Metals And Non-metals

Question 1:

Name one metal and one non-metal which exist in liquid state at room temperature.

Solution :

Metal – Mercury.

Non metal – Bromine.

Question 2:

Why are metals called electropositive elements whereas non-metals are called electronegative elements ?

Solution :

Metals are electropositive elements because they can form positive ions by losing electrons.

Non-metals are electronegative elements because they can form negative ions by gaining electrons.

Question 3:

(a) Name the most abundant metal in the earth's crust.

(b) Name the most abundant non-metal in the earth's crust.

Solution :

(a) Aluminium.

(b) Oxygen.

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Question 4:

Name one metal which has a low melting point.

Solution :

Cesium.

Question 5:

Name the metal which is the poorest conductor of heat.

Solution :

Lead.

Question 6:

State whether the following statement is true or false :

Non-metals react with dilute acids to produce a gas which burns with a 'pop' sound.

Solution :

False.

Question 7:

From amongst the metals sodium, calcium, aluminium, copper and magnesium, name the metal :

(i) which reacts with water only on boiling, and

(ii) another which does not react even with steam.

Solution :

(i) Aluminium.

(ii) Copper.

Question 8:

What changes in the colour of iron nails and copper sulphate solution do you observe after keeping the iron nails dipped in copper sulphate solution for about 30 minutes ?

Solution :

Iron nail gets covered with a red-brown coating of copper metal; The blue colour of copper sulphate solution fades gradually.

Question 9:

What is aqua-regia ? Name two special metals which are insoluble in common reagents but dissolve in aqua-regia.

Solution :

Aqua-regia is a freshly prepared mixture of one part of concentrated nitric acid and 3 parts of concentrated hydrochloric acid. Gold and platinum dissolve in aqua-regia

Question 10:

Give the names and formulae of (a) two acidic oxides, and (b) two basic oxides.

Solution :

(a) Carbon dioxide and sulphur dioxide.

(b) Sodium oxide and magnesium oxide.

Question 11:

What name is given to those metal oxides which show basic as well as acidic behaviour ?

Solution :

Amphoteric oxides.

Question 12:

Name two metals which form amphoteric oxides.

Solution :

Aluminium and zinc.

Question 13:

A copper coin is kept immersed in a solution of silver nitrate for some time. What will happen to the coin and the colour of the solution ?

Solution :

Copper coin will get a shining greyish white coating of silver metal. The color of the solution will turn blue.

Question 14:

Which property of copper and aluminium makes them suitable :

(a) for making cooking utensils and boilers ?

(b) for making electric wires ?

Solution :

(a) High thermal conductivity.

(b) High electrical conductivity.

Question 15:

Write the names and formulae of (a) a metal hydride, and (b) a non-metal hydride.

Solution :

Sodium hydride,Hydrogen sulphide

Question 16:

Name the metal which has been placed :

(a) at the bottom of the reactivity series

(b) at the top of the reactivity series

(c) just below copper in the reactivity series

Solution :

(a) Gold.

(b) Potassium.

(c) Mercury.

Question 17:

Which of the two metals is more reactive : copper or silver ?

Solution :

Copper.

Question 18:

(a) Name one metal which is stored in kerosene oil.

(b) Name one non-metal which is stored under water.

Solution :

(a) Sodium.

(b) White phosphorus.

Question 19:

Write equation for the reaction of :

(a) sodium with oxygen

(b) magnesium with oxygen

Solution :

(a)

$$4Na(s) + O_2(g) \rightarrow 2Na_2O(s)$$

Sodium (Metal) | Oxygen (From air) | Sodium oxide (Basic oxide)

(b)

$$2Mg(s) + O_2(g) \rightarrow 2MgO(s)$$

Magnesium (Metal) | Oxygen (From air) | Magnesium oxide (Basic oxide)

Question 20:

Name two metals which are used :

(a) for making electric wires.

(b) for making domestic utensils and factory equipment.

(c) for making jewellery and to decorate sweets.

Solution :

(a) Aluminium and copper.

(b) Copper and aluminium.

(c) Gold and silver.

Question 21:

Which metal foil is used for packing some of the medicine tablets ?

Solution :

Aluminium foil.

Question 22:

Name the non-metal which is used :

(a) to convert vegetable oil into vegetable ghee(solid fat).

(b) as a rocket fuel (in liquid form).

(c) to make electrodes of dry cells.

(d) to preserve food materials.

(e) in the vulcanisation of rubber.

Solution :

(a) Hydrogen.

(b) Hydrogen.

(c) Carbon.

(d) Nitrogen.

(e) Sulphur.

Question 23:

Name one property which is characteristic of (a) metals, and (b) non-metals.

Solution :

(a) Metals are malleable.

(b) Non-metals are non-malleable.

Question 24:

What is meant by "brittleness" ? Which type of elements usually show brittleness : metals or non-metals ?

Solution :

Brittleness is the property of being brittle i.e. breaking easily.

Non-metals show brittleness.

Question 25:

What will happen if a strip of zinc is immersed in a solution of copper sulphate ?

Solution :

When a strip of zinc metal is put in copper sulphate solution, then the blue colour of copper sulphate solution fades gradually and red brown coating of copper is deposited on zinc strip.

Question 26:

What will happen if a strip of copper is kept immersed in a solution of silver nitrate ($AgN0_3$) ?

Solution :

When a strip of copper metal is immersed in silver nitrate solution, the solution gradually

becomes blue and a shining greyish-white deposit of silver metal is formed on copper strip.

Question 27:

What happens when iron nails are put into copper sulphate solution ?

Solution :

When iron nails are placed in copper sulphate solution, the blue colour of copper sulphate solution fades gradually and red-brown copper metal is formed.

Question 28:

How would you show that silver is chemically less reactive than copper ?

Solution :

If a strip of silver metal is kept immersed in copper sulphate solution for some time, then no reaction occurs. This shows that silver is not able to displace copper from copper sulphate solution.

Question 29:

Give reasons for the following :

Blue colour of copper sulphate solution is destroyed when iron filings are added to it.

Solution :

Blue color of copper sulphate is destroyed because iron displaces copper from copper sulphate solution as iron is more reactive than copper.

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Question 30:

Name a non-metal having a very high melting point.

Solution :

Diamond.

Question 31:

Which property of graphite is utilised in making electrodes ?

Solution :

Since graphite is a good conductor of electricity, it is used in making electrodes.

Question 32:

Name two non-metals which are both brittle and non-ductile.

Solution :

Sulphur and phosphorus.

Question 33:

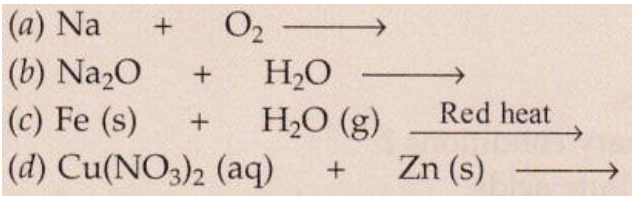
Explain why, the surface of some metals acquires a dull appearance when exposed to air for a long time.

Solution :

The surface of some metals acquires a dull appearance when exposed to air for a long time because metals form a thin layer of oxides, carbonates or sulphide on their surface by the slow action of various gases present in air.

Question 34:

Complete and balance the following equations :



Solution :

Question 35:

Fill in the following blanks with suitable words :

(a) Magnesium liberates..... gas on reacting with hot boiling water.

(b) The white powder formed when magnesium ribbon burns in oxygen is of.....

(c) Ordinary aluminium strips are not attacked by water because of the presence of a layer of..... on the surface of aluminium.

(d) A metal having low melting point is..... but a non-metal having very high melting point is.....

(e) Calcium is a..... reactive metal than sodium.

Solution :

(a)Hydrogen.

(b) Magnesium oxide.

(c) Aluminium oxide.

(d) Sodium; Diamond.

(e) Less.

Question 36:

(a) What is meant by saying that the metals are malleable and ductile ? Explain with examples.

(b) Name two metals which are both malleable and ductile.

(c) Which property of iron metal is utilised in producing iron sheets required for making buckets ?

(d) Which property of copper metal is utilised in making thin wires ?

Solution :

(a) Metals are malleable i.e. they can be beaten into thin sheets with a hammer.

Example: Aluminium.

Metals are ductile i.e. they can be drawn into thin wires.

Example: Copper.

(b) Aluminium and copper.

(c) Malleability.

(d) Ductility.

Question 37:

Name two metals which react violently with cold water. Write any three observations you would make when such a metal is dropped into water. How would you identify the gas evolved, if any, during the reaction ?

Solution :

Sodium and potassium metals react violently with cold water.

Observations:

1. Metal starts moving over the surface of water making a hissing sound.
2. Metal starts reacting with water causing little explosions.
3. Soon the metal catches fire and starts burning.

Question 38:

(a) With the help of examples, describe how metal oxides differ from non-metal oxides.

(b) Which of the following elements would yield : (i) an acidic oxide, (ii) a basic oxide, and (iii) a

neutral oxide ?

Na, S, C, K, H

Solution :

(a)M etal oxides are basic in nature and turn red litmus blue. For example: Magnesium oxide. Non-metal oxides are acidic or neutral in nature. The acidic oxides turn blue litmus red. For example: Carbon dioxide.

(b) (i) Acidic oxide: S, C

(ii) Basic oxide: Na, K

(iii) Neutral oxide: H

Question 39:

(a) What are amphoteric oxides ? Give two examples of amphoteric oxides.

(b) Choose the acidic oxides, basic oxides and neutral oxides from the following :

Na_2O ; CO_2 ; CO ; SO_2; MgO ; N_2O ; H_2O.

(c) Which of the following are amphoteric oxides :

MgO, ZnO, P_2O_3, Al_2O_3, NO_2

Solution :

(a) Those metal oxides which show basic as well as acidic behavior are known as amphoteric oxides.

Example: Aluminium oxide and zinc oxide.

(b) Acidic oxide – CO 2 , CO, SO 2 and N 2 O; Basic oxide – Na 2 O, MgO; Neutral oxide – H 2 O.

(c) ZnO, Al 2 O 3 .

Question 40:

(a) What is the nature of the oxide SO_2 ? What happens when it is dissolved in water ? Write the chemical equation of the reaction involved.

(b) What is the nature of the oxide Na_2O ? What happens when it is dissolved in water ? Write the chemical equation of the reaction inolved.

Solution :

(a) SO2 is acidic in nature. When dissolved in water, it produces sulphurous acid.

$$\underset{\text{Sulphurdioxide (Acidic oxide)}}{SO_2(g)} + \underset{\text{Water}}{H_2O(l)} \rightarrow \underset{\text{Sulphurous acid (Acid)}}{H_2SO_3(aq)}$$

(b) Na2O is basic in nature. When dissolved in water, it forms an alkali called sodium hydroxide.

$$\underset{\text{Sodium Oxide (Basic oxide)}}{Na_2O(s)} + \underset{\text{Water}}{H_2O(l)} \rightarrow \underset{\text{Sodium hydroxide (Alkali)}}{2NaOH(aq)}$$

Question 41:

(a) What type of oxides are formed when non-metals react with oxygen ? Explain with an example.

(b) What type of oxides are formed when metals combine with oxygen ? Explain with the help of an example.

Solution :

(a) When non-metals react with oxygen, they form acidic oxides or neutral oxides.

Example: Carbon reacts with oxygen to form an acidic oxide called carbon dioxide. Hydrogen reacts with oxygen

(b)When metals combine with oxygen, they form basic oxides.

Example: Sodium reacts with oxygen to form a basic oxide called sodium oxide.

Question 42:

(a) Explain why, metals usually do not liberate hydrogen gas with dilute nitric acid.
(b) Name two metals which can, however, liberate hydrogen gas from very dilute nitric acid.

Solution :

Metals do not liberate hydrogen gas with nitric acid because nitric acid is a strong oxidizing agent. So, as soon as hydrogen gas is formed in the reaction between a metal and dilute nitric acid, the nitric acid oxidises
this hydrogen to water.
(b) Magnesium and manganese.

Question 43:

(a) How do metals react with hydrogen ? Explain with an example.
(b) How do non-metals react with hydrogen ? Explain with an example.

Solution :

(a) Most of the metals do not react with hydrogen. Only a few reactive metals react with hydrogen to form metal hydrides. For example: When hydrogen gas is passed over heated sodium, then sodium hydride is formed.
(b) Non-metals react with hydrogen to form covalent hydrides. For example: Sulphur combines with hydrogen to form hydrogen sulphide.

Question 44:

(a) What happens when calcium reacts with chlorine ? Write an equation for the reaction which takes place.
(b) What happens when magnesium reacts with very dilute nitric acid ? Write an equation for the reaction involved.

