

Metals and Non-metals

Solved Intext Exercises

Q1. Give an example of a metal which

- (i) is a liquid at room temperature
- (ii) can be easily cut with a knife.
- (iii) is the best conductor of heat.
- (iv) is the poorest conductor of heat.

Sol. (i) Mercury (ii) Sodium (iii) Silver and Copper (iv) Lead and Mercury

Q2. Explain the meaning of 'malleability' and 'ductility' of a metal.

Sol. Malleability is the property of a metal by virtue of which it can be beaten into thin sheets when hammered. Ductility is the property of a metal by virtue of which it can be drawn into very thin wires.

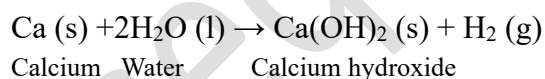
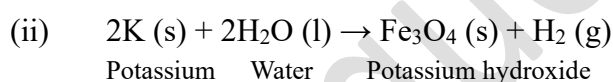
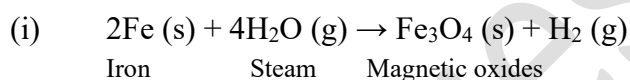
Q3. Why is sodium kept immersed in kerosene oil?

Sol. This is because sodium, being highly reactive, reacts with the oxygen of the air quite rapidly at the room temperature. Hence it is kept preserved in kerosene to cut off its contact with air.

Q4. Write equation for the reaction of

- (i) iron with steam
- (ii) calcium and potassium with water

Sol.



Q5. 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:

Metal	Iron(II) Sulphate	Copper(II) Sulphate	Zinc Sulphate	Silver Nitrate
A	No reaction	Displacement		
B	Displacement		No reaction	
C	No reaction	No reaction	No reaction	Displacement
D	No reaction	No reaction	No reaction	No reaction

Use the table given above to answer the following questions about metal A, B, C.

- (a) Which is the most reactive metal?
- (b) What would you observe when B is added to a solution of copper (II) sulphate
- (c) Arrange the metals A, B, C and D in order of decreasing reactivity.

Sol. (a) A can displace Cu, B can displace Fe, C can displace Ag. As order of reactivity of Cu, Fe and Ag is $\text{Fe} > \text{Cu} > \text{Ag}$, hence, B is most reactive.

(b) As B is more reactive than copper, it will displace Cu from copper (II) sulphate solution. Hence, blue colour of CuSO_4 will fade.

(c) B can displace Fe, A can displace Cu, C can displace Fe, A can displace Cu, C can displace Ag and D can displace none. Hence, order of decreasing reactivity will be $\text{B} > \text{A} > \text{C} > \text{D}$.

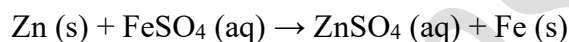
Q6. Which gas is produced when dilute hydro chloric acid is added to a reactive metal? Write the chemical reaction when iron reacts with dilute H_2SO_4 .

Sol. When dilute hydrochloric acid is added to re active metal then hydrogen gas is produced.

e.g. $\text{Zn(s)} + 2\text{HCl (dil)} \rightarrow \text{ZnCl}_2 \text{ (aq)} + \text{H}_2 \text{ (g)}$

Q7. What would you observe when zinc is added to a solution of iron (II) sulphate? Write the chemical reaction that take place.

Sol. Zinc will displace iron from an iron (II) sulphate solution and zinc sulphate is formed. As a result, the light green colour of the iron (II) sulphate solution disappears and the solution becomes colourless.



Q8. (i) Write the electron-dot structures for sodium, oxygen and magnesium.

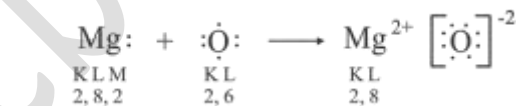
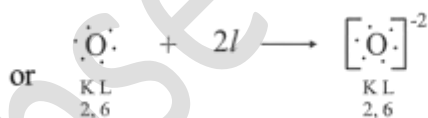
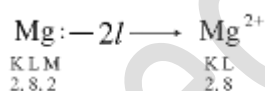
(ii) Show the formation of N_2O and MgO by the transfer of electrons.

