

NCERT Solutions for Class 10

Science

Chapter 3 – Metals and Non-Metals

INTEXT QUESTIONS:

1. Give an example of a metal which

i. Is a liquid at room temperature.

Ans: Mercury

ii. Can be easily cut with a knife.

Ans: Potassium

iii. Is the best conductor of heat.

Ans: Copper and Silver

iv. Is a poor conductor of heat.

Ans: Mercury.

2. Explain the meanings of malleable and ductile.

Ans: Malleable: Property of a metal due to which it can be beaten into thin sheets is known as malleability and the metal is known to be malleable.

Ductile: Property of a metal due to which it can be beaten into thin pipes/wire is known as ductility and the metal is known to be ductile.

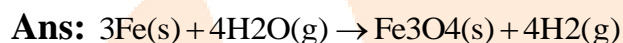
INTEXT QUESTIONS:

1. Why sodium is kept immersed in kerosene oil?

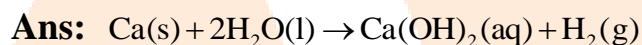
Ans: Sodium is a very reactive metal. It reacts with the air and catches fire as soon as it comes in contact with it. Hence, to avoid such accidents sodium is kept immersed in kerosene oil.

2. Write equations for the reactions of

i. Iron with steam



ii. Calcium and potassium with water



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

Metals	Iron Sulphate (II)	Copper Sulphate (II)	Zinc Sulphate	Silver Nitrate
A	No Reaction	Displacement		
B	Displacement		No Reaction	
C	No Reaction	No Reaction	No Reaction	
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.

Ans: According to the activity series the most reactive metal displaces the least reactive metal. according to the given table we can say that:

A is less reactive than iron but more reactive with copper.

$A + \text{FeSO}_4 \rightarrow$ No reaction

$A + \text{CuSO}_4 \rightarrow$ Single Displacement

B is more reactive than iron but less reactive than zinc.

$B + \text{FeSO}_4 \rightarrow$ Single Displacement

$B + \text{ZnSO}_4 \rightarrow$ No reaction

C is less reactive than iron, copper and zinc but more reactive with silver

$C + \text{FeSO}_4 \rightarrow$ No reaction

$C + \text{CuSO}_4 \rightarrow$ No reaction

$C + \text{ZnSO}_4 \rightarrow$ No reaction

$C + \text{AgNO}_3 \rightarrow$ Single Displacement

D is less reactive than iron, copper, zinc, and silver

$D + \text{FeSO}_4 \rightarrow$ No reaction

$D + \text{CuSO}_4 \rightarrow$ No reaction

$D + \text{ZnSO}_4 \rightarrow$ No reaction

$D + \text{AgNO}_3 \rightarrow$ No Reaction

i. Which is the most reactive metal?

Ans: B is the most reactive metal.

$B + \text{FeSO}_4 \rightarrow$ Single Displacement

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

Ans: When B is added to a solution of copper (II) sulphate then it shows the single displacement because B is more reactive than iron.

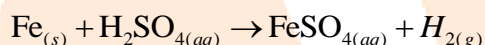
$B + CuSO_4 \rightarrow$ Single Displacement

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

Ans: $B > A > C > D$

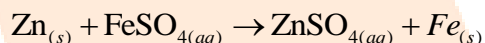
4. Which gas is produced when dilute hydrochloric acid is added to a reactive metal? Write the chemical reaction when iron reacts with dilute H_2SO_4 .

Ans: Iron is more reactive than hydrogen according to the reactivity series. So, when iron comes in contact with dilute H_2SO_4 it replaces hydrogen to form iron sulphate and in the reaction it releases hydrogen gas.



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

Ans: According to reactivity series we know zinc is more reactive than iron. So, when zinc comes in contact with iron sulphate solution it replaces iron and forms zinc sulphate. And the colour of solutions turns brown from green.



Intext Exercise :

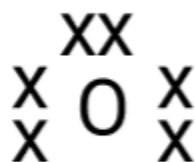
1. Answer the following:

i. Write the electron-dot structures for sodium, oxygen and magnesium.

Ans: Sodium, oxygen and magnesium atomic numbers are 11, 8 and 12. The electron dot structures are below:

