CLASS X: SCIENCE
Chapter 3: Metals and Non-metals

Questions and Solutions | Page No. 40 - NCERT Books

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 a poor conductor of heat.

Ans. (i) Metal that exists in liquid state at room temperature – Mercury
(ii) Metal that can be easily cut with a knife – Sodium
(iii) Metal that is the best conductor of heat – Silver
(iv) Metals that are poor conductors of heat –Mercury and lead

Q2. Explain the meaning of malleable and ductile.

Ans. Malleable: Substances that can be beaten into thin sheets are called malleable. For example, most of the metals are malleable.
Ductile: Substances that can be drawn into thin wires are called ductile. For example, most of the metals are ductile.

Questions and Solutions | Page No. 46 - NCERT Books

Q1. Why sodium is kept immersed in kerosene oil ?

Ans. Sodium and potassium are very reactive metals and combine explosively with air as well as water. Hence, they catch fire if kept in open. Therefore, to prevent accidental fires and accidents, sodium is stored immersed in kerosene oil.

Q2. Write equations for the reactions of
(i) Iron with steam
(ii) Calcium and Potassium with water

Ans. (i) $3Fe(s) + 4H_2O(g) \rightarrow Fe_3O_4(aq) + 4H_2(g)$
Iron Steam Iron (II, III) oxide Hydrogen

(ii) $Ca(s) + 2H_2O(\ell) \rightarrow Ca(OH)_2(aq) + H_2(g) + Heat$
Calcium Water Calcium Hydroxide Hydrogen

$2K(s) + 2H_2O(\ell) \rightarrow 2KOH(aq) + H_2(g) + Heat$
Potassium Water Potassium hydroxide Hydrogen

Q3. Samples of four metals A, B, C and D were taken and added to the following solutions one by one. The results obtained have been tabulated as follows.

Metal	$FeSO_4$	$CuSO_4$	$ZnSO_4$	$AgNO_3$
A.	N. R.	Dis.	–	–
B.	Dis.	–	N. R.	–
C.	N. R.	N. R.	N. R.	Dis
D.	N. R.	N. R.	N. R.	N. R.

Here N. R. = No reaction, Dis. = Displacement

Use the above table 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. $A + FeSO_4 \rightarrow$ No reaction, i.e., A is less reactive than iron

$A + CuSO_4 \rightarrow$ Displacement, i.e., A is more reactive than copper

$B + FeSO_4 \rightarrow$ Displacement, i.e., B is more reactive than iron

$B + ZnSO_4 \rightarrow$ No reaction, i.e., B is less reactive than zinc

$C + FeSO_4 \rightarrow$ No reaction, i.e., C is less reactive than iron

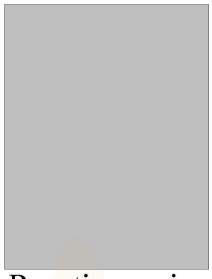
$C + CuSO_4 \rightarrow$ No reaction, i.e., C is less reactive than copper

$C + ZnSO_4 \rightarrow$ No reaction, i.e., C is less reactive than zinc

$C + AgNO_3 \rightarrow$ Displacement, i.e., C is more reactive than silver

$D + FeSO_4/CuSO_4/ZnSO_4/AgNO_3 \rightarrow$ No reaction, i.e., D is less reactive than iron, copper, zinc, and silver.

From the above equations, we obtain:



Reactive series

(i) B is the most reactive metal.

(ii) If B is added to a solution of copper (II) sulphate, then it would displace copper and blue colour of $CuSO_4$ will discharge.

B + $CuSO_4$ – Displacement

(iii) The arrangement of the metals in the order of decreasing reactivity is-

B > A > C > D

Q4. 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 evolved when dilute hydrochloric acid is added to a reactive metal.
When iron reacts with dilute H_2SO_4, iron (II) sulphate with the evolution of hydrogen gas is formed.

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

Q5. 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, if zinc is added to a solution of iron (II) sulphate, then it would displace iron from the solution and green colour of $FeSO_4$ solution will fade.