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

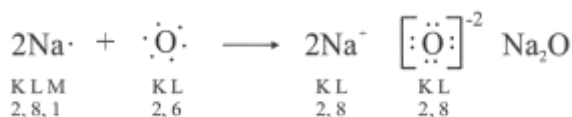
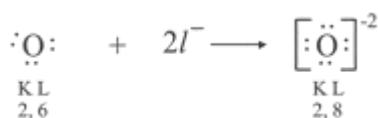
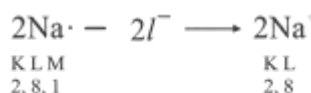
Sol.

- (i) Sodium (Na) 2,8,1 Na
 Oxygen (O) 2,6 $:\ddot{\text{O}}:$
 Magnesium (Mg) 2,8,2 $\text{Mg}:$

(ii) Formation of Magnesium oxide (MgO):



Formation of Sodium oxide (Na_2O):



- (iii) Ions present in Na_2O are Na^+ and O^{2-}
 Ions present in MgO are Mg^{2+} and O^{2-}

Q9. Why do ionic compounds have high melting points?

Sol. In ionic compounds, the cations and anions are held together by strong electrostatic (or inter ionic) force of attraction. To break or overcome these strong forces, a large amount of energy is required. So, melting points are high.

Q10. Define the following terms:

- (i) Mineral (ii) Ore (iii) Gangue

Sol.

- (i) **Minerals:** The naturally occurring chemical substances in the form of which the metals occur in the earth along with impurities are called minerals.
 (ii) **Ore:** The mineral from which the metal can be extracted conveniently and economically is called ore.
 (iii) **Gangue:** The earthy, sandy and rocky impurities associated with the minerals are called gangue.

Q11. Name two metals which are found in nature in the free state.

Sol. Gold and platinum.

Q12. What chemical process is used for obtaining a metal from its oxide?

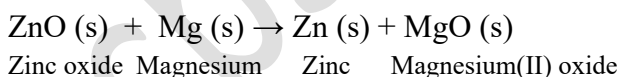
Sol. Metal is obtained from its oxide by reduction. This reduction can be done either by heating with carbon or by using highly reactive metals such as sodium, calcium etc.

Q13. Metallic oxides of zinc, magnesium and copper were heated with the following metals:

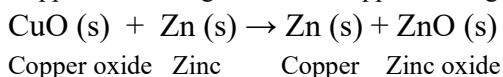
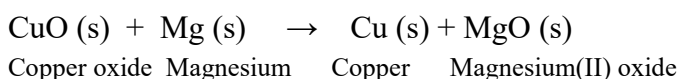
Metal Oxide	Zinc	Magnesium	Copper
Zinc Oxide			
Magnesium Oxide			
Copper Oxide			

In which cases will you find displacement reactions taking place?

Sol. Magnesium lies above zinc while copper lies below it. Therefore, magnesium is more reactive and hence can displace zinc from zinc oxide



Magnesium lies above zinc and copper, therefore, zinc and copper cannot displace magnesium from magnesium oxide. Lastly, both magnesium and zinc lie above copper in the activity series. Therefore, both magnesium and zinc can displace copper from copper oxide.



Q14. Which metals do not corrode easily?

Sol. Metals which lie low in the activity series are highly unreactive such as Au, Ag, Pt etc. are not attacked by atmospheric gases and moisture and hence do not corrode easily.

Q15. What are alloys?

Sol. Alloys are homogeneous mixture of two or more metals, or a metal and non-metal. e.g. steel.

Solved NCERT Exercises

Q1. Which of the following pairs will give displacement reactions?

- (a) NaCl solution and copper metal.
- (b) MgCl₂ solution and aluminium metal.
- (c) FeSO₄ solution and silver metal.
- (d) AgNO₃ solution and copper silver.

Sol. Copper being more reactive than the silver so copper displaces silver from silver nitrate solution.

So, (d) is correct. All others are less reactive than the metals to be displaced.

Q2. Which of the following methods is suitable for preventing an iron frying pan from rusting.