Solution :

(a)Calcium reacts vigorously with chlorine to form an ionic chloride called calcium chloride.

$$\underset{\text{Calcium}}{Ca(s)} + \underset{\text{Chlorine}}{Cl_2(g)} \rightarrow \underset{\text{Calcium chloride}}{CaCl_2(s)}$$

(b)Magnesium reacts with very dilute nitric acid to form magnesium nitrate and hydrogen gas.

$$\underset{\text{Magnesium}}{Mg(s)} + \underset{\text{Nitric acid}}{2HNO_3(aq)} \rightarrow \underset{\text{Magnesium nitrate}}{Mg(NO_3)_2(aq)} + \underset{\text{Hydrogen}}{H_2(g)}$$

Question 45:

(a) Arrange the following metals in order of their chemical reactivity, placing the most reactive metal first :
Magnesium, Copper, Iron, Sodium, Zinc, Lead, Calcium.
(b) What happens when a rod of zinc metal is dipped into a solution of copper sulphate ? Give chemical equation of the reaction involved.

Solution :

(a) Sodium > Calcium > Magnesium > Zinc > Iron > Lead > Copper
(b) When a strip of zinc metal is put in copper sulphate solution, then the blue colour of copper sulphate solution fades gradually and red brown coating of copper is deposited on the zinc strip.

$$\underset{\text{Zinc}}{Zn(s)} + \underset{\text{Copper sulphate}}{CuSO_4(aq)} \rightarrow \underset{\text{Zinc sulphate}}{ZnSO_4(aq)} + \underset{\text{Copper}}{Cu(s)}$$

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Question 46:

A copper plate was dipped in $AgNO_3$ After certain time, silver from the solution was deposited on the copper plate. State the reason why it happened. Give the chemical equation of the reaction involved.

Solution :

Silver gets deposited on the copper plate because copper is more reactive than silver and hence displaces silver from silver nitrate solution.

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

Question 47:

State five uses of metals and five of non-metals.

Solution :

Uses of metals:

(i) Lead metal is used in making car batteries.

(ii) Zinc is used for galvanizing iron to protect it from rusting.

(iii) Iron, copper and aluminium are used to make utensils.

(iv) Copper and aluminium metals are used to make electrical wires.

(v) Aluminium is used to make aluminium foil for packaging materials.

Uses of non-metals:

(i) Hydrogen is used in the hydrogenation of vegetable oils.

(ii) Carbon is used to make electrodes of electrolytic cells and dry cells.

(iii) Nitrogen is used in the manufacture of ammonia, nitric acid and fertilizers.

(iv) Sulphur is used for producing sulphuric acid.

(v) Liquid hydrogen is used as rocket fuel.

Question 48:

State one use each of the following metals :

Copper, Aluminium, Iron, Silver, Gold, Mercury

Solution :

(i) Copper – Copper is used to make wires to carry electric current.

(ii) Aluminium – Aluminium foils are used in packaging of food materials.

(iii) Iron – Iron is used to make utensils.

(iv) Silver – Silver is used to make jewellery.

(v) Gold – Gold is used to make jewellery.

(vi) Mercury – Mercury is used in thermometers.

Question 49:

(a) State one use each of the following non-metals :

Hydrogen, Carbon (as Graphite), Nitrogen, Sulphur

(b) Name the metal which is used in making thermometers.

Solution :

(a) (i) Hydrogen – Hydrogen is used in the hydrogenation of vegetable oils.

(ii) Carbon is used to make electrodes of electrolytic cells and dry cells.

(iii) Nitrogen is used in the manufacture of ammonia, nitric acid and fertilizers.

(iv) Sulphur is used in making sulphuric acid.

(b) Mercury

Question 50:

(a) Why does aluminium not react with water under ordinary conditions ?

(b) Name two metals which can displace hydrogen from dilute acids.

(c) Name two metals which cannot displace hydrogen from dilute acids.

Solution :

(a) Aluminium metal does not react with water under ordinary conditions because of the presence of a thin layer of aluminium oxide on its surface.

(b) Sodium and magnesium.

(c) Copper and silver.

Question 51:

(a) Why is sodium kept immersed in kerosene oil ?

(b) Why is white phosphorus kept immersed under water ?

(c) Can we keep sodium immersed under water ? Why ?

Solution :

(a) Sodium is a very reactive metal so it reacts vigorously with the oxygen of air and catches fire. It is kept immersed in kerosene oil to protect it from the action of oxygen, moisture and carbon dioxide of air and to prevent accidental fires.

(b) White phosphorus is kept immersed in water because it reacts spontaneously with oxygen of air to form phosphorus pentoxide but does not react with water.

(c) No, because sodium reacts vigorously with water to form sodium hydroxide and hydrogen.

Question 52:

(a) Describe the reaction of potassium with water. Write the equation of the reaction involved.

(b) Write an equation of the reaction of iron with steam. Indicate the physical states of all the reactants and products.

(c) Which gas is produced when dilute hydrochloric acid is added to a reactive metal ?

Solution :

(a) Potassium reacts violently with cold water to form potassium hydroxide and hydrogen gas.

$2K(s)+2H_2O(l)\rightarrow 2KOH(aq)+H_2(g)+Heat$

(b) $3Fe(s)+4H_2O(g)\rightarrow Fe_3O_4(s)+4H_2(g)$

(c) Hydrogen.

Question 53:

(a) Give one example, with equation, of the displacement of hydrogen by a metal from an acid.

(b) Name two metals (other than zinc and iron) which can displace hydrogen from dilute hydrochloric acid ?

Solution :

(a) Magnesium reacts with very dilute nitric acid to form magnesium nitrate and hydrogen gas.

$Mg(s) + 2HNO_3(aq) \rightarrow Mg(NO_3)_2(aq) + H_2(g)$

Magnesium Nitric acid Magnesium nitrate Hydrogen

(b) Magnesium and aluminium.

Question 54:

What is the action of water on (a) sodium (b) magnesium, and (c) aluminium ? Write equations of the chemical reactions involved.

Solution :

(a) Sodium reacts vigorously with cold water forming sodium hydroxide and hydrogen gas.

$2Na(s)+2H_2O(l)\rightarrow 2NaOH(aq)+H_2(g)+Heat$

(b) Magnesium reacts with hot water to form magnesium hydroxide and hydrogen.

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

(c) Aluminium reacts with steam to form aluminium oxide and hydrogen gas.

$2Al(s)+3H_2O(g)\rightarrow Al_2O_3(s)+3H_2(g)$

Question 55:

You are given samples of three metals — sodium, magnesium and copper. Suggest any two activities to arrange them in order of their decreasing reactivities.

Solution :

(i) When sodium, magnesium and copper are left in air, sodium reacts vigorously with oxygen to form sodium oxide, magnesium reacts with oxygen to form magnesium oxide only on heating , whereas copper does not burn in air even on strong heating. It reacts only on

prolonged heating. This shows that sodium is most reactive, then magnesium and copper is the least reactive among the three.
(ii) Sodium reacts vigorously with cold water to form sodium hydroxide and hydrogen, magnesium does not react with cold water but reacts with hot water to form magnesium hydroxide and hydrogen but copper does not react even with steam. This shows that sodium is highly reactive; magnesium is less reactive than sodium and copper is the least reactive among the three.

Question 56:

(a) Write one reaction in which aluminium oxide behaves as a basic oxide and another in which it behaves as an acidic oxide.
(b) What special name is given to substances like aluminium oxide.
(c) Name another metal oxide which behaves like aluminium oxide.

Solution :

(a)

$$Al_2O_3(s) + 6HCl(aq) \rightarrow 2AlCl_3(aq) + 3H_2O(l)$$

In this reaction, aluminium oxide behaves as a basic oxide because it reacts with an acid to form salt and water.

$$Al_2O_3(s) + 2NaOH(aq) \rightarrow 2NaAlO_2(aq) + H_2O(l)$$

In this reaction, aluminium oxide behaves as an acidic oxide because it reacts with a base to form salt and water.
(b) Amphoteric oxides.
(c) Zinc oxide.

Question 57:

(a) What happens when calcium reacts with water ? Write the chemical equation of the reaction of calcium with water.
(b) Write the chemical equation of the reaction which takes place when iron reacts with dilute sulphuric acid. What happens when the gas produced is ignited with a burning matchstick ?

Solution :

(a) Calcium reacts with cold water to form calcium hydroxide and hydrogen gas.

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

(b) When iron reacts with dilute sulphuric acid, it forms iron sulphate and hydrogen gas.

$$Fe(s) + H_2SO_4(aq) \rightarrow FeSO_4(aq) + H_2(g)$$

When hydrogen gas is ignited with a burning matchstick, it produces a 'pop'sound.

Question 58:

You are given a dry cell, a torch bulb with holder, wires and crocodile clips. How would you use them to distinguish between samples of metals and non-metals ?

Solution :

We would create an apparatus using dry cell, a torch bulb fitted in a holder and some connecting wires with crocodile clips and connect them to make an electric circuit. Then insert a piece of sulphur between the crocodile clips and the bulb does not light up at all. This means that sulphur does not allow the electric current to pass through it. Now insert a piece of copper between the crocodile clips and the bulb will light up. This observation shows that non metals (ex- sulphur) do not conduct electricity and metals (ex- copper) conduct electricity.

Question 59:

State any five physical properties of metals and five physical properties of non-metals.

Solution :

Properties of metals:

(i) Metals are malleable i.e. they can be beaten into thin sheets with a hammer.
(ii) Metals are ductile i.e. they can be drawn into thin wires.
(iii) Metals are good conductors of heat and electricity.
(iv) Metals are lustrous.

(v) Metals are generally hard.

Properties of non-metals:

(i) Non-metals are non-malleable i.e. they cannot be beaten into thin sheets with a hammer.

(ii) Non-metals are non-ductile i.e. they cannot be drawn into thin wires.

(iii) Non-m etals are bad conductors of heat and electricity.

(iv) Non-m etals are non- lustrous.

(v) Non-m etals are generally soft .

Question 60:

(a) Name two physical properties each of sodium and carbon in which their behaviour is not as expected from their classification as metal and non-metal respectively.

(b) Name two metals whose melting points are so low that they melt when held in the hand.

Solution :

(a) Sodium metal: Soft, low melting point

Carbon non-metal: graphite conducts electricity; diamond has a very high melting point.

(b) Gallium and cesium.

Question 61:

Metals are said to be shiny. Why do metals generally appear to be dull ? How can their brightness be restored ?

Solution :

Metals lose their shine or brightness on keeping in air for a long time and acquire a dull appearence due to the formation of a thin layer of oxide, carbonate or sulphide on their surface by the slow action of various gases present in air.

Brightness of metals can be restored by rubbing the dull surface of the metal object with a sand paper, then the outer corroded layer is removed and the metal object becomes shiny and bright once again.

Question 62:

(a) What are metals ? Name five metals.

(b) Name a metal which is so soft that it can be cut with a knife.

(c) Name the metal which is the best conductor of heat and electricity.

(d) What happens when a metal reacts with dilute hydrochloric acid ? Explain with the help of an example.

(e) Write the equations for the reactions of :

(i) Magnesium with dilute hydrochloric acid

(ii) Aluminium with dilute hydrochloric acid

(iii) Zinc with dilute hydrochloric acid

(iv) Iron with dilute hydrochloric acid

Name the products formed in each case. Also indicate the physical states of all the substances involved.

Solution :

(a) Metals are the elements that conduct heat and electricity, and are malleable and ductile.

Example: Iron, aluminium, copper, gold and silver.

(b) Sodium

(c) Silver

(d) When a metal reacts with dilute hydrochloric acid, it forms metal chloride and hydrogen gas.

Example: Magnesium reacts rapidly with dilute hydrochloric acid to form magnesium chloride and hydrogen.

$Mg(s)+2HCl(aq)\rightarrow MgCl_2(aq)+H_2(g)$

(e) (i)

$Mg(s)+2HCl(aq)\rightarrow MgCl_2(aq)+H_2(g)$

The products formed are magnesium chloride and hydrogen.

(ii)

$2Al(s)+6HCl(aq)\rightarrow 2AlCl_3(aq)+3H_2(g)$

The products formed are aluminium chloride and hydrogen.

(iii)

$Zn(s)+2HCl(aq)\rightarrow ZnCl_2(aq)+H_2(g)$

The products formed are zinc chloride and hydrogen.

(iv)

$Fe(s)+2HCl(aq)\rightarrow FeCl_2(aq)+H_2(g)$

The products formed are iron chloride and hydrogen.

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Question 63:

(a) Define non-metals. Give five examples of non-metals.

(b) Name a non-metal which conducts electricity.

(c) Name a non-metal having lustre (shining surface).

(d) Name a non-metal which is extremely hard.

(e) How do non-metals react with oxygen ? Explain with an example. Give equation of the reaction involved. What is the nature of the product formed ? How will you demonstrate it ?

Solution :

(a)Non-metals are the elements that do not conduct heat and electricity and are neither malleable nor ductile.

