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Important Questions from Metals & Non-Metals

1) Reverse of the following chemical reaction is not possible:
$Zn_{(s)} + CuSO_{4(aq)} \rightarrow ZnSO_{4(aq)} + Cu_{(s)}$
Justify this statement with reason.
Answer:
If a strip of zinc metal is put in copper sulphate solution, then the blue colour of copper sulphate fades gradually due to the formation of colourless zinc sulphate solution and reddish-brown copper metal is deposited on zinc strip.

$$\underset{\text{Copper sulphate (Blue solution)}}{CuSO_{4(aq)}} + \underset{\text{Zinc}}{Zn_{(s)}} \rightarrow \underset{\text{Zinc sulphate (Colourless solution)}}{ZnSO_{4(aq)}} + \underset{\text{Copper (Reddish brown)}}{Cu_{(s)}}$$

2) Name a metal which:
(a) is the best conductor of heat.
(b) has a very low melting point.
(c) does not react with oxygen even at high temperature.
(d) is most ductile.
Answer:
(a) Metal which is the best conductor of heat is silver.
(b) Gallium has a very low melting point.
(c) Silver and gold do not react with oxygen even at high temperature.
(d) Gold is the most ductile metal.

3) What is meant by amphoteric oxides? Choose the amphoteric oxides from the following :
Na_2O, ZnO, CO_2, Al_2O_3, H_2O
Answer:
Amphoteric oxides are those which show acidic as well as basic character, i.e., they react with bases as well as acids. ZnO and Al_2O_3 are amphoteric oxides.

4) Give reason for the following:
(i) Hydrogen gas is not evolved when most of the metals react with nitric acid.
(ii) Zinc oxide is considered as an amphoteric oxide.
(iii) Metals conduct electricity.
Answer:
(i) Hydrogen gas is not evolved when most metals react with nitric acid. It is because HNO_3 is a strong oxidising agent. It oxidises the H_2 produced to water and itself gets reduced to any of the nitrogen oxides (N_2O, NO, NO_2).

(ii) ZnO reacts both with acids as well as bases to form salt and water. Thus, ZnO is an amphoteric oxide.

$$\underset{\text{Zinc oxide}}{ZnO} + \underset{\text{Dil. hydrochloric acid}}{2HCl} \longrightarrow \underset{\text{Zinc chloride}}{ZnCl_2} + \underset{\text{Water}}{H_2O}$$

$$\underset{\text{Zinc oxide}}{ZnO} + \underset{\text{Sodium hydroxide}}{2NaOH} \longrightarrow \underset{\text{Sodium zincate}}{Na_2ZnO_2} + \underset{\text{Water}}{H_2O}$$

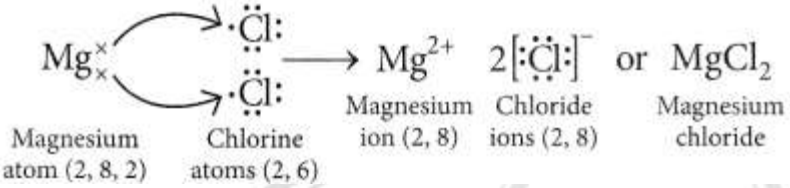
5) Give reason:
(a) Aluminium is a reactive metal but is still used for packing food articles.
(b) Calcium starts floating when water is added to it.
Answer:
(a) Aluminium is a strong and cheap metal. It is also a good conductor of heat. But it is highly reactive. When it is exposed to moist air, its surface is covered with a thin impervious layer of aluminium oxide (Al_2O_3). This layer does not allow moist air to come in contact with the fresh metal and hence, protects the metal underneath from further damage or corrosion. Thus, after the formation of this protective layer of Al_2O_3, aluminium becomes resistant to corrosion. It is because of this reason that although aluminium is a highly reactive metal, it is still used in food packaging.