Sodium (2,8,1) = $\overset{x}{Na}$

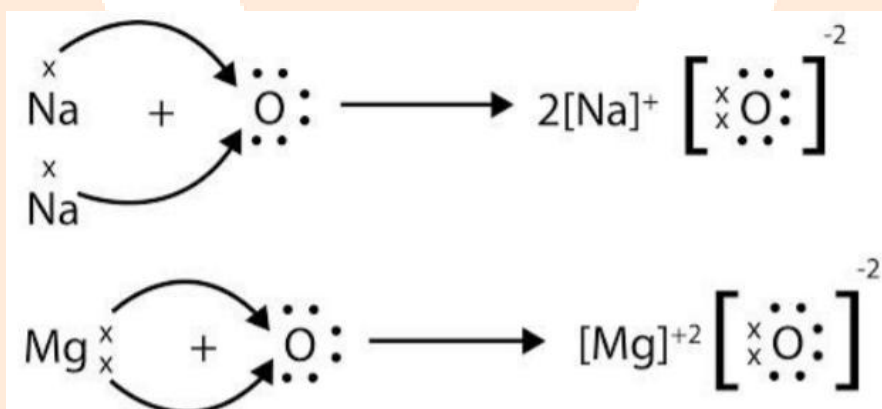
Oxygen (2,6) =



Magnesium (2,8,2) = $\overset{\text{XX}}{\text{Mg}}$

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

Ans: Both of the compounds will form an ionic bond.



iii. What are the ions present in these compounds?

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

2. Why do ionic compounds have high melting points?

Ans: Ionic compounds have high electrostatic force between the molecules due to which they are very closely packed and rigid. This tight packing results in ionic compounds having high melting points.

Intext Exercise:

1. Define the following terms.

i. Minerals: :

Ans: The minerals which are present as a mixture of metallic compounds and extractable impurities are known as ores and the compound of a metal found in nature is called mineral.

ii. Ore:

Ans: The minerals from which the metals can be conveniently and economically extracted are known as ores.

iii. Gangue:

Ans: The ore contains some impurities like sand, clay and rocky material. These impurities are called gangue or matrix. Gangue is removed before the metallurgical process starts.

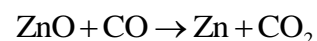
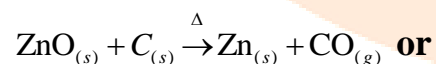
2. Name two metals which are found in nature in the free state.

Ans: Silver and Gold are found in free state as their reactivity potential is very low.

For example: Silver(Ag), Gold (Au), and Platinum(Pt).

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

Ans: More reactive metals are reduced by the electrolysis process. moderate reactive metals can be reduced by either carbon or carbon monoxide. Metal oxides are reduced by using suitable reducing agents such as carbon or by highly reactive metals to displace the metals from their oxides. For example, zinc oxide is reduced to metallic zinc by heating with carbon.



Thermite process: Chromium oxides are reduced to chromium by treating it with aluminium powder. In this case, aluminium displaces manganese from its oxide.



Intext Exercise

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

Metals	Zinc	Magnesium	Copper
Zinc Oxide	-	-	-
Magnesium Oxide	-	-	-
Copper Oxide	-	-	-

In which cases will you find displacement reactions taking place?

Ans:

Metals	Zinc	Magnesium	Copper
Zinc Oxide	No reaction	Displacement	No reaction
Magnesium Oxide	No reaction	No reaction	No reaction
Copper Oxide	Displacement	Displacement	No reaction

2. Which metals do not corrode easily?

Ans: Metals with less reactivity such as silver, platinum and gold.

3. What are alloys?

Ans: An alloy is a homogenous mixture of two metals or metal and non-metals. They are formed by melting the metals and mixing them and then solidifying them into alloy.

Example: Bronze is an alloy of copper and tin.

EXERCISE QUESTIONS

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

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: (c) Applying a coating of zinc

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

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.

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

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

Ans: Metals are naturally malleable. We can beat the given sample with the help of a hammer. If it turns into thin sheets, it is metal; otherwise, it is nonmetal.

Metals carry electricity. when we use a battery, a lamp, wires, and a switch to create a circuit. If the bulb glows, it indicates that the sample is metallic due to liberated electrons. If the bulb does not light up, this indicates that the sample is non-metallic.

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

Ans: The physical properties of metals and non-metals are represented by these tests. We can easily distinguish between them based on their physical characteristics.

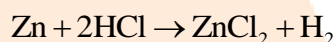
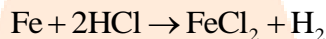
6. What are amphoteric oxides? Give two examples of amphoteric oxides.

Ans: Oxides which can react with both acid and base is known as amphoteric oxide.

Example: Zinc oxide (ZnO) and Aluminum oxide (Al_2O_3)

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

Ans: More reactive metals will displace hydrogen from its dilute acids. for example : Iron and Zinc.