Example: Carbon, sulphur, phosphorus, silicon and oxygen.

(b) Carbon.

(c) Iodine.

(d) Carbon (Diamond).

(e) Non-metals react with oxygen to form acidic oxides or neutral oxides. Carbon burns in air to form carbon dioxide.

$C(s)+O_2(g)\rightarrow CO_2(g)$

The nature of the product formed is acidic. When carbon dioxide dissolves in water, it forms carbonic acid. It turns blue litmus to red which shows it is acidic in nature.

Question 64:

(a) What is meant by the reactivity series of metals ? Arrange the following metals in an increasing order of their reactivities towards water :

Zinc, Iron, Magnesium, Sodium

(b) Hydrogen is not a metal but still it has been assigned a place in the reactivity series of metals. Why ?

(c) Name one metal more reactive and another less reactive than hydrogen.

(d) Name one metal which displaces copper from copper sulphate solution and one which does not.

(e) Name one metal which displaces silver from silver nitrate solution and one which does not.

Solution :

(a) The arrangement of metals in a vertical column in the order of decreasing reactivities is called reactivity series.

Increasing order of reactivity: Iron < zinc < magnesium < sodium

(b) Though hydrogen is not a metal but it has been placed in the reactivity series of metals due to the fact that like metals, hydrogen also loses electrons and forms positive ions.

(c) Lead is more reactive than hydrogen and copper is less reactive than hydrogen.

(d) Zinc displaces copper from copper sulphate solution and mercury does not displace copper from copper sulphate solution.

(e) Copper displaces silver from silver nitrate solution and gold does not.

Question 65:

(a) State any three differences between the physical properties of metals and non-metals.

(b) Differentiate between metals and non-metals on the basis of their chemical properties.

(c) State three reasons (of which at least one must be chemical) for believing that sodium is a metal.

(d) State three reasons (of which at least one must be chemical) for believing that sulphur is a non-metal.

(e) Which non-metal has been placed in the reactivity series of metals ?

Solution :

(a) Difference between metals and non-metals:

Metals

(i) Metals are malleable i.e. they can be beaten into thin sheets with a hammer.

(ii) Metals are ductile i.e. they can be drawn into thin wires.

(iii) Metals are good conductors of heat and electricity.

Non-metals

(i) Non-metals are non-malleable i.e. they cannot be beaten into thin sheets with a hammer.

(ii) Non-metals are non-ductile i.e. they cannot be drawn into thin wires.

(iii) Non-metals are bad conductors of heat and electricity.

(b) Difference between metals and non-metals:

Metals

(i) Metals form basic oxides.

(ii) Metals displace hydrogen from water

(iii) Metals displace hydrogen from dilute acids.

Non-metals

(i) Non-metals form acidic or neutral oxides.

(ii) Non-metals do not react with water.

(iii) Non-metals do not react with dilute acids.

(c) Sodium is a solid, it conducts electricity and forms basic oxides.

(d) Sulphur is a non-metal as it is brittle, non-ductile, non-conductor of electricity and forms acidic oxides.

(e) Hydrogen.

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Question 89:

An element E forms an oxide E_2 An aqueous solution of E_2O turns red litmus paper blue.

(a) What is the nature of the oxide E_2O ?

(b) State whether element E is a metal or a non-metal.

(a) Give one example of an element like E.

Solution :

(a) Basic oxide.

(b) Metal .

(c) Sodium, Na .

Question 90:

Metal A burns in air, on heating, to form an oxide A_2O_3 whereas another metal B burns in air only on strong heating to form an oxide BO. The two oxides A_2O_3 and BO can react with hydrochloric acid as well as sodium hydroxide solution to form the corresponding salts and water.

(a) What is the nature of oxide A_2O_3 ?

(b) What is the nature of oxide BO ?
(c) Name one metal like A.
(d) Name one metal like B.

Solution :

(a) Amphoteric oxide .
(b) Amphoteric oxide .
(c) Aluminium, Al.
(d) Zinc, Zn .

Question 91:

An element X forms two oxides XO and XO_2. The oxide XO has no action on litmus solution but oxide $X0_2$ turns litmus solution red.
(a) What is the nature of oxide XO ?
(b) What is the nature of oxide XO_2 ?
(c) Would you call element X a metal or a non-metal ? Give reason for your choice.
(d) Can you give an example of element like X ?

Solution :

(a) Neutral oxide.
(b) Acidic o xide .
(c) X is non-metal because non-metals form acidic and basic oxide .
(d) Carbon, C .

Question 92:

State and explain the reactions, if any, of the following metals with a solution of copper sulphate :
(a) Gold (b) Copper (c) Zinc (d) Mercury

Solution :

(a) No displacement reaction will take place because go ld is less reactive than copper.
(b) No reaction will take place between copper and copper sulphate solution ; there is no reaction possible.
(c) Zinc displaces copper from copper sulphate solution to form zinc sulphate solution and copper metal because zinc is m ore reactive than copper .
(d) No displacement reaction will take place because mercury is less reactive than copper

Question 93:

(a) Give the names and formulae of one metal chloride and one non-metal chloride.
(b) State an important property in which these metal chloride and non-metal chloride differ.
(c) Why do they differ in this property ?

Solution :

Non-metal chloride:
Carbon tetrachloride, CCl 4
(b) Sodium chloride solution conducts electricity whereas carbon tetrachlori de does not conduct electricity.
(c) Sodium chloride is an ionic compoun d whereas carbon tetrachloride is a covalent compound.

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Question 94:

In a solution of lead acetate, a strip of metal M was dipped. After some time, lead from the solution was deposited on the metal strip. Which metal is more reactive, M or lead ?

Solution :

M is more reactive than lead since it is able to displace lead from lead acetate solution

Question 95:

$$CuSO_4\ (aq) + Fe\ (s) \longrightarrow FeSO_4\ (aq) + Cu\ (s)$$
$$FeSO_4\ (aq) + Zn\ (s) \longrightarrow ZnSO_4\ (aq) + Fe\ (s)$$

On the basis of the above reactions, indicate which is most reactive and which is least reactive metal out of zinc, copper and iron.

Solution :

Zinc is most r eactive and copper is least reactive out of the three since iron displaced copper from its solution and zinc displaced iron from its solution.

Question 96:

Which of the following reactions will not occur ? Why not ?

$$(a)\ MgSO_4\ (aq) + Cu\ (s) \longrightarrow CuSO_4\ (aq) + Mg\ (s)$$
$$(b)\ CuSO_4\ (aq) + Fe\ (s) \longrightarrow FeSO_4\ (aq) + Cu\ (s)$$
$$(c)\ MgSO_4\ (aq) + Fe\ (s) \longrightarrow FeSO_4\ (aq) + Mg\ (s)$$

Solution :

Reaction (a) will not occur because Cu is less reactive than Mg

Reaction (c) will also not occur because Fe is less reactive than Mg .

Question 97:

In nature, metal A is found in a free state while metal B is found in the form of its compounds. Which of these two will be nearer to the top of the activity series of metals ?

Solution :

Metal B will be nearer to the top of the activity series since it is highly reactive and is hence found in the form of its compounds and not in free state.

Question 98:

If A, B, C, D, E, F, G, H, I, J and K represent metals in the decreasing order of their reactivity, which one of them is most likely to occur in a free state in nature ?

Solution :

K being the lowest in the reactivity series is least reactive and is most likely to occur in a free state in nature.

Question 99:

(a) Name a metal for each case :

(i) It does not react with cold as well as hot water but reacts with steam.

(ii) It does not react with any physical state of water.

(b) When calcium metal is added to water, the gas evolved does not catch fire but the same gas evolved on adding sodium metal to water catches fire. Why is it so ?

Solution :

(a) (i) Iron (ii) Gold

(b) More heat is evolved during the reaction of sodium metal with water due to which the hyd rogen gas formed catches fire. O n the other hand, less heat is evolved during the reaction of calcium metal with water which cannot make the hydrogen gas bu rn .

Question 100:

A zinc plate was kept in a glass container having $CuS0_4$ On examining it was found that the blue colour of the solution is getting lighter and lighter. After a few days, when the zinc plate was taken out of the solution, a number of small holes were noticed in it. State the reason and

give chemical equation of the reaction involved.

Solution :

Zinc metal is more reactive than copper. Some of the zinc metal of zinc plate dissolves and displaces copper from copper sulphate solution. This dissolving of zinc metal forms tiny holes in zinc plate. Blue colour of copper sulphate solution gets lighter and lighter due to the formation of colourless zinc sulphate solution.

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Question 1:

What is the name of the chemical bond formed :

(a) by the sharing of electrons between two atoms ?

(b) by the transfer of electrons from one atom to another ?

Solution :

(a) Covalent bond.

(b) Ionic bond .

Question 2:

Name a carbon containing molecule which has two double bonds.

Solution :

Carbon dioxide

Question 3:

What would be the electron-dot structure of carbon dioxide which has the formula $C0_2$?

Solution :

Question 4:

What type of chemical bond is formed between :

(a) potassium and bromine ?

(b) carbon and bromine ?

Solution :

(a) Ionic bond.

(b) Covalent bo nd.

Question 5:

(a) What do we call those particles which have more or less electrons than the normal atoms ?

(b) What do we call those particles which have more electrons than the normal atoms ?

(c) What do we call those particles which have less electrons than the normal atoms ?

Solution :

(a) Ions

(b) Anions

(c) Cations

Question 6:

(a) The atomic number of sodium is 11. What is the number of electrons in Na^+ ?

(b) The atomic number of chlorine is 17. What is the number of electrons in Cl^- ?

Solution :

(a) No. of electrons in $Na^+ = 10$

(b) No. of electrons in $Cl^- = 18$

Question 7:

The atomic number of an element X is 8 and that of element Y is 12. Write down the symbols of the ions you would expect to be formed from their atoms.

Solution :

X will form X^{2-}

Y will form Y^{2+}

Question 8:

(a) Write down the electronic configuration of (i) magnesium atom, and (ii)magnesium ion. (At. No. of Mg = 12)

(b) Write down the electronic configuration of (i) sulphur atom, and (ii) sulphide ion. (At. No. of S = 16)

Solution :

(a) (i) E.C of Mg = 2, 8, 2 (ii) E.C of Mg^{2+} = 2, 8

(b) (i) E.C of S = 2, 8, 6 (ii) E.C of S^{2-} = 2, 8, 8

Question 9:

What type of chemical bonds are present in a solid compound which has a high melting point, does not conduct electricity in the solid state but becomes a good conductor in the molten state ?

Solution :

Ionic bonds .

Question 10:

State whether the following statement is true or false :

The aqueous solution of an ionic compound conducts electricity because there are plenty of free electrons in the solution.

Solution :

False (It should be 'ions' in place of 'electrons') .

Question 11:

What type of bonds are present in hydrogen chloride and oxygen ?

Solution :

Covalent bond

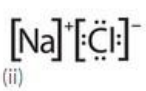
Question 12:

Write the electron-dot structures for the following molecules :

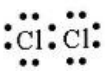
(i) NaCl (ii) Cl_2

Solution :

(i)



(ii)

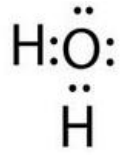


Question 13:

What type of bonds are present in water molecule ? Draw the electron-dot structure of water (H_20).

Solution :

Covalent bonds are present in a water molecule. Electron dot structure of water:



Question 14:

What type of bonds are present in methane (CH_4) and sodium chloride (NaCl) ?

Solution :

Methane: Covalent bonds

Sodium chloride: Ionic bonds

Question 15:

State one major difference between covalent and ionic bonds and give one example each of covalent and ionic compounds.

Solution :

Ionic compounds conduct electricity when dissolved in water or melted whereas covalent compounds do not conduct electricity.

Ionic compound – NaCl

Covalent compound – Carbon Dioxide

Question 16:

What type of bonds are present in the following molecules ? Draw their electron-dot structures.

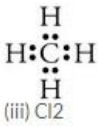
(i) H_2 (ii) CH_4 (iii) Cl_2 (iv) O_2

Solution :

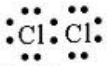
Covalent bonds are present in the given molecules

(i) H2

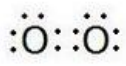
(ii) CH4



(iii) Cl2



(iv) O2



Question 17:

Which inert gas electron configuration do the Cl atoms in Cl_2 molecule resemble ? What is this electron configuration ?

Solution :

Argon; E.C = 2, 8,8

Question 18:

Which of the following compounds are ionic and which are covalent ?

Urea, Cane sugar, Hydrogen chloride, Sodium chloride, Ammonium chloride, Carbon tetrachloride, Ammonia, Alcohol, Magnesium chloride.

Solution :

Ionic compounds: Sodium chloride, Ammoniu m chloride, Magnesium chloride.

