Class 10th Science

Chapter - 3

Metals and Non-metalse

Textual Questions and Answers :

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Q.1. Give an example of metal which

(i) is a liquid at room temperature.

(ii) can be easily cut with a knife.

(iii) in the best conductor of heat.

(iv) is a poor conductor of heat.

Ans :- (i) Mercury.

(ii) Sodium.

(iii) Silver.

(iv) Lead

Q.2. Explain the meanings of malleable and ductile.

Ans :- The property of metals by which they can be beaten into thin sheets is called malleability and this type of metal is called malleable metal.

The property of metal by which it can be drawn into wires is called ductile.

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Q.1. Why is sodium kept immersed in kerosene oil ?

Ans :- Sodium metal is very reactive. It reacts vigorously with oxygen and water. A lot of heat is generated in the reaction. It is therefore, stored in kerosene.

Q.2. Write equation for the reaction of

(i) iron with steam.

(ii) calcium and potassium with water.

Ans :- (i) $3Fe + 4H_2O(g) \rightarrow Fe_3O_4 + 4H_2$
(Iron) (Magnetic oxide of iron)

(ii) $Ca + 2H_2O \rightarrow Ca(OH)_2 + H_2$
(calcium) (Calcium hydroxide)
$2K + 2H_2O \rightarrow 2KOH + H_2$

(potassium) (cold) (potassium hydroxide)

Q.3. Samples of four metals A, B, C and D were takenand added to the following solution one by one. The results obtained have been tabulated as follows :

Metal	Iron (II) sulphate	Copper (II) sulphate	Zinc sulphate	Silver nitrate
A	No reaction	Displace ment	–	–
B	Displace ment	–	No reaction	–
C	No reaction	No reaction	No reaction	Displace ment
D	No reaction	No reaction	No reaction	No reaction

Use the table above to answer the following questions about metals A, B, C and D.

(i) Which is the most reactive metal ?

(ii) What would you observe if B is added to a solution of copper (II) sulphate ?

(iii) Arrange the metals A, B, C and D in the order of decreasing reactivity.

Ans :- (i) B is the most reactive metal.

(ii) B is the more reactive than iron which is more reactive than copper. Hence B is more reactive than copper. B will displace copper from its solution. The chemical equation is -

$$B + CuSO_4 \rightarrow Cu + BSO_4$$

(iii) B > A> C > D

Q.4. Which gas is produced when dilute hydrochloric acid is added to a reactive metal ? Write the chemical reaction when iron reacts with dilute H_2SO_4.

Ans :- Hydrogen gas is produced when dilute hydrochloric acid is added to a reactive metal.

Chemical reaction :- $Fe + H_2SO_4 \rightarrow FeSO_4 + H_2$

Q.5. What would you observe when zinc is added to a solution of iron (II) sulphate ? Write the chemical reaction that takes place.

Ans :- Zinc is more reactive than iron. Therefore zinc replace iron from its solution. The chemical reaction is-

$$Zn + FeSO_4 \rightarrow ZnSO_4 + Fe$$

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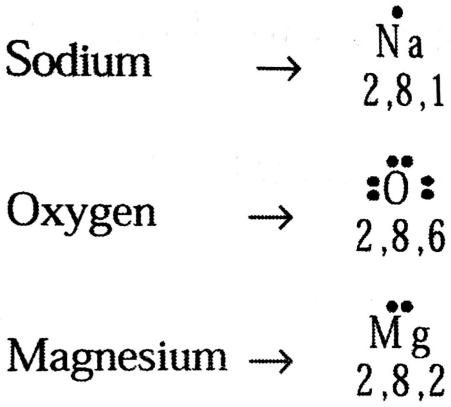
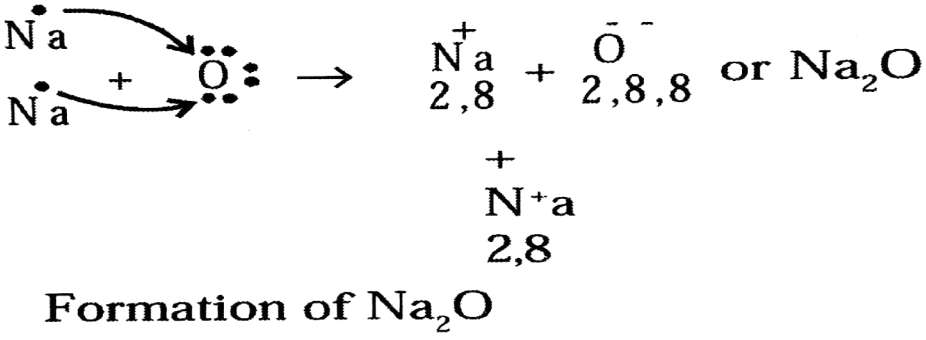
Q.1. (i) Write the electron-dot structures for sodium, oxygen and magnesium.