Least reactive metals will not displace hydrogen from its dilute acids. for example : copper and silver

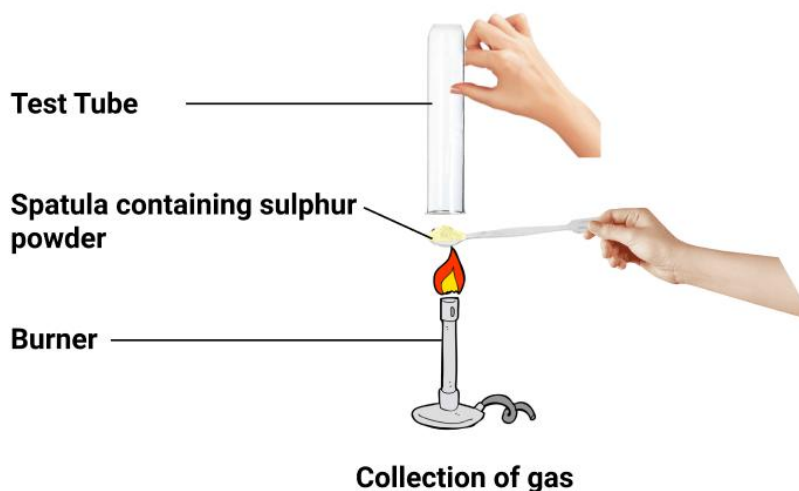


8. In the electrolytic refining of a metal M, what would you take as the anode, the cathode and the electrolyte?

Ans: In the electrolytic refining of a metal M:

- i. Cathode \rightarrow Pure metal M
- ii. Anode \rightarrow Impure metal M
- iii. Electrolyte \rightarrow Salt Solution of the metal M

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

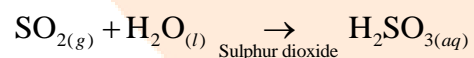
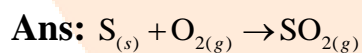
i. Dry litmus paper?

Ans: No reaction with dry litmus paper.

ii. Moist litmus paper?

Ans: Moist blue litmus will turn red due to the formation of sulphur dioxide. Sulphur dioxide is acidic oxide when it will react with water converts into sulphurous acid.

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



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

Ans: The process of degrading metals in presence of air and water is known as rusting. Two ways in which rusting can be prevented are as follows:

i. Painting: It prevents iron from coming in direct contact with air and water.

ii. Galvanization: In this process iron is coated with a layer of zinc.

11. What type of oxides is formed when non-metals combine with oxygen?

Ans: Non-metals combines with oxygen and forms acidic oxides which when combined with water turns into acidic solution.

12. Give reasons

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

Ans: These metals are very less reactive and are lustrous which makes them suitable for making jewellery.

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

Ans: They are highly reactive metals and catch fire as soon as it comes in contact with the air. Hence, to avoid any accidents these metals are kept under oil.

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

Ans: Aluminium is highly reactive and they react with oxygen present in atmosphere to form a stable compound Al_2O_3 . Along with this, they are very good conductor of heat. Therefore, aluminium is used in making utensils for cooking.

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

Ans: Extracting metals from their oxides are easier as compared to their carbonate and sulphides. Therefore, ores are usually converted into oxides by the process of roasting and calcination.

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 forms basic copper carbonate ($\text{CuCO}_3 \cdot \text{Cu(OH)}_2$) when it combines with damp carbon dioxide in the air. It turns green, and the copper vase loses its gleaming brown finish. The presence of citric acid in the lemon or tamarind neutralizes the basic copper carbonate and dissolves the layer.

14. Differentiate between metals and non-metals.

Ans: Differences between metals and non-metals are as follows:

METALS	NON-METALS
Metals are electropositive.	Non-metals are electronegative.
They react with water to form oxides and hydroxides. Some metals react with cold water, some with hot water, and some with steam. $2\text{Na} + 2\text{H}_2\text{O} \rightarrow 2\text{NaOH} + \text{H}_2 \uparrow$	They do not react with water.
They react with oxygen to form basic oxides $4\text{Na} + \text{O}_2 \rightarrow 2\text{Na}_2\text{O}$ These have ionic bonds.	They react with oxygen to form acidic or neutral oxides. $\text{C} + \text{O}_2 \rightarrow \text{CO}_2$ These have covalent bonds
They react with dilute acids to form a salt and evolve hydrogen gas. However, Cu, Ag, Au, Pt, Hg do not react. $2\text{Na} + 2\text{HCl} \rightarrow 2\text{NaCl} + \text{H}_2 \uparrow$	They do not react with dilute acids. These are not capable of replacing hydrogen.
They react with the salt solution of metals. Depending on their reactivity,	These react with the salt solution of non-metals

displacement reaction can occur $\text{CuSO}_4 + \text{Zn} \rightarrow \text{ZnSO}_4 + \text{Cu}$	
They act as reducing agents. $\text{Na} \rightarrow \text{Na}^+ + \text{e}^-$	These act as oxidizing agents. $\text{Cl}_2 + 2\text{e}^- \rightarrow 2\text{Cl}^-$

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. The 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: The man is using Aqua Regia which is 3 parts of HCL and 1 part of HNO_3 solution. Gold is least reactive metal but when we put it in aqua regia the upper most layer and gets dissolved in the solution and the inner layer comes out due to which it weighs less than before but are glitterier.

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

Ans: In the reactivity reaction copper comes below hydrogen and hence, it will not react with the water present/stored. On the other hand, steel which is an alloy of iron will react with the steam and can get corroded easily.