6) An element 'X' displaces iron from the aqueous solution of iron sulphate. List your observations if the element 'X' is treated with the aqueous solutions of copper sulphate, zinc sulphate and silver nitrate. Based on the observations arrange X, Zn, Cu and Ag in increasing order of their reactivities.
Answer:
As X displaces iron from its salt solution hence X is more reactive than iron. It will also displace copper from copper sulphate and silver from silver nitrate as both are less reactive than iron. As zinc is more reactive than iron hence, X can be more or less reactive than zinc. Then the order of their reactivities can be
Ag < Cu < Fe < Zn < X or Ag < Cu < Fe < X < Zn.

7) A metal 'X' combines with a non-metal 'Y' by the transfer of electrons to form a compound Z.
(i) State the type of bond in compound Z.
(ii) What can you say about the melting point and boiling point of compound Z?
(iii) Will this compound dissolve in kerosene or petrol?
(iv) Will this compound be a good conductor of electricity? (Board Term I, 2017)
Answer:
X being a metal loses electrons and Y being a non-metal gains electrons to form Z.
(i) The chemical bond formed by the transfer of electrons from one atom to another is known as an ionic bond. Hence, Z is an ionic compound.
(ii) Compound Z is an ionic compound thus, it has high melting and boiling points.
(iii) Ionic compounds are insoluble in non-polar solvents such as kerosene or petrol.

(iv) As Z is an ionic compound, it does not conduct electricity in the solid state because movement of ions in the solid is not possible due to their rigid structure. But it conducts electricity in the molten state or in aqueous solution due to the movement of ions freely.

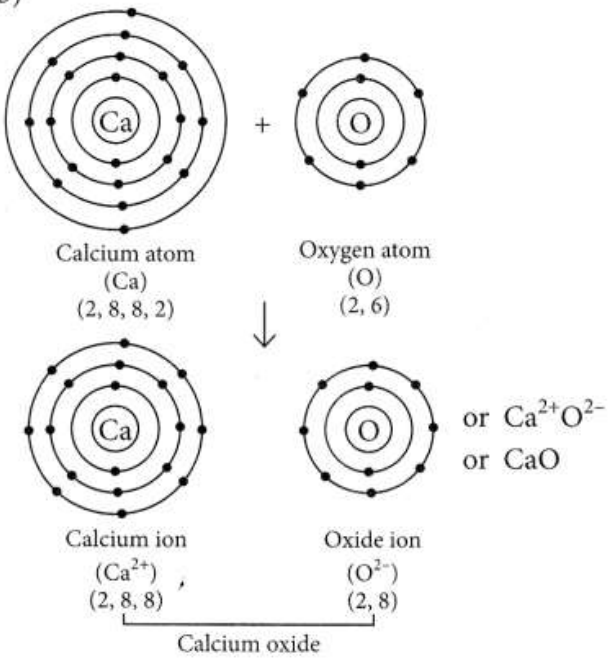
8) (i) By the transfer of electrons, illustrate the formation of bond in magnesium chloride and identify the ions present in this compound.
(ii) Ionic compounds are solids. Give reasons.
Answer:



(ii) Ionic compounds are solids because the particles which make up ionic compounds are held together by strong electrostatic bonds.

9) (a) (i) Write two properties of gold which make it the most suitable metal for ornaments.
(ii) Name two metals which are the best conductors of heat.
(iii) Name two metals which melt when you keep them on your palm.
(b) Explain the formation of ionic compound CaO with electron-dot structure. Atomic numbers of calcium and oxygen are 20 and 8 respectively.
Answer:
(a) (i) The malleability and ductility properties of gold make it suitable for ornaments.
(ii) Silver and gold.
(iii) Gallium and caesium have so low melting points that they melt even on keeping them on palm.