$Zn(s) + FeSO_4(aq) \rightarrow ZnSO_4(aq) + Fe(s)$

Questions and Solutions | Page No. 49 - NCERT Books

Q1. (i) Write the electron-dot structures for sodium, oxygen and magnesium.

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

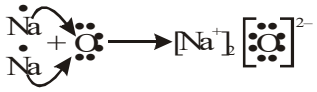
(iii) What are the ions present in these compounds?

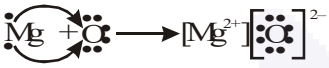
Ans. (i) The representation of elements with valence electrons as dots around the elements is referred to as electron-dot structure for elements.

(a) Sodium (2, 8, 1) = 

(b) Oxygen (2, 6) = 

(c) Magnesium (2, 8, 2) = 

(ii) 



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

Q2. Why do ionic compounds have high melting points?

Ans. Ionic compounds have strong electrostatic forces of attraction between the ions. Therefore, it requires a lot of energy to overcome these forces. That is why ionic compounds have high melting points.

Questions and Solutions | Page No. 53 - NCERT Books

Q1. Define the following terms.

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

Ans. (i) Mineral: Most of the elements occur in nature in combined state as minerals. The chemical composition of minerals is fixed.

(ii) Ore : Minerals from which metals can be extracted profitably are known as ores.

(iii) Gangue: The impurities (sand, silt, soil, gravel,etc.) present in the ore are called gangue.

Q2. Name two metals which are found in nature in the free state.

Ans. The metals at the bottom of the reactivity series are mostly found in free state. For example- gold, silver, and platinum.

Q3. What chemical process is used for obtaining a metal from its oxide ?

Ans. The chemical process used for obtaining a metal from its oxide is reduction. In this process, metal oxides are reduced by using suitable reducing agents such as carbon or by using highly reactive metals to displace the metals from their oxides.

For example, zinc oxide is reduced to metallic zinc by heating with carbon.

$ZnO(s) + C(s) \xrightarrow{\Delta} Zn(s) + CO(g)$

Manganese dioxide is reduced to manganese by treating it with aluminium powder. In this case, aluminium displaces manganese from its oxide.

$3MnO_2(g) + 4Al(s) \rightarrow 3Mn(l) + 2Al_2O_3(s) + Heat$

Oxides of highly reactive metals are reduced by electrolysis.

Questions and Solutions | Page No. 55 - NCERT Books

Q1. 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	N. R.	Dis.	N. R.

Magnesium oxide	N. R.	N. R.	N. R.
Copper oxide	Dis.	Dis.	N. R.

Here N. R. = No reaction, Dis. = Displacement

Q2. Which metals do not corrode easily ?

Ans. More reactive a metal is, more likely it is to be corroded. Therefore, less reactive metals are less likely to get corroded. This is why gold plating provides high resistance to corrosion.

Q3. What are alloys ?

Ans. Alloys are homogeneous mixtures of two or more elements. The elements could be two metals, or a metal and a non-metal. An alloy is formed by first melting the metal and then dissolving the other elements in it. For example, steel is an alloy of iron and carbon.

EXERCISES

Q1. 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

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.

Ans. (c) Applying a coating of zinc

(We can also apply grease and paint to prevent iron from rusting. However, in case of iron frying pan, grease and paint cannot be applied because when the pan will be heated and washed again and again, the coating of grease and paint would get destroyed.)

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

Ans. (a) The element is likely to be calcium

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.

Ans. (c)Food cans are coated with tin and not with zinc because 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.

Ans. (a)With the hammer, we can beat the sample and if it can be beaten into thin sheets (that is, it is malleable), then it is a metal otherwise a non metal. Similarly, we can use the battery, bulb, wires, and a switch to set up a circuit with the sample. If the sample conducts electricity, then it is a metal otherwise a non-metal.

(b)The above tests are useful in distinguishing between metals and non-metals as these are based on the physical properties. No chemical reactions are involved in these tests.