Covalent compounds:

Urea, Cane sugar, Hy drogen chloride,
Carbon tetrachloride, Ammonia, Alcohol .

Question 19:

Give one example each of the following :
(i) Amolecule containing a single covalent bond
(ii) Amolecule containing a double covalent bond
(iii) Amolecule containing a triple covalent bond
(iv) Acompound containing an ionic bond

Solution :

(i) Hydrog en
(ii) Oxygen
(iii) Nitrogen
(iv) Sodium chloride

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Question 20:

Fill in the blanks in the following sentences :
(i) Two atoms of the same element combine to form a molecule. The bond between them is known as……bond.
(ii) Two chlorine atoms combine to form a molecule. The bond between them is known as
(iii) In forming oxygen molecule,…….. electrons are shared by each atom of oxygen.
(iv) In forming N_2 molecule,…….. electrons are shared by each atom of nitrogen.
(v) The number of single covalent bonds in C_2H_2 molecule are……
(vi) Melting points and boiling points of ionic compounds are generally…… than those of covalent compounds.

Solution :

(i) Covalent
(ii) Covalent
(iii) Two
(iv) Three
(v) Two
(vi) Higher

Question 21:

(a) What is a covalent bond ? What type of bond exists in (i) CCl_4, and (ii) $CaCl_2$?
(b) What is an ionic bond ? What type of bond is present in oxygen molecule ?

Solution :

(a) The chemical bond formed by the sharing of electrons between two atoms is known as a covalent bond.
(i) Covalent bonds (ii) Ionic bonds
(b) The chemical bond formed by the transfer of electrons from one atom to another is known as an ionic bond.
Covalent bond is present in an oxygen molecule.

Question 22:

(a) What is an ion ? Explain with examples.
(b) What is the nature of charge on (i) a cation, and (ii) an anion ?
(c) Name the cation and anion present in $MgCl_2$. Also write their symbols.

Solution :

(a) An ion is an electrically charged atom (or group of atoms). Example: Sodium ion, Na + ,

magnesium ion, Mg^{2+} .
(b) (i) Positive charge (ii) Negative charge
(c) Cation: Magnesium ion, Mg^{2+}
Anion: Chloride ions, $2Cl^-$

Question 23:
(a) What type of chemical bond is present in chlorine molecule ? Explain your answer.
(b) Explain the formation of a chlorine molecule on the basis of electronic theory of valency.
Solution :
(a) Covalent bond ; Because whenever two atoms of the same element combine to form a molecule, a covalent bond is formed.
(b) The atomic number of chlorine is 17, so its electronic configuration is 2,8,7. Chlorine atom has 7 electrons in its outermost shell and needs 1 more electron to complete its octet and become stable.
It gets this electron by sharing with another chlorine atom. So, two chlorine atoms share one electron each to form a chlorine molecule. Because the two chlorine atoms share electrons, there is a strong force of attraction between them which holds them together. This force is called covalent bond.
Now, each chlorine atom in the chlorine molecule has the electronic configuration 2,8,8 resembling its nearest inert gas argon. Since the chlorine atoms in a chlorine molecule have inert gas electron arrangements, therefore, a chlorine molecule is more stable than two separate chlorine atoms.

Question 24:
(a) Giving one example each, state what are (i) ionic compounds, and (ii) covalent compounds.
(b) Compare the properties of ionic compounds and covalent compounds.
Solution :
(a) (i) The compounds containing ionic bonds are known as ionic compounds. They are formed by the transfer of electrons from one atom to another.
Example: Sodium chloride, NaCl.
(ii) The compounds containing covalent bonds are known as covalent compounds. They are formed by the sharing of electrons between atoms. Example: Methane, CH_4 .
(b)
Ionic compounds
(i) Ionic compounds are usually crystalline solids.
(ii) Ionic compounds have high melting and boiling points.
(iii) Ionic compounds are usually soluble in water.
Covalent compounds
(i) Covalent compounds are usually liquids or gases.
(ii) Covalent compounds have low melting and boiling points.
(iii) Covalent compounds are usually insoluble in water.

Question 25:
Explain why :
(a) covalent compounds have generally low melting points.
(b) ionic compounds have generally high melting points.
Solution :
(a) Covalent compounds have generally low melting points because they are made up of electrically neutral molecules. So, the force of attraction between the molecules of a covalent compound is ve ry weak. Hence, only a small amount of heat energy is required to break these weak molecular forces.
(b) Ionic compounds are made of up of positive and negative ions. There is a strong force of

attraction between the oppositely charged ions, so a lot of heat energy is required to break this force of attraction and melt or boil the ionic compound. Due to this, ionic compounds have high melting points.

Question 26:

(a) Give two general properties of ionic compounds and two those of covalent compounds.

(b) State one test by which sodium chloride can be distinguished from sugar.

Solution :

(a) Ionic compounds:

(i) They have high melting and boiling points.

(ii) They are usually soluble in water.

Covalent compounds:

(i) They have low melting and boiling points.

(ii) They are usually insoluble in water.

(b) An aqueous solution of sodium chloride conducts electricity but a sugar solution does not conduct electri city.

Question 27:

(a) Explain why, ionic compounds conduct electricity in solution whereas covalent compounds do not conduct electricity .

(b) Which of the following will conduct electricity and which not ?

$MgCl_2$, CCl_4, NaCl, CS_2, Na_2S Give reasons for your choice.

Solution :

(a) Ionic compounds conduct electricity in solution because they are made up of electrically charged ions but covalent compounds are made u p of electrically neutral molecules so they do not conduct electricity.

(b) Conduct electricity: MgCl 2 , NaCl, Na 2 S (Ionic compounds)

Do not con duct electricity: CCl 4 , CS 2 (Covalent compounds) .

Question 28:

(a) Name one ionic compound containing chlorine and one covalent compound containing chlorine.

(b) How will you find out which of the water soluble compound A or B is ionic ?

Solution :

(a) Ionic co mpound: Sodium chloride, NaCl.

Cova lent c ompound: Carbon tetrachloride, CCl 4

(b) Out of A and B, the compound whose aqueous solution cond ucts electricity will be an ionic compound.

Question 29:

Explain why, a solution of cane sugar does not conduct electricity but a solution of common salt is a good conductor of electricity.

Solution :

Common salt is an ionic compound containing ionic bonds whereas cane sugar is a covalent compound containing covalent bonds. Since, ionic compounds conduct electricity and covalent compounds do not, hence common salt is a good conductor of electricity and cane sugar is a non-conductor of electricity.

Question 30:

Give the formulae of the compounds that would be formed by the combination of the following pairs of elements :

(a) Mg and N_2 (b) Li and O_2

(c) Al and Cl_2 (d) K and H

Solution :

(a) Mg 3 N 2

(b) Li 2 O

(c) AlCl 3

(d) KH

Question 31:

(a) What are noble gases ? What is the characteristic of the electronic configuration of noble gases ?

(b) What is the cause of chemical bonding (or chemical combination) of atoms of elements ?

Solution :

(a) There are some elements in group 18 of the periodic table which do not combine with other elements. These elements are helium, neon, argon, krypton, xenon and radon . They are known as noble gases or inert gases because they are unreactive.

If we look at the electronic configuration of noble gases, we would notice that except helium, all other inert gases have 8 electrons (helium has 2) in their outermost shells. This is considered to be the most stable arrangement of electrons.

(b) Atoms form chemical bonds to achieve stability by acquiring the inert gas electron configuration.

Question 32:

(i) Write electron-dot structures for magnesium and oxygen.

(ii) Show the formation of MgO by the transfer of electrons.

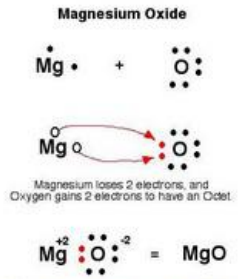
(iii) What are the ions present in this compound ?

Solution :

(i) Magnesium

Oxygen

(ii) Formation of MgO



(iii) Both positive and negative ions i.e. Mg^{2+} and O^{2-} respectively.

Question 33:

Draw the electron-dot structure of a hydrogen chloride molecule :

(i) Which inert gas does the H atom in HCl resemble in electron arrangement ?

(ii) Which inert gas does the Cl atom in HCl resemble in electron arrangement ?

Solution :

(i) Helium

(ii) Argon

Question 34:

What type of bonding would you expect between the following pairs of elements ?

(i) Calcium and Oxygen

(ii) Carbon and Chlorine

(iii) Hydrogen and Chlorine

Solution :

(i) Ionic bonding.

(ii) Covalent bonding.

(iii) Covalent bonding.

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Question 35:

Describe how sodium and chlorine atoms are changed into ions when they react with each other to form sodium chloride, NaCl. What is the name given to this type of bonding ? (At. No of sodium = 11; At. No. of chlorine = 17)

Solution :

The atomic number of sodium is 11, so its electronic configuration is 2,8,1. Sodium atom has only 1 electron in its outermost shell. So, the sodium atom donates one electron (to a chlorine atom) and forms a sodium ion, Na + . The atomic number of chlorine is 17, so its electronic configuration is 2,8,7. Chlorine atom has 7 electrons in its outermost shell and needs 1 more electron to achieve the stable 8-electron inert gas configuration. So, a chlorine atom takes one electron (from the sodium atom) and forms a negatively charged chloride ion, Cl- This type of bonding is called ionic bonding.

Question 36:

What is the difference between a cation and an anion ? How are they formed ? Give the names and symbols of one cation and one anion.

Solution :

A positively charged ion is known as cation. A cation is formed by the loss of one or more electrons by an atom. For example: sodium loses 1 electron to form a sodium ion, Na + , which is a cation.

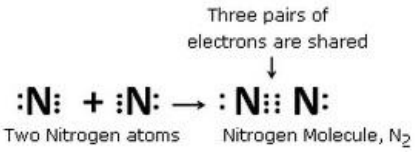
A negatively charged ion is known as anion. An anion is formed by the gain of one or more electrons by an atom. For example: A chlorine atom gains (accepts) 1 electron to form a chloride ion, Cl – , which is an anion.

Question 37:

Using electron-dot diagrams which show only the outermost shell electrons, show how a molecule of nitrogen, N_2, is formed from two nitrogen atoms. What name is given to this type of bonding ? (Atomic number of nitrogen is 7)

Solution :

Since nitrogen has 5 electrons in its outermost shell so, to achieve the 8-electron structure of an inert gas, it needs 3 more electrons and hence combines with another nitrogen atom to form a molecule of nitrogen gas.



This type of bonding is called covalent bonding.

Question 38:

Draw the electron-dot structures of the following compounds and state the type of bonding in

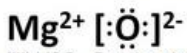
each case :

(i) CO_2 (ii) MgO (iii) H_2O (iv) HCl (v) $MgCl_2$

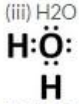
Solution :

(i) CO2 - Covalent bond

(ii) MgO - Ionic bond

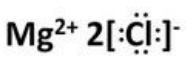


(iii) H2O - Covalent bond



(iv) HCl - Covalent bond

(v) MgCl2 - Ionic bond

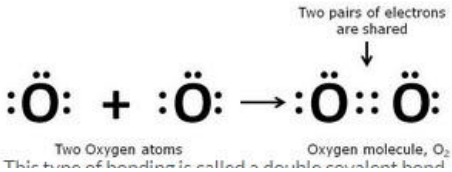


Question 39:

Using electron-dot diagrams which show only the outermost shell electrons, show how a molecule of oxygen, O_2, is formed from two oxygen atoms. What name is given to this type of bonding ? (At. No. of oxygen = 8)

Solution :

Since an oxygen atom has 6 electrons in its outermost shell so, it needs 2 more electrons to achieve the stable 8-electron inert gas configuration. Hence, it combines with another oxygen atom and forms a molecule of oxygen.



This type of bonding is called a double covalent bond.

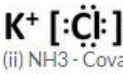
Question 40:

Draw the electron-dot structures of the following compounds and state the type of bonding in each case :

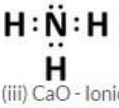
(i) KCl (ii) NH_3 (iii) CaO (iv) N_2 (iv) $CaCl_2$

Solution :

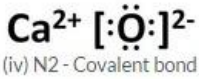
(i) KCl - Ionic bond



(ii) NH3 - Covalent bond

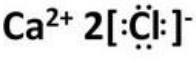


(iii) CaO - Ionic bond



(iv) N2 - Covalent bond

(v) CaCl2 - Ionic bond



Question 41:

Explain why, a salt which does not conduct electricity in the solid state becomes a good conductor in molten state.

Solution :

Although solid ionic compounds are made up of ions but they do not conduct electricity in solid state. This is because in the solid ionic compound, the ions are held together in fixed positions by strong electrostatic forces and cannot move freely. However, when we dissolve the ionic solid in water or melt it, the crystal structure is broken down and ions become free to move and conduct electricity. Thus, an aqueous solution of an ionic compound conducts electricity because there are plenty of free ions in the solution which are able to conduct electric current.