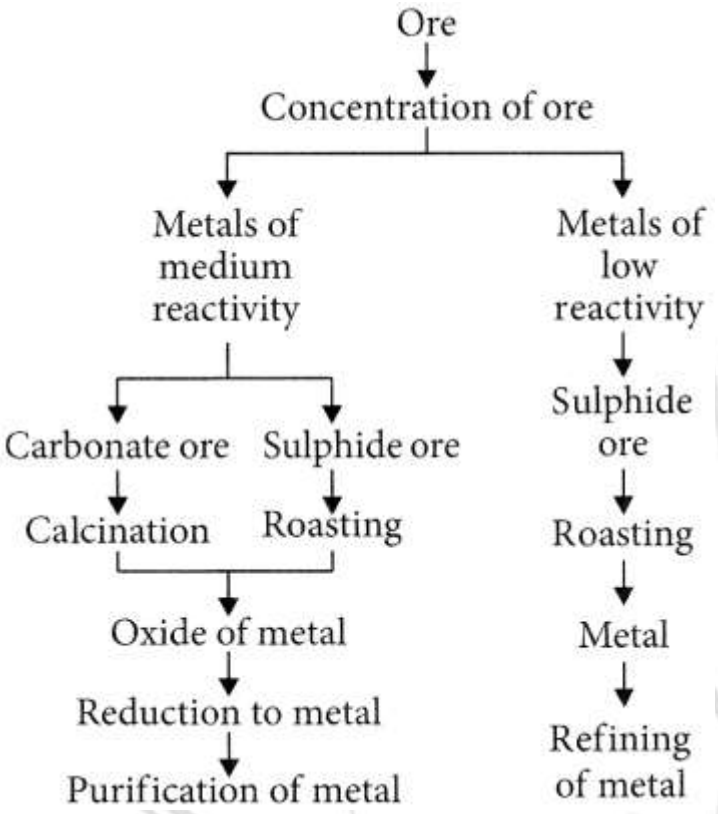
(b)



10) Draw a schematic diagram of the various steps involved in the extraction of metals from ores for metals of medium reactivity and for metals of low reactivity. (Board Term I, 2018)

Answer:

Various steps involved in the extraction of a metal from its ore followed by refining of the metal is called 'metallurgy'. The steps involved are summarised as follows :



11) a) Define corrosion.

(b) What is corrosion of iron called?

(c) How will you recognise the corrosion of silver?

(d) Why corrosion of iron is a serious problem?

(e) How can we prevent corrosion of iron? (Board Term I, 2017)

Answer:

(a) The process of slowly eating up of metals due to their conversion into oxides, carbonates, sulphides, etc., by the action of atmospheric gases and moisture is called corrosion.

(b) The corrosion of iron is called rusting.

(c) Silver articles become black after sometime when exposed to air. This is due to formation of a coating of black silver sulphide (Ag_2S) on its surface by the action of H_2S gas present in the air.

(d) Corrosion of iron is a serious problem. Every year large amount of money is spent to replace damaged iron articles. Corrosion causes damage to car bodies, bridges and

iron railings, ships and to all objects made of metals specially those of iron.
(e) Corrosion of iron is prevented by coating it with a layer of oil. The reason being that the layer of oil does not allow air and water to react the surface of iron. Corrosion of iron can also be prevented by painting, greasing, galvanising, anodising, electroplating or making alloys.

12) Give reason for the following :
(a) Ionic compounds have higher melting point and higher boiling point.
(b) Sodium is kept immersed in kerosene.
(c) Reaction of calcium with water is less violent.
Answer:
(a) Due to strong forces of attraction, the ions are bound to each other very firmly. As a result, the electrovalent or ionic solids have high melting and boiling points.
(b) Refer to answer 23(b) (ii).
(c) Calcium reacts with cold water but the reaction is less violent. The heat evolved is not sufficient for the hydrogen to catch fire.

$$\underset{\text{Calcium}}{Ca_{(s)}} + \underset{\text{Cold water}}{2H_2O_{(l)}} \longrightarrow \underset{\text{Calcium hydroxide}}{Ca(OH)_{2(aq)}} + \underset{\text{Hydrogen}}{H_{2(g)}\uparrow}$$

13) 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 substance.
(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.

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

15) 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.

16) 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.

17) 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.

18) 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.

19) Why does calcium float in water?
Answer. It is because hydrogen gas is formed which sticks to surface of calcium, therefore it floats.

20) $X + YSO_4$——-> $XSO_4 + Y$
$Y + XSO_4$ ———> 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.

21) 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
[$CuCO_3.Cu(OH)_2$].

22) 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.

23) 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.

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