurities settle at the bottom, below the anode.

OR (iii) (B) You have two beakers 'A' and 'B' containing copper sulphate solution. What would you observe after about 2 hours if you dip a strip of zinc in beaker 'A' and a strip of silver in beaker 'B'? Give reason for your observations in each case.

Beaker A: The blue colour fades, because zinc is more reactive than copper and pushes it out.

Beaker B: No change, because silver is less reactive than copper.

10) *Many pure metals like copper, iron and gold are very soft and as such are considered unsuitable for certain uses. Metallic objects around us such as cooking utensils, statues, ornaments, guns etc. are actually not made up of pure metals. Instead of pure metals, alloys are used in the design of most of the useful objects. Making alloys enhances the basic properties of a metal which is the primary constituent (metal) of an alloy.*
(I) How does electrical conductivity and melting point of a metal change when it is converted to its alloy by mixing a small amount of an element in it? (1)

Both become lower than those of the pure metal.

(II) Name an alloy used for welding two wires together in an electric circuit. Write its major constituents. (1)

Solder. It is made of lead and tin.

(III) (a) What are alloys? How is 'Brass' (an alloy) prepared? (2)

An alloy is a uniform mixture of two or more metals, or of a metal and a non-metal.

Brass is made by mixing copper and zinc in a fixed proportion.

OR (III) (b) What is stainless steel? How is it prepared? Write one important property which makes it more useful in making cooking utensils as compared to its primary metal.

Stainless steel is an alloy of iron with nickel and chromium.

Iron is first mixed with a little carbon (about 0.05%) to make it hard and strong, and then mixed with nickel and chromium.

It does not rust.

11) *Two students decided to investigate the effect of water and air on iron object under identical experimental conditions. They measured the mass of each object before placing it partially immersed in 10 ml of water. After a few days, the object were removed, dried and their masses were measured. The table shows their results.*

Student	Object	Mass before rusting (g)	Mass of the coated object (g)
A	Nail	3.0	3.15
B	Thin plate	6.0	6.33

(a) What might be the reason for the varied observations of the two students? (2)

Both objects rusted, so both became heavier.

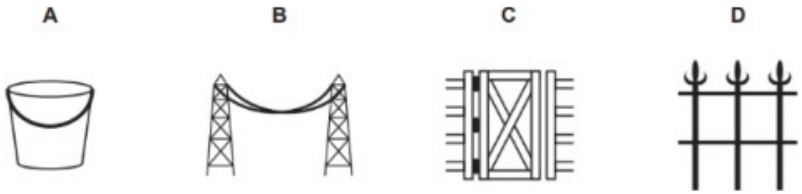
The thin plate (B) has a larger surface, so more of it rusted and its mass went up more.

(b) In another set up the students coated iron nails with zinc metal and noted that, iron nails coated with zinc prevents rusting. They also observed that zinc initially acts as a physical barrier, but an extra advantage of using zinc is that it continues to prevent rusting even if the layer of zinc is damaged. Name this process of rust prevention and give any two other methods to prevent rusting. (2)

Galvanisation.

Other methods: oiling and painting.

OR (b) In which of the following applications of Iron, rusting will occur most? Support your answer with valid reason. A - Iron Bucket electroplated with Zinc; B - Electricity cables having iron wires covered with aluminium; C - Iron hinges on a gate; D - Painted iron fence



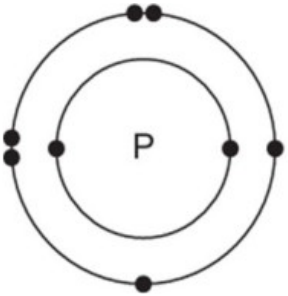
C, the iron hinges on a gate. The bare iron is in contact with both air (oxygen) and moisture.