Ans :-

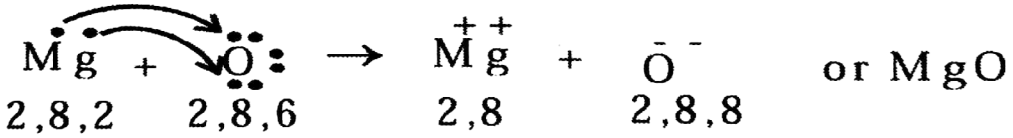


(ii) Show the formation of Na_2O and MgO by the transfer of electrons.

Ans :-



Formation of Na_2O



Formation of MgO

(iii) What are the ions present in these compounds ?

Ans :- In Na_2O, ions present are Na^+ and O^{2-} In MgO, ions present are Mg^{2+} and O^{2-}

Q.2. Why do ionic compounds have high melting points?

Ans :- This is because a considerable amount of energy is required to break the strong interionic attraction.

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Q.1. Define the following terms.

(i) Mineral.

(ii) Ore.

(iii) Gangue.

Ans :- Mineral :- The elements of compounds, which occur naturally in the earth's crust are known as minerals.

(ii) Ore :- The minerals which contain a very high percentage of a particular metal and the metal can be profitably extracted from it is called ores.

(iii) Gangue :- Ores mined from the earth are usually contaminated with large amounts of impurities such as soil, sand etc. called gangue.

Q.2. Name two metals which are found in nature in the free state.

Ans :- Gold and platinum.

Q.3. What chemical process is used for obtaining a metal from its oxide ?

Ans :- Metal oxide can be converted to metal by a process called reduction. For example, zinc oxide is reduced to metallic zinc by heating with carbon.

$$Zno(s) + C(s) \rightarrow 2Fe(l) + Al_2O_3(s) + Heat$$

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Q.1. Metallic oxides of zinc, magnesium and copper were heated with the following metals.

Metal	Zinc	Magnesium	Copper
Zinc oxide	-----	-----	-----
Magnesium oxide	-----	-----	-----
Copper oxide	-----	-----	-----

In which cases will you find displacement reactions taking place ?

Ans :-

Metal	Zinc	Magnesium	Copper
Zinc oxide	No	Yes	No
Magnesium oxide	No	No	No

Copper oxide	Yes	Yes	No

Q.2. Which metals do not corrode easily ?

Ans :- Gold and platinum.

Q.3. What are alloys ?

Ans :- An alloy is a homogeneous mixture of two or more metals, or a metal and a nonmetal.

EXERCISES

Q.1. Which of the following pairs will give displacement reactions ?

(a) Nacl solution and copper metal.

(b) $MgCl_2$ solution and aluminium metal.

(c) $FeSO_4$ solution and silver metal.

(d) $AgNO_3$ solution and copper metal.

Ans :- (d) $AgNO_3$ solution and copper metal.

Q.2. Which of the following methods is suitable for preventing an iron frying pan from rusting ?

(a) Applying grease.

(b) Applying paint.

(c) Applying a coating of zinc.

(d) all of the above.

Ans :- (d) All of the above.

Q.3. An element reacts with oxygen to give a compound with a high melting point. This compound is also soluble in water. The element is likely to be.

(a) Calcium.

(b) Carbon.

(c) Silicon.

(d) iron.

Ans :- (a) Calcium.

Q.4. Food cans are coated with tin and not with zinc because.

(a) Zinc is costlier than tin.

(b) Zinc has a higher melting point than tin.