Question 42:

(a) Write down the electronic configuration of (i) sodium atom, and (ii) chlorine atom.

(b) How many electrons are there in the outermost shell of (i) a sodium atom, and (ii) a chlorine atom ?

(c) Show the formation of NaCl from sodium and chlorine atoms by the transfer of electron(s).

(d) Why has sodium chloride a high melting point ?

(e) Name the anode and the cathode used in the electrolytic refining of impure copper metal.

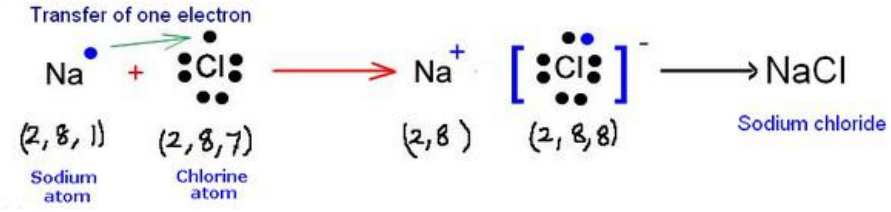
Solution :

(a) (i) Sodium – 2, 8, 1 (ii) Chlorine – 2, 8, 7

(b) (i) Sodium = 1 (ii) Chlorine = 7

(c)

(c)



(d) Sodium chloride has a high melting point because it is an ionic compound and these compounds are made of up of positive and negative ions. There is a strong force of attraction between the oppositely charged ions, so, a lot of heat energy is required to break this force of attraction and melt or boil the ionic compound.

(e) Anode: Thick block of impure copper metal; Cathode: Thin strip of p ure copper metal

Question 43:

(a) Write the electron arrangement in (i) a magnesium atom, and (ii) an oxygen atom.

(b) How many electrons are there in the valence shell of (i) a magnesium atom, and (ii) an oxygen atom ?

(c) Show on a diagram the transfer of electrons between the atoms in the formation of MgO.

(d) Name the solvent in which ionic compounds are generally soluble.

(e) Why are aqueous solutions of ionic compounds able to conduct electricity ?

Solution :

(a) (i) Magnesium -2, 8, 2

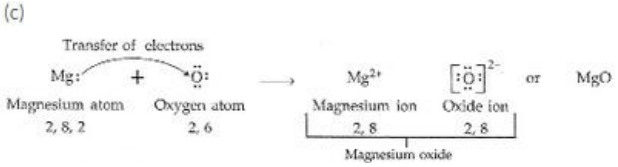
(ii) Oxygen – 2, 6

(b) (i) Magnesium = 2

(ii) Oxygen = 6

(c)

(c)



(d) Water .

(e) An aqueous solution of an ionic compound conducts electricity because there are plenty of free ions in the solution which are able to conduct electric current.

Question 44:

(a) What is the electronic configuration of (i) a sodium atom, and (ii) an oxygen atom ?

(b) What is the number of outermost electrons in (i) a sodium atom, and (ii) an oxygen atom ?

(c) Show the formation of Na_20 by the transfer of electrons between the combining atoms.

(d) Why are ionic compounds usually hard ?

(e) How is it that ionic compounds in the solid state do not conduct electricity but they do so when in molten state ?

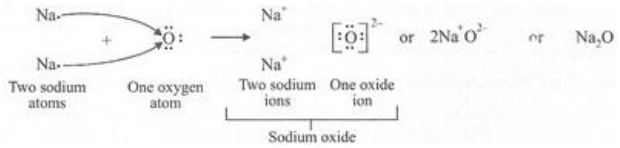
Solution :

(a) (i) 2,8,1 (ii) 2,6

(b) (i) 1 (ii) 6

(c)

(c)



(d)I onic compounds are usually hard because their oppositely charged ions attract one another strongly and form a regular crystal structure.

(e) Although solid ionic compounds are made up of ions but they do not conduct electricity in solid state. This is because in the solid ionic compound the ions are held together in fixed positions by strong electrostatic forces and cannot move freely. However, when we dissolve the ionic solid in water or melt it, the crystal structure is broken down and ions become free to move and conduct electricity. Thus, an aqueous solution of an ionic compound conducts electricity because there are plenty of free ions in the solution which are able to conduct electric current.

Question 45:

(a) Write down the electron arrangement in (i) a magnesium atom, and (ii) a chlorine atom.

(b) How many electrons are there in the valence shell of (i) a magnesium atom, and (ii) a chlorine atom ?

(c) Show the formation of magnesium chloride from magnesium and chlorine by the transfer of electrons.

(d) State whether magnesium chloride will conduct electricity or not. Give reason for your answer.

(e) Why are covalent compounds generally poor conductors of electricity ?

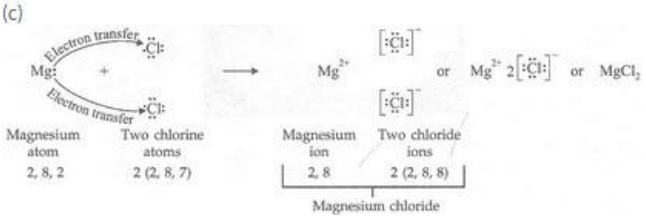
Solution :

(a)(i) Magnesium: 2, 8, 2 (ii) Chlorine: 2, 8, 7

(b)(i) 2 (ii) 7

(c)

(c)



(d)Magnesium chloride will conduct electricity because it is an ionic compound .

(e) Covalent compounds are generally poor conductors of electricity b ecause they do not contain ions.

Question 67:

Two non-metals combine with each other by the sharing of electrons to form a compound X.

(a) What type of chemical bond is present in X ?

(b) State whether X will have a high melting point or low melting point.

(c) Will it be a good conductor of electricity or not ?

(d) Will it dissolve in an organic solvent or not ?

Solution :

(a) Covalent bond

(b) Low melting point

(c) No

(d) Yes

Question 68:

A metal combines with a non-metal by the transfer of electrons to form a compound Y.

(i) State the type of bonds in Y.

(ii) What can you say about its melting point and boiling point ?

(iii) Will it be a good conductor of electricity ?

(iv) Will it dissolve in an organic solvent or not ?

Solution :

(i) Ionic bond

(ii) High melting point and boiling point

(iii) Yes

(iv) No

Question 69:

The electronic configurations of three elements X, Y and Z are as follows :

X 2, 4

Y 2,1

Z 2, 1

(a) Which two elements will combine to form an ionic compound ?

(b) Which two elements will react to form a covalent compound ?

Give reasons for your choice.

Solution :

(a) Y and Z will form an ionic compound because an ionic bond is formed when one of the atoms can donate electrons to achieve the inert gas configuration, and the other atom needs electrons to achieve the inert gas configuration. Since Y has 7 and Z has 1 electron in their outermost shell, they would form an ionic bond.

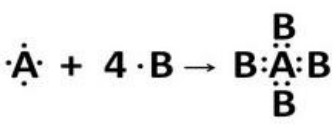
(b) X and Y will react to form a covalent compound because a covalent bond is formed when both the reacting atoms need electrons to achieve the inert gas electron arrangement.

Question 70:

An element A has 4 valence electrons in its atom whereas element B has only one valence electron in its atom. The compound formed by A and B does not conduct electricity. What is the nature of chemical bond in the compound formed ? Give its electron-dot structure.

Solution :

Covalent bond will be formed since covalent compounds are non conductors of electricity.



Question 71:

In the formation of a compound XY_2 atom X gives one electron to each Y atom. What is the nature of bond in XY_2 ? Give two properties of XY_2.

Solution :

XY_2 has ionic bonds.

(i) XY 2 would conduct electricity when dissolved in water.

(ii) XY 2 would have high melting and boiling point.

Question 72:

An element 'A' has two electrons in the outermost shell of its atom and combines with an element 'B' having seven electrons in the outermost shell, forming the compound AB_2. The compound when dissolved in water conducts electric current. Giving reasons, state the nature of chemical bond in the compound.

Solution :

AB_2 forms ionic bonds because an aqueous solution of an ionic compound conducts electricity because there are plenty of free ions in the solution which are able to conduct electric current.

Question 73:

The electronic configurations of two elements A and B are given below :

A 2, 6

B 2, 8, 1

(a) What type of chemical bond is formed between the two atoms of A ?

(b) What type of chemical bond will be formed between the atoms of A and B ?

Solution :

(a) Covalent bond.

(b) Ionic bond .

Question 74:

Four elements A, B, C and D have the following electron arrangements in their atoms :

A 2, 8, 6

B 2, 8, 8

C 2, 8, 8, 1

D 2,1

(a) What type of bond is formed when element C combines with element D ?

(b) Which element is an inert gas ?

(c) What will be the formula of the compound between A and C ?

Solution :

(a) Ionic bond will be formed; element C donates its electron to element D.

(b) B is an inert gas; has complete octet configuration.

(c) C 2 A; element A needs two electrons to complete its octet.

Question 75:

An element X of atomic number 12 combines with an element Y of atomic number 17 to form a compound XY_2. State the nature of chemical bond in XY_2 and show how the electron configurations of X and Y change in the formation of this compound.

Solution :

XY_2 forms ionic bo nd. The electronic configuration of X changes from 2, 8, 2 to 2, 8, it donates its 2 electrons to two Y atoms. Hence, the elec tronic configuration of Y changes f rom 2, 8, 7 to 2, 8, 8 giving the compound XY_2.

Question 76:

The electronic configurations of three elements A, B and C are as follows :

A 2, 8, 1

B 2, 8, 7

C 2, 4

(a) Which of these elements is a metal ?

(b) Which of these elements are non-metals ?

(c) Which two elements will combine to form an ionic bond ?

(d) Which two elements will combine to form a covalent bond ?

(e) Which element will form an anion of valency 1 ?

Solution :

(a) A is a metal

(b) B and C are non-metals

(c) A and B combines to form an ionic bond.

(d) B and C combines to form a covalent bond.

(e) B will form an anion with valency 1 since it needs only 1 electron to complete its octet.

Question 77:

The electronic configurations of four particles A, B, C and D are given below :

A 2, 8, 8

B 2, 8, 2

C 2, 6

D 2, 8

Which electronic configuration represents :

(i) magnesium atom ? (ii) oxygen atom ?

(iii) sodium ion ? (iv) chloride ion ?

Solution :

(i) B: Magnesium atom (At. no. = 12)

(ii) C: Oxygen atom (At. no. = 8)

(iii) D: Sodium ion (E.C = 2, 8)

(iv) A: Chloride ion (E.C = 2, 8, 8)

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Question 78:

The atomic number of an element X is 12.

(a) What must an atom of X do to attain the nearest inert gas electron configuration ?

(b) Which inert gas is nearest to X ?

Solution :

(a) An atom of X loses 2 electrons to attain the nearest gas electron configuration (2,8).

(b) Neon

Question 79:

The atomic number of an element Y is 16.

(a) What must an atom of Y do to achieve the nearest inert gas electron arrangement ?

(b) Which inert gas is nearest to Y ?

Solution :

(a) A n atom of Y a ccepts 2 electrons to achieve the nearest inert gas electron arrangement (2, 8, 8).

(b) Argon

Question 80:

You can buy solid air-freshners in shops. Do you think these substances are ionic or covalent ?

Why ?

Solution :

Solid air-fresheners are covalent compounds because they are volatile compounds with low melting and boiling points.

Question 81:

Give the formulae of the chlorides of the elements X and Y having atomic numbers of 3 and 6 respectively. Will the properties of the two chlorides be similar or different ? Explain your answer.

Solution :

Formula of chloride of element X is XCl

Formula of chloride of element Y is YCl 4

The properties of two chlorides will be different because XCl is an i onic chloride whereas YCl 4 is a covalent chloride.

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Question 1:

A zinc ore gave CO_2 on treatment with a dilute add. Identify the ore and write its chemical formula.

Solution :

Calamine, ZnC O 3

Question 2:

What chemical process is used for obtaining a metal from its oxide ?

Solution :

Reduction .

Question 3:

State two ways to prevent the rusting of iron.

Solution :

Rusting of iron can be prevented:

(i) By painting.

(ii) By applying grease or oil.

Question 4:

What is meant by galvanisation ? Why is it done ?

Solution :

The process of depositing a thin layer of zinc metal on iron objects is called galvanisation; It prevents iron from rusting.

Question 5:

Name the metal which is used for galvanising iron.

Solution :

Zinc is used for galvanising iron.

Question 6:

Explain why, iron sheets are coated with zinc.

Solution :

Zinc is a quite reactive metal. The action of air on zinc metal forms a very thin coating of zinc oxide all over it, which is hard and impervious to air and hence prevents the further corrosion of zinc metal as well as the iron below it.

Question 7:

Why do we apply paint on iron articles ?