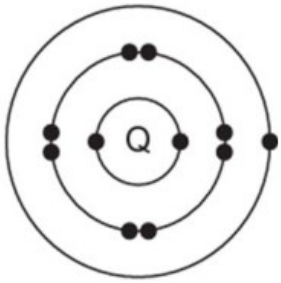
5 Mark Questions

1) *(i) Consider the following metals: K, Ca, Al, Cu, Ag, Fe. Select from the above metals, a metal which I. does not react with oxygen even at high temperature. II. reacts with oxygen at ordinary temperature and forms a protective oxide layer which prevents the metal from further oxidation. III. catches fire when kept in the open. IV. does not burn in oxygen but the hot metal is coated with a black coloured oxide layer.*
(ii) What are amphoteric oxides? With the help of balanced chemical equations show that aluminium oxide is an amphoteric oxide.
(iii) What are alkalis? Give one example.
(i) I. Ag II. Al III. K IV. Cu
(ii) Metal oxides that react with both acids and bases to give salt and water are amphoteric oxides.
With an acid: $Al_2O_3 + 6HCl \rightarrow 2AlCl_3 + 3H_2O$
With a base: $Al_2O_3 + 2NaOH \rightarrow 2NaAlO_2 + H_2O$
(iii) Bases that dissolve in water are called alkalis. Example: NaOH

2) *The electronic structures of atoms P and Q are shown below. Based on the information given above, answer the following questions:*
(a) If P and Q combine to form a compound, what type of bond is formed

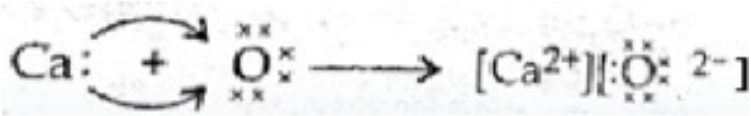
between them?
(b) Give the chemical formula of the compound formed.
(c) The compound so formed is dissolved in water. Is the resultant solution acidic or basic in nature? Justify your answer.
(d) Write the chemical equation for the reaction between 'Q' and ethanol.
(e) What will be the formula of the compound formed when 'P' undergoes bonding with carbon?





(a) Ionic bond
(b) Q_2P
(c) Basic, because metal oxides are basic.
(d) $2C_2H_5OH + 2Q \rightarrow 2C_2H_5OQ + H_2$
(e) CP_2

3) *(i) Write the balanced chemical equations when: (I) A mixture of Cu_2O and Cu_2S is heated. (II) ZnS is heated in the presence of oxygen.*
(ii) Give reasons for the following: (I) The wires carrying current in homes have a coating of PVC. (II) To make hot water tanks, copper is used and not steel.
(iii) Show the formation of ionic compound CaO with electron dot structure. [Atomic number: Ca = 20, O = 8]
(i) (I) $2Cu_2O + Cu_2S \rightarrow 6Cu(s) + SO_2(g)$
(II) $2ZnS(s) + 3O_2(g) \rightarrow 2ZnO(s) + 2SO_2(g)$
(ii) (I) PVC does not conduct electricity, so it insulates the wires.
(II) Copper does not react with cold water, hot water or steam.
(iii)



4) *(i) Give reasons for the following: (I) Ionic compound have generally high melting points and boiling points. (II) Solder, an alloy of lead and tin, is used for welding electrical wires. (III) Carbon cannot reduce the oxides of Na or Mg.*
(ii) The reaction of compound 'X' with aluminium is used to join railway tracks: (I) Identify the compound 'X'. (II) Name the reaction. (III) Write the balanced chemical equation of the reaction of compound 'X' with aluminium.
(i) (I) A lot of energy is needed to break the strong attraction between the ions.
(II) Solder has a low melting point.
(III) (refer 12th 3 mark question)
(ii) (I) X: iron (III) oxide, Fe_2O_3 (II) Thermit reaction
(III) $Fe_2O_3(s) + 2Al(s) \rightarrow 2Fe(l) + Al_2O_3(s) + Heat$

5) *(i) With the help of balanced chemical equations state the process of extracting (I) mercury from its ore called cinnabar, and (II) copper from its sulphide ore.*
(ii) Silver and copper articles slowly lose their shiny surfaces when exposed to air. Name the compounds formed on (I) silver articles, and (II) copper articles in the form of coating.
(i) (I) (refer 17th 3 mark question)
(II) (refer 10th 3 mark question)
(ii) (refer 23rd 3 mark question)