(c) Zinc is more reactive than tin.

(d) Zinc is less reactive than tin.

Ans :- (c) Zinc is more reactive than tin.

Q.5. You are given a hammer, a battery, a bulls, wires and a switch.

(a) How could you use them to distinguish between samples of metals and non-metals ?

(b) Assess the usefulness of these tests in distinguishing between metals and nonmetals.

Ans :- Metals can be beaten into thin sheets when it strike with a hemmer. But in a non-metal when it strike with a hammer it becomes Powder.

When metals connected into circuit using battery bulb, wires and switch current passes through the circuit and bulb glows while in a non-metal no current will pass through the circuit.

(b) Hammer is a reliable method because no non-metal can be spread in to sheet because non-metal carbon in the form of graphite is a conductor of electricity.

Q.6. What are amphoteric oxides ? Give two examples of amphoteric oxides.

Ans. The oxides which shows the properties of both basic as well as acidic oxides are known as amphoteric oxides.

Examples :- Aluminium oxide and zinc oxide.

Q.7. Name two metals which will displace hydrogen from dilute acids, and two metals which will not.

Ans :- The two metals which will displace hydrogen from dilute acids are Sodium and Magnesium.

The two metals which will not displace hydrogen from dilute acids are copper and silver.

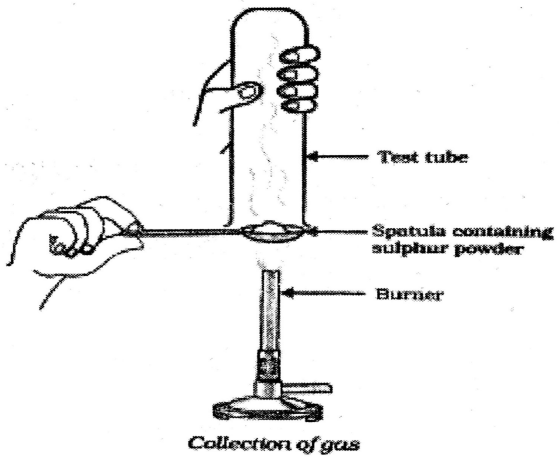
Q.8. In the electrolytic refining of a metal M, what would you take as the anode, the cathode and the electrolyte ?

Ans :- Anode – Impure metal

Cathode – Pure metal

Electroliti – Metal salt solution.

Q.9. Pratyush took sulphur powder on a spatula and heated it. He collected the gas evolved by inverting a test tube over it, as shown in figure below :



(a) What will be the action of gas on

(i) dry litmus paper ?

(ii) Moist litmus paper ?

Ans :- (i) Dry litmus paper – No, action.

(ii) Moist litmus paper – becomes red.

(b) Write the balanced chemical equation for the reaction taking place.

$$S + O_2 \rightarrow SO_2 + H_2O \rightarrow H_2SO_3$$

(Sulphurous acid)

Q.10. State two ways to prevent the rusting of iron.

Ans :- (i) By painting.

(ii) By oiling.

Q.11. What type of oxides are formed when nonmetals combine with oxygen ?

Ans :- Acidic oxides or neutral oxides.

Q.12. Give reasons.

(a) Platinum, gold and silver are used to make jewellery.

(b) Sodium, Potassium and lithium are stored under oil.

(c) Aluminium is highly reactive metal. Yet it is used to make utensils for cooking.

(d) Carbonate and sulphide ores are usually converted into oxides during the process of extraction.

Ans :- (a) Because they are non-reactive and they have shining surface.

(b) Sodium, Potassium and lithium react so vigorously that they catch fire if kept in the open. Hence, to protect them and to prevent accidental fires, they are kept immersed in kerosene oil.

(c) The surface of aluminium covered with a thin layer of oxide. The protective oxide layer prevent the aluminium from further oxidation.

(d) It is easier to reduce oxides into metal.

Q.13. You must have seen tarnished copper vessels being cleaned with lemon or tamarind juice. explain why these sour substances are effective in cleaning the vessels.

Ans :- Copper vessels get a green deposit of copper carbonate. Since Copper Carbonate dissolves in mild acids of lemon or tamarind juice, copper vessels are cleaned.