Solution :

Iron objects are painted so that air and moisture can not come in contact with the iron objects and hence no rusting takes place.

Question 8:

Give reason for the following :

Carbonate and sulphide ores are usually converted into oxides during the process of extraction of metals.

Solution :

Carbonate and sulphide ores are usually converted into oxides because it is easier to obtain metals from their oxides (by reduction) than from carbonates or sulphides.

Question 9:

Name a reducing agent that may be used to obtain manganese from manganese dioxide.

Solution :

Aluminium powder is used as the reducing agent for the extraction of manganese from its oxide.

Question 10:

Name an alloy of lead and tin.

Solution :

Solder is an alloy of lead and tin.

Question 11:

Give the composition of an alloy called solder. State its one property and one use.

Solution :

Solder is an alloy of lead (Pb) and tin (Sn). It contains both the elements in 50-50 ratio. It has a low melting point and is used for soldering electrical wires together.

Question 12:

What is an amalgam ?

Solution :

An alloy of mercury metal with one or more other metals is known as an amalgam.

Question 13:

How many carats is pure gold ? Why is pure gold not suitable for making ornaments ?

Solution :

Pure gold is said to be of 24 carats. It is not suitable for making ornaments because it is very soft.

Question 14:

Name one method for the refining of metals.

Solution :

Electrolytic refining.

Question 15:

State two conditions for the rusting of iron.

Solution :

(i) Presence of air (oxygen).

(ii) Presence of water (or moisture).

Question 16:

In one method of rust prevention, the iron is not coated with anything. Which is this method ?

Solution :

Rusting of iron can be prevented by alloying iron with chromium and nickel to make stainless steel.

Question 17:

Name two alloys of iron. What elements are present in these alloys ?

Solution :

Steel – Iron and carbon.

Stainless steel – Iron, chromium and nickel.

Question 18:

Give reason for the following :

Silver, gold and platinum are used to make jewellery.

Solution :

Silver, gold and platinum are used to make jewellery b ecause all of these metals have a bright shiny surface and are resistant to corrosion.

Question 19:

Which metal becomes black in the presence of hydrogen sulphide gas in air ?

Solution :

Silver metal becomes black in the presence of hydrogen sulphide gas in air .

Question 20:

Name the gas in air which tarnishes silver articles slowly.

Solution :

Hydrogen sulphide gas tarnishes silver articles .

Question 21:

Silver metal does not combine easily with oxygen but silver jewellery tarnishes after some time. How ?

Solution :

The silver articles combine slowly with the hydrogen sulphide gas present in air to form a black coating of silver sulphide. The tarnishing of the silver objects is due to this silver sulphide coating on the object's surface.

Question 22:

Write the composition of the alloy called bronze. Give two uses of bronze.

Solution :

Bronze is an alloy of copper and tin; 90% copper and 10% tin. It is used for making statues and coins.

Question 23:

Why does a new aluminium vessel lose shine so soon after use ?

Solution :

A new aluminium vessel lose shine so soon after use due to the corrosion of aluminium metal when exposed to moist air. This happens because the oxygen of air reacts with aluminium to form a thin, dull layer of aluminium oxide all over the vessel.

Question 24:

Why do gold ornaments look new even after several years of use ?

Solution :

Gold ornaments look new even after several years of use because gold does not corrode when exposed to atmosphere. It is a highly unreactive metal which remains unaffected by air, water vapour and other gases in the atmosphere.

Question 25:

Name two metals which are highly resistant to corrosion.

Solution :

Gold and platinum are highly resistant to corrosion.

Question 26:

Which property of 'solder' alloy makes it suitable for welding electrical wires ?

Solution :

Low melting point of solder makes it sutaible for welding electrical wires .

Question 27:

Explain why, carbon cannot reduce oxides of sodium or magnesium.

Solution :

Carbon cannot reduce oxides of sodium or magnesium because carbon is less reactive than magnesium or sodium. Carbon, which is a non-metal, is more reactive than zinc and can be placed just above Zn in the reactivity series. Hence, carbon can reduce the oxides of zinc and all other metals below zinc to form metals.

Question 28:

Why are the metals like Na, K, Ca and Mg never found in their free state in nature ?

Solution :

The metals like Na, K, Ca and Mg never found in their free state in nature because of the reason that all of these metals are high-up in the reactivity series. And just because they are so reactive, they are never found in nature as free elements.

Question 29:

Name one metal each which is extracted by :

(a) reduction with carbon. (b) electrolytic reduction.

(c) reduction with aluminium (d) reduction with heat alone.

Solution :

(a) Zinc

(b) Sodium

(c) Manganese

(d) Mercury

Question 30:

Fill in the following blanks with suitable words :

(a) The corrosion of iron is called……

(b) ……and…… are necessary for the rusting of iron.

(c) The process of depositing a thin layer of zinc on iron articles is called……..

(d) Tiffin boxes are electroplated with…… but car bumpers are electroplated with…… to protect them from rusting.

(e) The corrosion of copper produces a…… coating of basic copper carbonate on its surface.

(f) Brass is an alloy of copper and……..

(g) Bronze is an alloy of copper and……..

(h) The non-metal present in steel is……

(i) The alloy in which one of the metals is mercury is called an……..

(j) The electrical conductivity and melting point of an alloy is…….. than that of pure metals.

(k) The rocky material found with ores is called……

Solution :

(a) rusting

(b) air; water

(c) galvanisation

(d) tin; chromium

(e) green

(j) zinc

(g) tin

(h) carbon

(i) amalgam

(j) less

(k) gangue

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Question 31:

How is manganese extracted from manganese dioxide, MnO_2 ? Explain with the help of an equation.

Solution :

Manganese metal is extracted by the reduction of its oxide with aluminium powder as the reducing agent. Thus, when manganese dioxide is heated with aluminium powder, then manganese metal is formed.

$$\underset{\text{Manganese dioxide}}{3MnO_2(s)} + \underset{\text{Aluminium powder}}{4Al(s)} \rightarrow \underset{\text{Manganese metal}}{3Mn(l)} + \underset{\text{Aluminium oxide}}{2Al_2O_3} + \text{Heat}$$

Question 32:

What is a thermite reaction ? Explain with the help of an equation. State one use of this reaction.

Solution :

The reduction of a metal oxide to form metal by using aluminium powder as a reducing agent is called a thermite reaction.

This property of reduction by aluminium is made use of in thermite welding for joining the broken pieces of heavy iron objects like girders etc.

A mixture of Iron (III) oxide and aluminium powder is ignited with a burning magnesium ribbon. Aluminium reduces iron oxide to produce iron metal with the evolution of a lot of heat. Due to this heat, iron metal is produced in the molten state. This molten iron is then poured between the broken iron pieces to weld them (to join them).

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

Question 33:

Which one of the methods given in column I is applied for the extraction of each of the metals given in column II :

Column I	Column II
Electrolytic reduction	Aluminium
Reduction with Carbon	Zinc
Reduction with Aluminium	Sodium
	Iron
	Manganese
	Tin

Solution :

Electrolytic reduction: Aluminium and Sodium;
Reduction with carbon : Zinc, Iron and Tin;
Reduction with aluminium: Manganese

Question 34:

(a) Give reason why copper is used to make hot water tanks but steel (an alloy of iron) is not.
(b) Explain why, the surface of some metals acquires a dull appearance when exposed to air for a long time.

Solution :

(a) Copper does not corrode easily in the presence of water but steel rusts in the presence of water.
(b) The surface of some metals acquires a dull appearance when exposed to air b ecause of the formation of an oxide layer on the surface of the metal.

Question 35:

(a) Why does aluminium not corrode right through ?
(b) What is meant by 'anodising' ? Why is it done ?

Solution :

(a) Aluminium does not corrode right through because aluminium is more reactive than iron and it forms a layer of aluminium oxide as soon as it comes in contact with moist air. This aluminium oxide layer is very tough and prevents the aluminium underneath from corroding.
(b) The process of thickening of aluminium oxide layer on the surface of aluminium objects by electrolysis is called anodizing. It is done to provide more protection to the aluminium object from corrosion.

Question 36:

(a) Why is an iron grill painted frequently ?
(b) Explain why, though aluminium is more reactive than iron, yet there is less corrosion of aluminium when both are exposed to air.

Solution :

(a) An iron grill is painted frequently to prevent its rusting .
(b)There is less corrosion of aluminium than iron when both are exposed to air because aluminium forms a layer of aluminium oxide on its surface as soon as it comes in contact with moist air. This aluminium oxide is very tough and prevents it from corroding right through.

Question 37:

(a) Name the method by which aluminium metal is extracted.
(b) Give the name and chemical formula of one ore of copper.
(c) How is zinc extracted from its carbonate ore (calamine) ? Explain with equations.

Solution :

(a) Electrolytic reduction .
(b)Copper glance (Cu 2 S)

(c) When calamine ore is heated strongly in the absence of air i.e. calcined, it decomposes to form zinc oxide and carbon dioxide.

$$\underset{\text{Zinc carbonate (Calamine ore)}}{ZnCO_3(s)} \xrightarrow{\text{Calcination}} \underset{\text{Zinc oxide}}{ZnO(s)} + \underset{\text{Carbon dioxide}}{CO_2(g)}$$

Then, zinc oxide is heated with carbon and zinc metal is produced.

$$\underset{\text{Zinc oxide}}{ZnO(s)} + \underset{\text{Carbon}}{C(s)} \rightarrow \underset{\text{Zinc metal}}{Zn(s)} + \underset{\text{Carbon monoxide}}{CO(g)}$$

Question 38:

(a) Name two metals which occur in nature in free state as well as in combined state.

(b) Name one ore of manganese. Which compound of manganese is present in this ore ? Also write its chemical formula.

(c) A zinc ore on heating in air forms sulphur dioxide. Describe briefly any two stages involved in the conversion of this concentrated ore into zinc metal.

Solution :

(a) Copper and Silver occur in nature in free state as well as in combined state.

(b) Pyrolusite; Manganese dioxide; MnO 2

(c)

(i) Roasting: When zinc sulphide (zinc blende ore) is strongly heated in air (roasted), it forms zinc oxide and sulphur dioxide.

(ii) Reduction: Zinc oxide obtained is heated with carbon to form zinc metal.

Question 39:

How does the method used for extracting a metal from its ore depend on the metal's position in the reactivity series ? Explain with examples.

Solution :

Different methods are used for extracting metals belonging to category of highly reactive metals, moderately reactive metals and less reactive metals. This is because the extraction of a metal from its concentrated ore is essentially a process of reduction of the metal compound present in the ore. For example: Manganese metal is obtained by the reduction of its oxide with aluminium powder and not carbon. This is because carbon is less reactive than manganese. Carbon, which is a non-metal, is more reactive than zinc and it can be placed just above Zn in the reactivity series. Hence, carbon can reduce the oxides of zinc and all other metals below zinc to form metals

Question 40:

Explain giving one example, how highly reactive metals (which are high up in the reactivity series) are extracted.

Solution :

The highly reactive metals are extracted by the electrolytic reduction of their molten chlorides or oxides.

Example: Sodium metal is extracted by the electrolytic reduction of molten sodium chloride. When electric current is passed through molten sodium chloride, it decomposes to form sodium metal and chlorine gas.

$$2NaCl(l) \xrightarrow{\text{Electrolysis}} 2Na(s) + Cl_2(g)$$

Question 41:

Describe with one example, how moderately reactive metals (which are in the middle of reactivity series) are extracted.

Solution :

The moderately reactive metals are extracted by the reduction of their oxides with carbon, aluminium, sodium or calcium.
Example: When zinc sulphide (zinc blende ore) is strongly heated in air (roasted), it forms zinc oxide and sulphur dioxide. This process is called roasting. Then, zinc oxide is heated with carbon to form zinc metal. This process is termed as reduction.

Question 42:

How are the less reactive metals (which are quite low in the reactivity series) extracted ? Explain with the help of an example.

Solution :

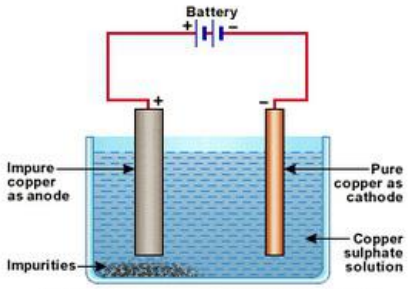
The less reactive metals are extracted by the reduction of their oxides by heat alone.
Example: Mercury (II) sulphide ore is roasted in air when mercury (II) oxide is formed. When this mercury (II) oxide is heated to about 300^{o}C, it decomposes to form mercury metal.

Question 43:

What is meant by refining of a metal ? Name the most widely used method for the refining of impure metals obtained by various reduction processes. Describe this method with the help of a labelled diagram by taking the example of any metal.