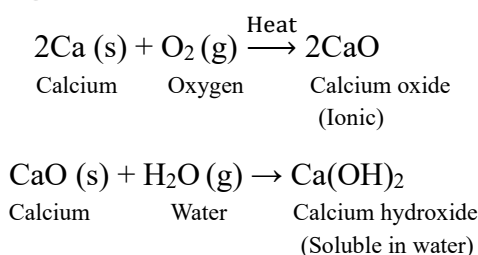
- (a) Applying grease
- (b) Applying paint
- (c) Applying a coating of zinc
- (d) All of the above

Sol. (d) All of the above

Q3. 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

Sol. Calcium reacts with oxygen to form calcium oxide. Being ionic compound, it has high melting point. It also dissolves in water to form calcium hydroxide:



On the other hand, the oxide of carbon is CO₂ which is a gas; the oxide of silicon is SiO₂ (silica or sand) which is a high melting solid but is insoluble in water; the oxide of iron is iron oxide, which has also high melting point but is insoluble in water. Thus option (b), (c) and (d) are wrong.

Q4. 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.

Sol. (c) Zinc is more reactive than tin.

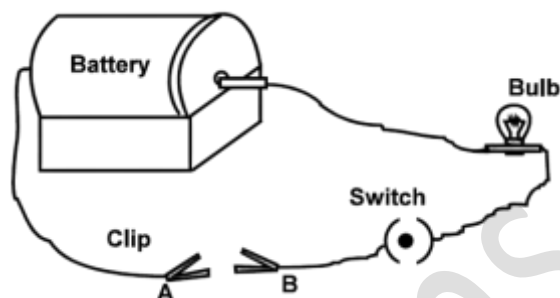
Q5. You are given a hammer, a battery, a bulb, wires and a switch.

(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 non-metals.

Sol. (a) (i) Using a hammer: If the sample breaks, it means that it is brittle. So, non-metal. If the sample flattens to form a sheet, it means sample is malleable. So metal.

(ii) Set up the battery, bulb wire and switch as in figure.

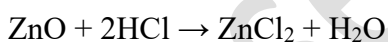
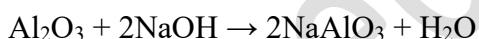
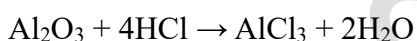


Place the sample between clip A and B and put the switch 'on'. If the bulb glow. Sample is a metal and vice-versa.

(b) Because of malleability of iron and many other metals we can cast them into sheets and can use for roofing, making trunks etc. As metals are good conductor of electricity, wires of metals are used for carrying electricity.

Q6. What are amphoteric oxides? Give two examples of amphoteric oxides.

Sol. The metal oxides which react with both acids as well as alkalis to produce salt and water are called amphoteric oxides. For example, Al_2O_3 and ZnO are amphoteric oxides.



Q7. Name two metals which will displace hydrogen from dilute acids, and two metals which will not.

Sol. Sodium and calcium can displace hydrogen from dilute acids. Copper and silver cannot displace hydrogen from dilute acids.

Q8. In the electrolytic refining of a metal M, what would you take as the anode, the cathode and the electrolyte?

Sol. Anode- Impure metal M

Cathode - A thin strip of pure metal, M.

Electrolyte - A solution of metal (M) salt.

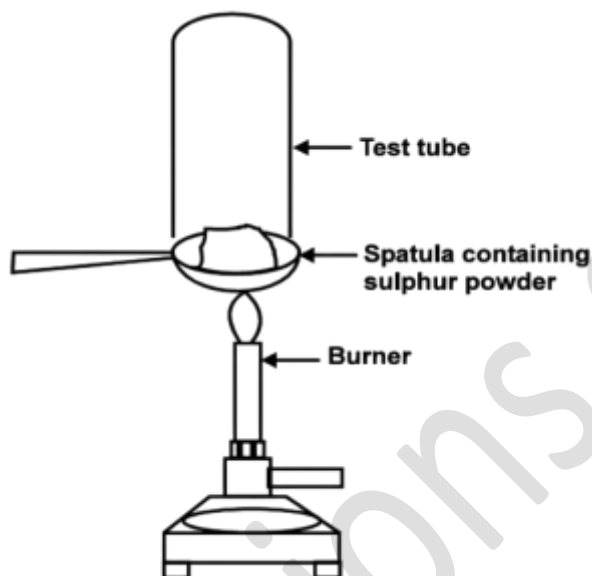
Q9. Pratyush took sulphur powder on a spatule and heated it. He collected the gas evolved by inverting a test tube over it, as shown in figure below:

(a) What will be the action of gas on

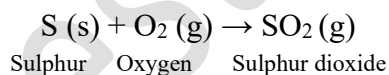
(i) dry litmus paper?