Q.14. Differentiate between metal and non-metal on the basis of their chemical properties.

Ans :-

Metals	Non-metals
(1) Oxides of metals are basic.	(1) Oxides of metals are are acidic.
(2) Metals react with water to produce metal hydroxide and hydrogen gas.	(2) Generally,m non-metals do not react with water.
(3) Metals react with acids and produce metal Salt and hydrogen.	(3) Generally non-metals do not react with acids.

Q.15. A man went door to door posing as a goldsmith. He promised to bring back the glitter of old and dull gold ornaments. An unsuspecting lady gave a set of gold bangles to him which he dipped in a particular solution. The bangles sparkled like new but their weight was reduced drastically. They lady was upset but after a futile argument the man beat a hasty retreat. Can you play the detective to find out the nature of the solution he had used ?

Ans :- Aqua regia, is a freshly prepared mixture of concentrated hydrochloric acid and concentrated nitric acid in the ratio of 3:1; since it dissolves gold.

Q.16. Give reasons why copper is used to make hot water tanks and not steel (an alloy of iron).

Ans :- Steel (an alloy of iron) reacts with hot water. The chemical reaction is

$$3Fe(s) + 4H_2O \xrightarrow[(hot)]{} Fe_3O_4\ (s) + 4H_2(g)$$

But copper does not react with hot water

$$Cu\ (s) + H_2O \xrightarrow[(hot)]{} \text{No reaction}$$

Therefore copper is used to make hot water tanks.

Additional Questions and Answers :

Q.1. What are metals ?

Ans :- Metals are the elements which can easily form positive ions by losing electrons. They are good conductors of heat and electricity. reflect light and have lustre.

Q.2. What are non-metals ?

Ans :- Materials which are soft and dull in appearance, break down into powdery mass on tapping with hammer, are not sonorous and are poor conductors of heat and electricity are called non-metals. e.g. sulphur, carbon, oxygen, phosphorus etc.

Q.3. Write two soft metals.

Ans :- Sodium and Potassium.

Q.4. Write the name of liquid metal.

Ans :- Mercury.

Q.5. What is metallic lustre ?

Ans :- Metals, in their pure state, have a shining surface. This property is called metallic lustre.

Q.6. What is malleability ? Give two names of malleable metals ?

Ans :- Some metals can be beaten into thin sheets. This property is called malleability. Gold and silver are two malleable metals.

Q.7. What is ductility ? Give example.

Ans :- The ability of metals to be drawn into thin wires is called ductility. Gold is the most ductile metal.

Q.8. Write the name of two metals which are best conductor of heat ?

Ans :- Silver and copper.

Q.9. What is full name of PVC ?

Ans :- Poly vinyl chloride.

Q.10. What do you mean by Sonorous ?

Ans :- The metals that produce a sound on striking a hard surface are said to be sonorous.

Q.11. What is the name of liquid non-metals ?

Ans :- Bromine.

Q.12. Which metals have very low melting point ?

Ans :- Gallium and calcium.

Q.13. Which non-metal is lustrous ?

Ans :- Lodine.

Q.14. Write the name of two allotrope of carbon :

Ans :- Diamond and Graphite.

Q.15. Write the name of three alkali metals.

Ans :- Lithium, Sodium and Potassium.

Q.16. Non-metals do not conduct heat and electricity except one. Name the non metal.

Ans :- Carbon as graphite conduct heat and electricity.

Q.17. What happens when you hammer a metal and a non metal ?

Ans :- When you hammer a metal, it is converted into sheets. When you hammer a non-metal, it breaks away easily.

Q.18. Name some metalloids.

Ans :- Arsenic, antimony, silicon and germanium.

Q.19. Arrange the following metals in the order of their l decreasing chemical activity. Magnesium, Potassium, iron, gold.

Ans :- Potassium > magnesium > iron > gold.

Q.20. Why do some metals replace the other metals from their solution ?

Ans :- Because of the difference in the reactivity, some metals replace the less reactive metals. More reactive metal replaces the less reactive metal from its solution.

Q.21. Write the name of three metals which do not react either gushu with cold or hot water but react with steam.

Ans :- Aluminium, iron and zinc.