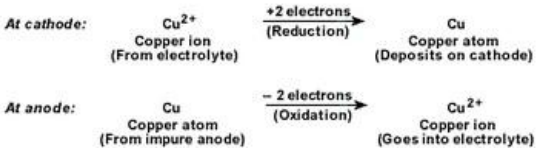
Solution :

The process of purifying impure metals is called refining of metals.
Electrolytic refining is the most widely used method for the refining of impure metals obtained by various reduction processes.
In an electrolytic tank, acidified copper sulphate (CuSO 4 + dil ute H 2 O 4) solution forms the electrolyte. A block of impure copper is made into an anode by connecting the positive terminal of a power supply (battery). A thin strip of highly pure copper metal is the cathode of the cell. The negative terminal of the power supply is connected to it.



Experimental set up for the electrolytic refining of copper.

A small electric curr ent is passed through the cell. Atoms from the anode enter the electrolyte. The copper from the anode gets converted into copper sulphide. An equal number of copper atoms from the solution get deposited on the cathode. This is to keep the concentration of the solution constant. Impurities from the anode block either remain in solution or collect below the anode, as they are unable to displace copper from the sulphate solution. The insoluble impurities remain in the electrolyte and are called anode mud.
Copper sulphate solution contains ions of Cu ++ and SO 4 — . The following reactions take place at the anode and cathode when an electric current is passed.



Pure copper is scraped or removed from the cathode. Anode becomes thinner as the electrolysis process proceeds. Some important metals like gold and silver are present in the anode mud. These can be recovered separately.

Question 44:

(a) Define the terms (i) mineral (ii) ore, and (iii) gangue.
(b) What is meant by the 'concentration of ore' ?
(c) Name one ore of copper (other than cuprite). Which compound of copper is present in this ore ? Also, write its chemical formula.

Solution :

(a) (i) Minerals – The natural materials in which the metals or their compounds are found in earth are called minerals.
(ii) Ores – Those minerals from which the metals can be extracted conveniently and profitably are called ores.
(iii) Gangue – The unwanted impurities like sand, rocky material, earthy particles etc., present in an ore are called gangue.
(b) Before extracting metal from an ore, it is necessary to remove these impurities (gangue) from it. By removing the gangue, we get a concentrated ore containing a much higher percentage of metal. This is called concentration of ore; also known as enrichment of ore.
(c) Ore: Copper glance; Copper (I) sulphide, Cu 2 S.

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Question 45:

Explain how, a reduction reaction of aluminium can be used for welding cracked machine parts of iron. Write a chemical equation for the reaction involved.

Solution :

A mixture of Iron (III) oxide and aluminium powder is ignited with a burning magnesium ribbon. Aluminium reduces iron oxide to produce iron metal with the evolution of lot of heat. Due to this heat, iron metal is produced in the molten state. This molten iron is poured between broken iron parts of the machine to weld them (to join them).

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

Question 46:

(a) What is corrosion ?
(b) Name any two metals which do not corrode easily.
(c) What is the corrosion of iron known as ?
(d) Explain why, aluminium is a highly reactive metal, still it is used to make utensils for cooking.

Solution :

(a) The eating up of metals by the action of air, moisture or a chemical (such as an acid) on their surface is called corrosion.
(b) Gold and Platinum
(c) Rusting
(d) Aluminium begins to corrode quickly when it comes in contact with moist air. The action of moist air on aluminium metal forms a thin layer of aluminium oxide all over the metal. This aluminium oxide is very tough and prevents the metal underneath from further corrosion. Therefore, aluminium is used for making utensils irrespective of its highly reactive property as its corrosion leads to the non-corrosion of the metal in the longer run.

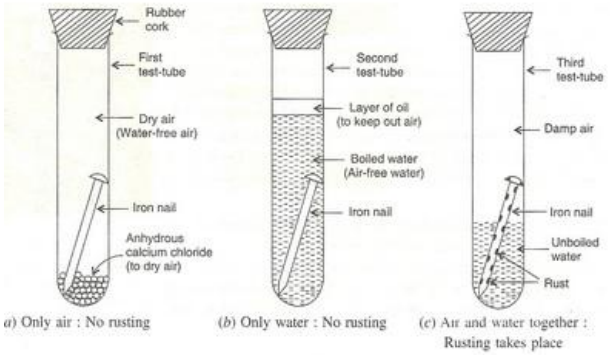
Question 47:

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

Solution :

When an iron object is left in damp air (or water) for a considerable time, it gets covered with a red-brown flaky substance called rust. This is called rusting of iron .

Experiment to show that rusting of Iron requires both, air and water :
We take three test-tubes and put one clean iron nail in each of the three test-tubes:



1. In the first test-tube containing iron nail, we put some anhydrous calcium chloride and close its mouth with a tight cork . Anhydrous calcium chloride absorbs water moisture from the damp air present in the test-tube and make it dry. In this way, the iron nail in the first test-tube is kept in dry air (having no water vapour in it).
2. In the second test-tube containing iron nail , we put boiled distilled water. Boiled water does not contain any dissolved air (or oxygen) in it (this is because the process of boiling removes all the dissolved air from it). A layer of oil is put over boiled water in the test-tub e to prevent the outside air from mixing with boiled water. In this way, the iron nail in the second test-tube is kept in air free boiled water.
3. In the third test-tube containing an iron nail, we put unboiled wa ter so that about two-thirds of nail is immersed in water and the rest is a bove the water, exposed to damp air. In this way , the iron nail in the third test-tube has been placed in air and water together.
The mouth of all three test tube s is cl osed with a cork and it is kept aside for about one week. After one week, we observe the iron nails kept in all the three test-tubes, one by one. We find tha t (i) No rust is seen on the surface of iron nai l kept in dry air (water-f ree air) in the first test-tube. This tells us that rusting of iron does not take place in air alone.
(ii) No rust is seen on the surface of iron nail kept in air-free, boiled water in the second test-tube. This tells us that rusting of iron does not take place in water alone.
(iii) Red-brown rust is seen on the surface of iron nail kept in the presence of both air and wat er together the third test-tube. This tells us that rusting of iron takes pla ce in the presence of both air and water together.

Question 48:

(a) What is an alloy ? How is an alloy made ?
(b) What elements are present in steel ? How are the properties of steel different from those of pure iron ?
(c) Give the constituents and one use of brass.

Solution :

(a) An alloy is a homogeneous mixture of two or more metals (or a metal and small amount of non-metals). An alloy is prepared by mixing the various metals in molten state in required proportions, and then cooling their mixture to the room temperature.
(b) Steel contains iron and carbon.
This alloy of iron (steel) is hard and strong. It also rusts less readily than pure iron.
(c) Brass contains copper and zinc.
Brass is used for making cooking utensils.

Question 49:

(a) Name two metals which resist corrosion due to the formation of a thin, hard and impervious layer of oxide on their surface.
(b) Name five methods of preventing rusting of iron.

(c) What are the constituents of stainless steel ? What are the special properties of stainless steel ?

Solution :

(a) Aluminium and Zinc resist corrosion due to the formation of a thin, hard and impervious layer of oxide on their surface.

(b)(i) Painting (ii) Applying grease or oil (iii) Galvanisation (iv) Tin and chromium plating (v) Alloying to form stainless steel.

(c)Stainless steel contains i ron, chromium and nickel.

Stainless steel does not rust at all and is strong and tough.

Question 50:

(a) Name an alloy of copper. State its chemical composition and any one use.

(b) Explain why, when a copper object remains in damp air for a considerable time, a green coating is formed on its surface. What is this process known as ?

Solution :

(a) Brass:It contains Copper (Cu)-80% and Zinc(Zn) – 20%. It is used for making cooking utensils.

(b) When a copper object remains in damp air for a considerable time, then copper reacts slowly with the carbon dioxide and water of air to form a green coating of basic copper carbonate on the surface of the object. The formation of this green coating of basic copper carbonate corrodes it. This process is known as corrosion of copper.

Question 51:

(a) How does the painting of an iron object prevent its rusting ?

(b) How does the electrical conductivity of copper alloys, brass and bronze, differ from that of pure copper ?

(c) What is meant by 22 carat gold ? Name the metals which are usually alloyed with gold to make it harder.

Solution :

(a) When a coat of paint is applied to the surface of an iron object, it prevents air and moisture to come in contact with the object; hence no rusting takes place.

(b) The electrical conductivity of copper alloys like brass and bronze is less than that of pure copper.

(c) It means that 22 parts pure gold is alloyed with 2 parts of either silver or copper for making ornaments; Silver and copper are usually alloyed with gold to make it harder .

Question 52:

Explain giving equation, what happens when :

(a) $ZnCO_3$ is heated in the absence of air ?

(b) a mixture of CU_2O and CU_2S is heated ?

Solution :

(a) When zinc carbonate is heated strongly in the absence of air, it decomposes to form zinc oxide and carbon dioxide.

$$\underset{\text{Zinc carbonate (Calamine ore)}}{ZnCO_3(s)} \xrightarrow{\text{Calcination}} \underset{\text{Zinc oxide}}{ZnO(s)} + \underset{\text{Carbon dioxide}}{CO_2(g)}$$

(b) When copper (I) oxide reacts with copper (I) sulphide, it forms copper metal and sulphur dioxide.

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

Question 53:

(a) For the reduction of a metal oxide, suggest a reducing agent other than carbon.

(b) Explain why, an aqueous solution of sodium chloride is not used for the electrolytic extraction of sodium metal.

Solution :

(a) Aluminium can be used a reducing agent other than carbon.

(b) We cannot use an aqueous solution of sodium chloride to obtain sodium metal because if we electrolyse an aqueous solution of sodium chloride, then as soon as sodium metal is produced at cathode, it will react with water present in the aqueous solution to form sodium hydroxide. Hence, electrolysis of an aqueous solution of sodium chloride will produce sodium hydroxide and not sodium metal.

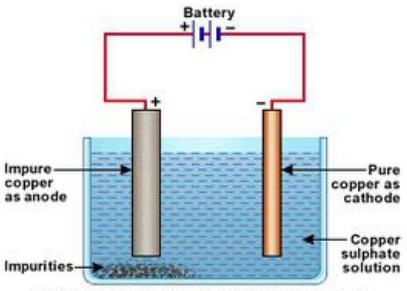
Question 54:

How are metals refined by the electrolytic process ? Describe the electrolytic refining of copper with the help of a neat labelled diagram.

Solution :

For the refining of an impure metal by the process of electrolysis, a thick block of impure metal is made anode (connected to +ve terminal of the battery) and a thin strip of the pure metal is made cathode (connected to -ve terminal of battery). A water soluble salt (of the metal to be refined) is taken as electrolyte. On passing current, impure metal dissolves from the anode and goes into the electrolyte solution. And pure metal from the electrolyte deposits on the cathode.

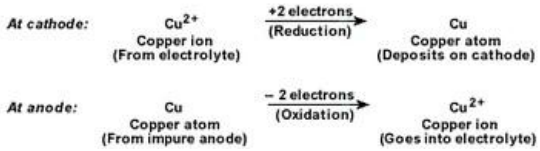
Electrolytic refining of copper: In an electrolytic tank, acidified copper sulphate (CuSO 4 + dil ute H 2 O 4) solution forms the electrolyte. A block of impure copper is made into an anode by connecting the positive terminal of a power supply (battery). A thin strip of highly pure copper metal is the cathode of the cell. The negative terminal of the power supply is connected to it.



Experimental set up for the electrolytic refining of copper.

A small electric curr ent is passed through the cell. Atoms from the anode enter the electrolyte. The copper from the anode gets converted into copper sulphide. An equal number of copper atoms from the solution get deposited on the cathode. This is to keep the concentration of the solution constant. Impurities from the anode block either remain in solution or collect below the anode, as they are unable to displace copper form the sulphate solution. The insoluble impurities remain in the electrolyte and are called anode mud.

Copper sulphate solution contains ions of Cu ++ and SO 4 — . The following reactions take place at the anode and cathode when an electric current is passed.



Pure copper is scraped or removed from the cathode. Anode becomes thinner as the electrolysis process proceeds. Some important metals like gold and silver are present in the anode mud. These can be recovered separately.

Question 55:

(a) Name the chemical compound which is electrolysed in molten state to obtain aluminium metal. Which gas is evolved during this process ?

(b) Name the chemical compound which is electrolysed in molten state to obtain sodium metal. Which gas is produced in this process ?
(c) Name the gas produced when calamine ore is calcined.
(d) Name the gas evolved when cinnabar ore is roasted.

Solution :

(a) Aluminium oxide is electrolysed in molten state to obtain aluminium metal. Oxygen gas is evolved during the process.
(b) Sodium chloride is electrolysed in molten state to obtain sodium metal. Chlorine gas is evolved during this process.
(c) Carbon dioxide is produced when calamine ore is calcined.
(d) Sulphur dioxide gas is evolved when cinnabar ore is roasted.