(ii) moist litmus paper?

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

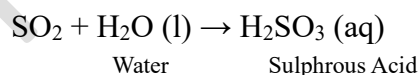


Sol. (a) When sulphur is burnt, it produces sulphur dioxide (SO_2) gas



(i) There is no action of gas (SO_2) on dry litmus paper.

(ii) The gas dissolves in water present in moist litmus paper to form sulphurous acid (H_2SO_3) which turns blue litmus red.



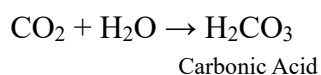
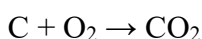
(b) The balanced equation of the reaction is given above.

Q10. State two ways to prevent the rusting of iron.

Sol. (i) Galvanization (ii) Alloying, painting, oiling, greasing

Q11. What type of oxides are formed when non metals combine with oxygen?

Sol. When non-metals react with oxygen then acidic oxides are formed, e.g.



Q12. Give reasons:

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

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

(c) Aluminium is a 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.

Sol. (a) Platinum, gold and silver are highly reactive metals. Therefore, they do not undergo corrosion due to attack by moisture and atmospheric gases. So they are used to make jewellery.

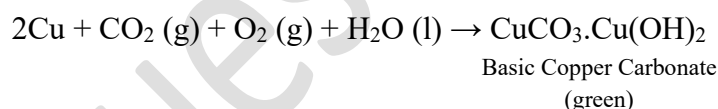
(b) Lithium, sodium and potassium readily attacked by O_2 present in air to form their respective oxides. They also react with moisture present in air producing H_2 gas which sometimes catches fire and causes accidents. To protect these metals from attack by O_2 and moisture and to prevent accidental fires, lithium, sodium and potassium are stored under oil.

(c) Aluminium is a good conductor of heat. But it is highly reactive. When it is exposed to moist air, its surface is covered with a thin impervious (in-penetrable) layer of aluminium oxide (Al_2O_3). This layer does not allow moist air to come in contact with the fresh metal and hence protects the metal underneath from further damage or corrosion. So they are used to make utensils for cooking.

(d) Carbonate and sulphide ores are typically converted into oxides during metal extraction because it's easier to reduce metal oxides to obtain the pure metal compared to reducing the original carbonate or sulphide ores. The process of converting these ores into oxides makes the subsequent extraction of the metal more efficient and economical.

Q13. You must have seen tarnished copper being cleaned with lemon or tamarind juice. Explain why these sour substances are effective in cleaning the vessels.

Sol. When copper is exposed to moist air, it gets tarnished or corroded by the formation of basic carbonate.



When lemon juice contains citric acid and tamarind contains tartaric acid. When copper vessels are rubbed with lemon juice etc., the weak acids present in them dissolve the basic copper carbonate and original shine returns.

Q14. Differentiate between metal and non-metal on the basis of their chemical properties.

Sol. Chemical properties – Metals:

1. Metals combine with oxygen to form basic oxides.
2. Reactive metals like Na, Mg, Zn, Fe, etc., dissolve in dil. acids to produce H_2 gas.
3. Metals (except Na, Ca) generally do not combine with hydrogen.
4. Metals react with chlorine to form ionic metal chloride.
5. Metals react with hydrogen to form ionic metal hydride.

Chemical properties – Non-Metals:

1. Non-metals combine with oxygen to form acidic oxides or neutral oxides.
2. Non-metals do not dissolve in dil. acids.
3. Non-metals combine with hydrogen to form covalent non-metal hydride.
4. Non-metals react with chlorine to form covalent non-metal chloride.
5. Non-metals act as oxidizing agents.

Q15. A man went door to door posing as a gold smith. He promised to bring back the glitter or 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?

Sol. The solution was aqua-regia or royal water. Aqua-regia is a freshly prepared solution of concentrated hydrochloric acid and nitric acid in the 3 : 1 by volume. It dissolved a considerable amount of gold bangles and hence weight reduced drastically. The man can recover the dissolved gold from solution by a suitable treatment.

Q16. Give reasons why copper is used to make hot water tanks and not steel (an alloy of iron).

Sol. Copper is better conductor of heat than steel. To save heat losses, hot water tanks are made up of copper instead of steel.