Q.22. Give the name of four metals which do not react with water at all stages.

Ans :- Lead, copper, silver and gold.

Q.23. Fill in the blanks :

(i) Metals react with acids to give a ---------- and---------.

(ii) Almost all metals Combine with ---------- to from metal oxides.

(iii) --------- is a liquid non-metal.

(iv) Calcium is ---------- reactive metal than sodium.

(v) Most of the meals have ---------- melting points.

(vi) Metal oxides are ---------- in nature.

(vii) Metals usually occur in ---------- state.

(viii) Iodine is a non-metal but it is ----------

(ix) Non-metal oxides are ---------- in nature.

(x) Rust is a mixture of ---------- and ----------

Ans :- (i) Salt, hydrogen gas.

(ii) Oxygen.

(iii) Bromine.

(iv) less.

(v) high.

(vi) basic .

(vii) combined.

(viii) lustrous.

(ix) acidic.

(x) ferric hydroxide, ferric oxide.

Q.24. Differentiate between roasting and calcination.

Ans :-

Calcination	Roasting
1. The ore is heated in absence of air.	1. The ore is heated in the presence of air.
2. It is used for carbonate ores.	2. It is sued for sulphide ores.

Q.25. Explain the term gangue.

Ans :- Ores are associated with earthy or rocky materials as impurities. These impurities are called gangue.

Q.26. Explain the terms :

(a) Anodising.

(b) Aqua regia.

Ans :- (a) Anodising is a process of forming a thick oxide layer of aluminium. During anodising, a clean aluminium article is made the anode and is electrolysed with dilute sulphuric acid. The oxygen liberate at the anode reacts with aluminium to produce a thick protective oxide layer on its surface. Also the oxide layer can be dyed easily to give an attractive finish to the aluminium articles.

(b) Aqua regia is a freshly prepared mixture of concentrated hydrochloric acid and concentrated nitric acid in the ratio 3:1. It is also called royal water. It is highly corrosive and faming liquid. It can dissolve noble metals like gold and platinum.

Q.27. Write the electronic configuration of the following :

Helium, Sodium, Calcium, Nitrogen, Oxygen, Sulphur, Neon, Argan Chlorine, Aluminium.

Ans :-

Element	**Atomic number**	**Number of electrons in shells**			
		K	**L**	**M**	**N**
Helium (He)	2	2	---	---	---
Sodium (Na)	11	2	8	1	---
Calcium (Ca)	20	2	8	8	2

Nitrogen (N)	7	2	5	---	---
Oxygen (O)	8	2	6	---	---
Sulphur (s)	16	2	8	6	---
Neon (Ne)	10	2	8	---	---
Argon (Ar)	18	2	8	8	---
Chlorine (cl)	17	2	8	7	---
Aluminium (Al)	13	2	8	3	---

Q.28. What are ionic compounds or electrovalent compounds ?

Ans :- The compounds formed by the transfer of electrons from a metal to a non-metal are known as ionic compounds or electrovalent Cpunodunds.

Q.29. Give the examples of two ionic compound.

Ans :- Sodium chloride (Nacl) and Calcium oxide (CaO)

Q.30. Why ionic compounds are solid ?

Ans :- Ionic compounds are solid and some what hard because of the strong force of attraction between the positive and negative ions.

Q.31. Why ionic compounds have high melting and boiling points ?

Ans :- This is because a considerable amount of energy is required to break the strong interionic attraction.

Q.32. Which one is the one attraction of mercury ?

Ans :- Cinnabar (HgS)

Q.33. Define the terms roasting and calcination.

Ans :- Roasting :- The sulphide ores are converted into oxides by heating strongly in the presence of excess air. This process is known as roasting.

Calcination :- The carbonate ores are changed into oxides by heating strongly in limited air. This process is known as calcination.

Q.34. Write the chemical reaction that takes place during roasting and calcination of zinc ores.

Ans :-

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

Calcination : $ZnCo_3(s) \xrightarrow{heat} ZnO(s) + Co_2(g)$

Q.35. What is cinnabar ?

Ans :- Cinnabar is an ore of mercury.

Q.36. What is Galvanisation ?