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

Ans. Those oxides that behave as both acidic and basic oxides are called amphoteric oxides. Examples- Aluminium oxide (Al_2O_3), Zinc oxide (ZnO)

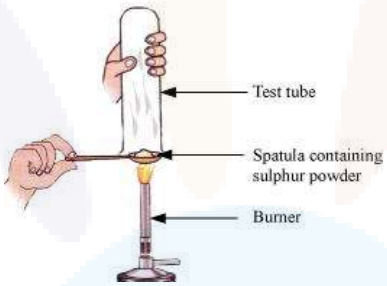
Q7. Name two metals which will displace hydrogen from dilute acids, and two metals which will not.

Ans. Metals that are more reactive than hydrogen displace it from dilute acids. For example- sodium and potassium. Metals that are less reactive than hydrogen do not displace it. For example- copper and silver.

Q8. 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-
Anode – Impure metal M
Cathode – Thin strip of pure metal M
Electrolyte – Acidified solution of salt of the metal M

Q9. 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.



Collection of gas

(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.

Ans. (a)(i) There will be no action on dry litmus paper.
(ii) Since the gas is sulphur dioxide (SO_2), it turns moist blue litmus paper to red because sulphur dioxide reacts with moisture to form sulphurous acid.

(b) $S(s) + O_2(g) \rightarrow SO_2(g)$ Sulphurdioxide

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

Ans. Two ways to prevent the rusting of iron are-
(i) Oiling, greasing, or painting- By applying oil, grease, or paint, the surface becomes water proof and the moisture and oxygen present in the air cannot come into direct contact with iron. Hence, rusting is prevented.
(ii) Galvanisation - An iron article is coated with a layer of zinc metal, which prevents the iron to come in contact with oxygen and moisture. Hence, rusting is prevented.

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

Ans. Non-metals combine with oxygen to form acidic oxides.

For example,

$S(s) + O_2(g) \rightarrow SO_2(g)$

(Acidic in nature)

Q12. Give reasons.

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

(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.

Ans. (a)Platinum, gold, and silver are used to make jewellery because they are very lustrous. Also, they are very less reactive and do not corrode easily.

(b)Sodium, potassium, and lithium are very reactive metals and react very vigorously with air as well as water. Therefore, they are kept immersed in kerosene oil in order to prevent their contact with air and moisture.

(c)Though aluminium is a highly reactive metal, it is resistant to corrosion. This is because aluminium reacts with oxygen present in air to form a thin layer of aluminium oxide. This oxide layer is very stable and prevents further reaction of aluminium with oxygen. Also, it is light in weight and a good conductor of heat. Hence, it is used to make cooking utensils.

(d)Carbonate and sulphide ores are usually converted into oxides during the process of extraction because metals can be easily extracted from their oxides rather than from their carbonates and sulphides.

Q13. 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 reacts with moist carbon dioxide in air to form copper carbonate and as a result, copper vessel loses its shiny brown surface forming a green layer of copper carbonate. The citric acid present in the lemon or tamarind neutralises the basic copper carbonate and dissolves the layer. That is why, tarnished copper vessels are cleaned with lemon or tamarind juice to give the surface of the copper vessel its characteristic lustre.\

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

Ans. **Metals**

(i) Metals are electropositive.
(ii) They react with oxygen to form basic oxides.
(iii) These have ionic bonds.
(iv) They react with water to form oxides and hydroxides. Some metals react with cold water, some with hot water, and some with steam.
(v) They react with dilute acids to form a salt and evolve hydrogen gas. However, Cu, Ag, Au, Pt, Hg do not react.
(vi) They react with the salt solution of metals. Depending on their reactivity, displacement reaction can occur.
(vii) These act as reducing agents (as they can lose electrons).

Non-metals

(i) Non-metals are electronegative.
(ii) They react with oxygen to form acidic or neutral oxides.
(iii) These have covalent bonds.
(iv) They do not react with water.
(v)They do not react with dilute acids. These are not capable of replacing hydrogen.
(vi) These react with the salt solution of non-metals.
(vii) They act as oxidizing agents (as they can easilygain electrons).

Q15. A man went door to door posing as a goldsmith. He promised to bring back the glitter of old and dull gold ornaments. A
in a particular solution. T
The lady was upset but a
detective to find out the

Ans. He must have dipped the
and conc. HNO_3. Aqua r
dipping the gold orname
shiny layer appears. That is why the weight of gold ornament reduced.