Question 56:

(a) Name two metals which are found in nature mainly in the free state (as metallic elements).
(b) Name two metals which are always found in combined state.
(c) What iron compound is present in haematite ore ? Also write its chemical formula.

Solution :

(a) Gold and Platinum are found in nature mainly in the free state.
(b) Sodium and Magnesium are always found in combined state.
(c) Iron (III) oxide; Fe 2 O 3 is present in haematite ore.

Question 57:

(a) What is the difference between a mineral and an ore ?
(b) Which metal is extracted from cinnabar ore ?
(c) Name one ore of sodium. Name the sodium compound present in this ore and write its chemical formula.
(d) How is sodium metal extracted ? Explain with the help of equation of the reaction involved.
(e) Name three other metals which are extracted in a manner similar to sodium.

Solution :

(a)The natural materials in which the metals or their compounds are found in earth are called minerals. Those minerals from which the metals can be extracted conveniently and profitably are called ores.
(b) Mercury.
(c)Rock salt – Sodium chloride, NaCl.
(d)Sodium metal is extracted by the electrolytic reduction of molten sodium chloride. When electric current is passed through molten sodium chloride, it decomposes to form sodium metal and chlorine gas.

$$2NaCl(l) \xrightarrow{\text{Electrolysis}} 2Na(s) + Cl_2(g)$$

(e) Potassium, Calcium and Magnesium .

Question 58:

(a) Name the metal which is extracted from haematite ore.
(b) Name one ore of aluminium. Name the aluminium compound present in this ore and write its chemical formula.
(c) How is aluminium metal extracted ? Explain with the help of an equation.
(d) Name the electrode at which aluminium metal is produced.
(e) Which gas is produced during the extraction of aluminium ? At which electrode is this gas produced ?

Solution :

(a)Iron is extracted from haematite ore .
(b)Bauxite; Aluminium oxide, Al 2 O 3 .2H 2 O

(c)Aluminium metal is extracted by the electrolytic reduction (electrolysis) of molten aluminium oxide. When electric current is passed through molten aluminium oxide, it decomposes to form aluminium metal and oxygen gas.

$$2Al_2O_3(l) \xrightarrow{\text{Electrolysis}} 4Al(s) + 3O_2(g)$$

(d) A luminium metal is produced at Cathode (Negative electrode).

(e) Oxygen gas is produced; at anode (Positive electrode).

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Question 59:

(a) Which metal is extracted from bauxite ore ?

(b) Give the name of one ore of iron. Which iron compound is present in this ore ? Write its chemical formula.

(c) Describe the extraction of zinc metal from its sulphide ore (zinc blende). Write equations of the reactions involved.

(d) Explain why, the galvanised iron article is protected against rusting even if the zinc layer is broken.

(e) Name a common metal which is highly resistant to corrosion.

Solution :

(a) Aluminium.

(b) Haematite; Iron (III) oxide, Fe 2 O 3

(c) Zinc sulphide (zinc blende ore) is strongly heated in air (roasted), it forms zinc oxide and sulphur dioxide. This process is called roasting.

$$2ZnS(s) + 3O_2(g) \xrightarrow{\text{Roasting}} 2ZnO(s) + 2SO_2(g)$$

Then, zinc oxide is heated with carbon to form zinc metal. This process is termed as reduction.

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

(d) The galvanized iron object remains protected against rusting even if a break occurs in the zinc layer because zinc is more easily oxidised than iron. Hence, the zinc continues to corrode but iron object does not corrode or rust.

(e) Aluminium .

Question 60:

(a) Name the metal which is extracted from the ore called 'rock salt'.

(b) Name two ores of zinc. Write the names of the chemical compounds present in them and give their chemical formulae.

(c) Explain how, mercury is extracted from its sulphide ore (cinnabar). Give equations of the reactions involved.

(d) In the electrolytic refining of a metal M, what would you take as anode, cathode and electrolyte ?

(e) Name any five metals which are purified by electrolytic refining method.

Solution :

(a) Sodium.

(b) (i) Calamine; Zinc carbonate, ZnCO 3

(ii) Zinc blende; Zinc sulphide, ZnS

(c) Mercury (II) sulphide ore is roasted in air when mercury (II) oxide is formed.

$$\underset{\text{Mercury (II) Sulphide}}{2HgS(s)} + \underset{\text{Oxygen}}{3O_2(g)} \xrightarrow{\text{Roasting}} \underset{\text{Mercury (II) Oxide}}{2HgO(s)} + \underset{\text{Sulphur dioxide}}{2SO_2(g)}$$

When this mercury (II) oxide is heated to about 300°C, it decomposes to form mercury metal.

$$\underset{\text{Mercury (II) Oxide}}{2HgO(s)} \xrightarrow[\text{Reduction}]{\text{Heat}} \underset{\text{Mercury metal}}{2Hg(l)} + \underset{\text{Oxygen}}{O_2(g)}$$

(d) Anode – Thick block of i mpure metal M

Cathode – Thin strip of p ure metal M
Electrolyte – Water soluble salt (of metal M).
(e) (i) Copper
(ii) Zinc
(iii) Nickel
(iv) Gold
(v) Silver

Question 61:

(a) Which metal is extracted from calamine ore ?
(b) Name one ore of mercury. Which mercury compound is present in this ore ? Write its chemical formula.
(c) How is copper extracted from its sulphide ore (copper glance), Cu_2S ? Explain with equations of the reactions involved.
(d) What is an alloy ? Give two examples of alloys.
(e) How are the properties of an alloy different from those of the constitutent elements ?

Solution :

(a) Zinc
(b) Cinnabar; Mercury (II) sulphide, HgS
(c) The concentrated copper (I) sulphide ore (copper glance), Cu 2 S is roasted in air when a part of copper (I) sulphide is oxidised to copper (I) oxide.

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

When a good amount of copper (I) sulphide has been converted to copper (I) oxide, then the supply of air for roasting is stopped. In the absence of air, copper (I) oxide formed above reacts with remaining copper (I) sulphide to form copper metal and sulphur dioxide.

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

(d) An alloy is a homogeneous mixture of two or more metals (or a metal and small amounts of non-metals).
Steel and Brass are examples of alloys.
(e) (i) Alloys are stronger than the metals from which they are made.
(ii) Alloys are harder than the constituent metals.
(iii) Alloys are more resistant to corrosion.
(iv) Alloys have lower melting points than constituent metals.
(v) Alloys have lower electrical conductivity than pure metals.

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Question 92:

An element A which is a part of common salt and kept under kerosene reacts with another element B of atomic number 17 to give a product C. When an aqueous solution of product C is electrolysed then a compound D is formed and two gases are liberated.
(a) What are A and B ?
(b) Identify C and D.
(c) What will be the action of C on litmus solution ? Why ?
(d) State whether element B is a solid, liquid or gas at room temperature.
(e) Write formula of the compound formed when element B reacts with an element E having atomic number 5.

Solution :

(a) A is sodium and B is chlo rine
(b) C is sodium chloride and D is sodium hydroxide
(c) C will have no effect on litmus solution since it is neutral in nature.

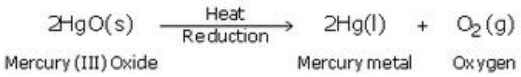
(d) B is a gas at room temperature.
(e) EB 3

Question 93:

A metal which exists as a liquid at room temperature is obtained by heating its sulphide ore in the presence of air.
(a) Name the metal and write its chemical symbol.
(b) Write the name and formula of the sulphide ore.
(c) Give the equations of chemical reactions involved in the production of metal from its sulphide ore.
(d) Name a common device in which this metal is used.
(e) Can this metal displace copper from copper sulphate solution ? Why ?

Solution :

(a) Mercury, Hg
(b) Cinnabar, HgS
(c)



(d) Thermometer
(e) No; Because it is less reactive than copper.

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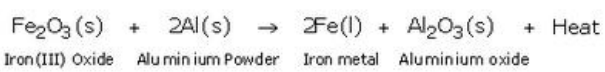
Question 94:

No chemical reaction takes place when granules of a rusty-brown solid A are mixed with the powder of another solid B. However, when the mixture is heated, a reaction takes place between its components. One of the products C is a metal and settles down in the molten state while the other product D floats over it. It was observed that the reaction is highly exothermic.
(a) What could the solids A and B be ?
(b) What are the products C and D most likely to be ?
(c) Write the chemical equation for the reaction between A and B leading to the formation of C and D. Mention the physical sates of all the reactants and products in this equation and indicate the heat change which takes place.
(d) What is the special name of such a reaction ? State one use of such a reaction.
(e) Name any two types of chemical reactions under which the above reaction can be classified.

Solution :

(a) A is iron (III) oxide and B is aluminium powder.
(b) C is molten iron metal and D is aluminium oxide.
(c)



(d) This reaction is called thermite reaction. It is used for welding of broken pieces of heavy iron objects like railway tracks, etc.
(e) Displacement reactions and oxidation-reduction reactions.

Question 95:

In an electrolytic tank, aluminium metal is being extracted by the electrolysis of molten aluminium oxide using carbon electrodes. It is observed that one of the carbon electrodes is

gradually burnt away and has to be replaced.
(a) Which carbon electrode (cathode or anode) is burnt away ?
(b) Why is this carbon electrode burnt away ?

Solution :

(a) Positively charged carbon electrode (Anode)
(b) This carbon electrode is burnt away because oxygen produced during the electrolysis of molten aluminium oxide reacts gradually with the carbon of carbon anode to form carbon dioxide gas.

Question 96:

A metal X which is resistant to corrosion is produced by the electrolysis of its molten oxide whereas another metal Y which is also resistant to corrosion is produced by the reduction of its oxide with carbon. Metal X can be used in powder form in thermite welding whereas metal Y is used in making cathodes of ordinary dry cells.
(a) Name the metals X and Y.
(b) Which of the two metals is more reactive : X or Y ?
(c) Name one ore or metal X. Also write its chemical formula.
(d) Name one ore of metal Y. Also write its chemical formula.
(e) Name one alloy of metal X and one alloy of metal Y.

Solution :

(a) X is aluminium and Y is zinc.
(b) X is more reactiv e than Y.
(c) Bauxite; Al 2 O 3 .2H_2O
(d) Calamine, ZnCO 3
(e) Alloy of metal X : Duralumin ; Allo y of metal Y : Brass

Question 97:

When an object made of metal A is kept in air for a considerable time, it loses its shine and becomes almost black due to the formation of a layer of substance B. When an object made of another metal C is kept in damp air for a considerable time, it gets covered with a green layer of substance D. Metal A is the best conductor of electricity whereas metal C is the next best conductor of electricity.
(a) What is metal A ?
(b) What is metal C ?
(c) Name the substance B.
(d) Name the substance D.
What type of chemical can be used to remove the green layer from metal C and clean it ? Why ?

Solution :

(a) Silver
(b) Copper
(c) Silver sulphide
(d) Basic copper carbonate
(e) Dilute acid solution; The acid sol ution dissolves green coloured basic copper carbonate present on the corroded copper object makes it look shiny, red brown again.

Question 98:

Four metals P, Q, R and S are all obtained by the reduction of their oxides with carbon. Metal P is used to form a thin layer over the sheets of metal S to prevent its corrosion. Metal Q is used for electroplating tiffin boxes made of metal S whereas metal R is used in making car batteries. Metals Q and R form an alloy called solder. What are metals P, Q, R and S ? How have you arrived at this conclusion ?

Solution :

Metal P is zinc; Metal Q is tin; Metal R is lead; Metal S is iron.

Metal P (zinc) is used to form a thin layer on metal S (iron) by the process of galvanisation to prevent its corrosion.

Metal Q (tin) i s used for electroplating tiffin boxes made of metal S (iron).

Metal R (lead) is used in making car batteries.

Metals Q (tin) and R (lead) form an alloy called solder .

Question 99:

A black metal oxide XO_2 is used as a catalyst in the preparation of oxygen gas from potassium chlorate. The oxide XO_2 is also used in ordinary dry cells. The metal oxide XO_2 cannot be reduced satisfactorily with carbon to form metal X.

(a) Name the metal X.

(b) Name the metal oxide XO_2

(c) Which reducing agent can be used to reduce XO_2 to obtain metal X ?

(d) Name another metal which can also be extracted by the reduction of its oxide with the above reducing agent.

Solution :

(a) Manganese

(b) Manganese dioxide

(c) Aluminium

(d) Chromium

Question 100:

Metals X and Y can be recovered from the anode mud left behind after the electrolytic refining of copper metal. The coins made of metal X look new even after several years of use but the coins made of metal Y lose their shine gradually and get blackened soon. When metal X is alloyed with a small amount of metal Y, it becomes hard and hence suitable for making ornaments. What are metals X and Y ? Also state the colour of metal X.

Solution :

Metal X is gold and Metal Y is silver; The colour of metal X (gold) is yellow.