Ans :- Galvanisation is a method of protecting steel and iron from rusting by coating them with a thin layer of zinc.

Q.37. Give some differences with examples between metals and nonmetals with reference to their physical properties. Give one exception in each case.

Ans :- (i) Metallic Lustre :- Metals have a shining surface called metallic lustre. Non-metals have dull appearance. Metals like silver, gold have shining appearance. Non-metal like sulphur has dull appearance.

Exception :- Carbon as diamond is a non-metal but has a most a shining look, Iodine is another non-metal which gives shining crystals.

(2) Malleability :- Metals are malleable. They can be beaten into sheets. But non-metals can not be beaten into sheets. They break into proces when hammered. They are not malleable. Metals like gold, aluminium, copper etc. form sheets when hammered.

Exception :- Mercury is a metal. It breaks into pieces when hammered.

(3) Ductility :- Metals are ductile. They can be drawn into wires. Non-metals cannot be drawn into wires.

Exception :- Mercury is a metal but not ductile.

(4) Conductivity :- Metals are good conductors of heat and electricity while non-metals are bad conductors of heat and electricity.

Exception :- Graphite is a non-metal but is a good conductors of heat and electricity.

Q.38. Write true or false :

(i) Sodium is more reactive than magnesium.

Ans :- True.

(ii) Magnesium react with cold water.

Ans :- False.

(iii) All metals exist in solid form at room temperature.

Ans :- False.

(iv) Gallium has a low melting point.

Ans :-

(v) Gold is alloyed with copper to make it hand.

Ans :- True.

Q.39. Silver does not combine easily with oxygen but silver jewellery tarnishes after sometime. Why ?

Ans :- Silver does not combine with oxygen easily but jewellery exposed to atmosphere tarnishes black after some time because it reacts with gases like hydrogen sulphide in air to form silver sulphide which is black.

Q.40. Define the terms :

(i) Thermal conductivity.

(ii) Electrical conductivity.

Ans :- (i) Thermal conductivity is the ability of a material to conduct heat from the hot end to the cold end. Silver is the best conductor of heat. So it has the highest thermal conductivity.

(ii) Electrical conductivity is the ability of a material to conduct electricity. A material which allows electric current to pass through it with minimum loss is called a good conductor of electricity. Siver is the best electric conductor followed by copper, gold and aluminium.

Q.41. Which of the following can be beaten into thin sheets ?

(a) Zinc.

(b) Phosphorus.

(c) Sulphur.

(d) oxygen.

Ans :- (a) Zinc.

Q.42. Which of the following statements is correct ?

(a) All metals are ductile.

(b) All non-metals are ductile.

(c) Generally metals are ductile.

(d) Some non-metals are ductile.

Ans :- (c) Generally metals are ductile.

Q.43. What happens when iron nails are placed in copper sulphate solution ?

Ans :- Brown coating is deposited on the iron nails. This is because of the displacement of copper from copper sulphate solution by iron. Iron + Copper sulphate (solution) → Iron sulphate (solution) + Copper.

Q.44. Why hydrogen gas is not evolved when a metal reacts with nitric acid ?

Ans :- It is because nitric acid is a strong oxidising agent. It oxidises the H_2 produced to water and itself gets reduced to any of the nitrogen oxides.

Q.45. Why are ionic compounds generally solids ?

Ans :- They are solids due to strong force of attraction between oppositely charged ions resulting in the formation of ionic lattice.

Q.46. How is an ore different from a mineral ?

Ans :- The metals found in nature in combined state are called minerals. If some minerals contain a very high percentage of a particular metal and the metals can be profitably and economically extracted, there it is called ore.

Q.47. Distinguish between alloy and amalgam.

Ans :- An alloy is a homogeneous solid solution of a metal with other metals or non-metals, with essentially metallic properties.

An amalgam is an alloy of a metal with the mercury.

Q.48. Name two important alloys of aluminium.

Ans :- (i) Magnalium.

(ii) Duralumin.

Q.49. Write the name given to the alloy of iron, chromium and nickel.

Ans :- Stainless steel.

Q.50. Which of the following is not metallic ?

(i) Brass.

(ii) Neon.

(iii) Lead.

(iv) Calcium.

Ans :- (ii) Neon.