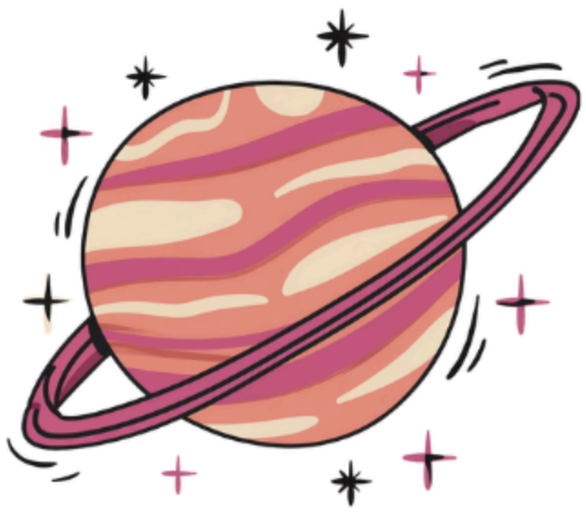


padhayi

H2O

Class - 10th

NCERT Solution

science

CLASS 10 SCIENCE CHAPTER 3 METALS AND NON-METALS NCERT : DETAILED SOLUTIONS

1. **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) Metal that is poor conductor of heat Lead
2. 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 like copper, aluminium, etc.
Ductile: Substances that can be drawn into thin wires are called ductile. For example, most of the metals are ductile like Au,Ag, etc.

3. **Why is sodium 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 the open. Therefore, to prevent accidental fires and accidents, sodium is stored immersed in kerosene oil.

4. **Write equations for the reactions of:**
(i) Iron with steam
(ii) Calcium and Potassium with water
Ans.
(i) Reaction of Iron with Steam:
The reaction between iron and steam produces iron(II,III) oxide (also known as triiron tetraoxide) and hydrogen gas. The balanced chemical equation for this reaction is: $3\ Fe(s) + 4\ H_2O(g) \rightarrow Fe_3O_4(s) + 4\ H_2(g)$
(ii) Reaction of Calcium and Potassium with Water:
Calcium with Water: Calcium reacts with water to form calcium hydroxide, hydrogen gas, and heat is also released. The balanced chemical equation is: $Ca(s) + 2\ H_2O(l) \rightarrow Ca(OH)_2(aq) + H_2(g)$ + Heat Calcium Water Calcium hydroxide Hydrogen Potassium with Water: Potassium reacts vigorously with water to form potassium hydroxide, hydrogen gas, and a significant amount of heat is released. The balanced chemical equation is: $2\ K(s) + 2\ H_2O(l) \rightarrow 2\ KOH(aq) + H_2(g)$ + Heat Potassium Water Potassium hydroxide Hydrogen.

5. **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	FeSO4	CuSO4	ZnSO4	AgNO3
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 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 + $FeSO_4$ → No reaction, i.e., A is less reactive than iron

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

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

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

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

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

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

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

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

From the above equations, we obtain:

Reactivity 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 the 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

Zn	Most reactive
B	
Fe	
A	
Cu	
C	
Ag	
D	Least
∇	Reactive

6. **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.

7. **When iron reacts with dilute H_2SO_4, iron (II) sulphate with the evolution of hydrogen gas is formed.**

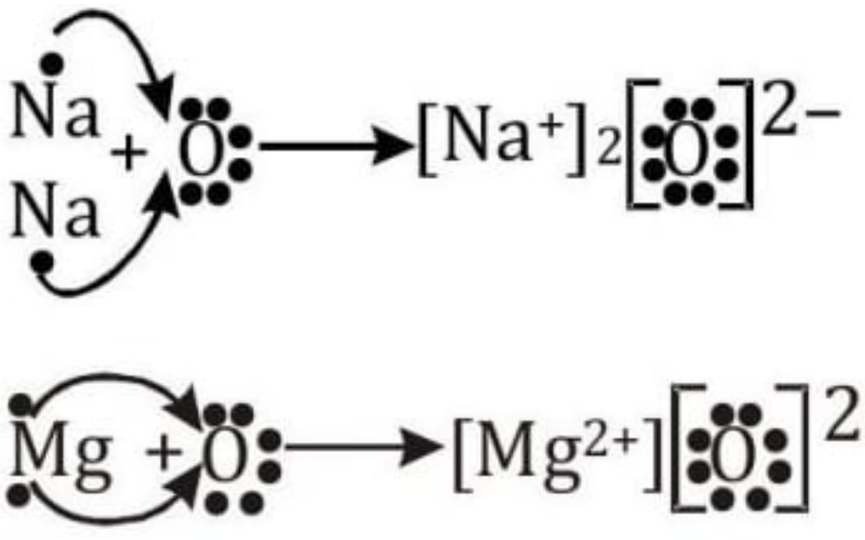
$Fe(s) + H_2SO_4(aq) \rightarrow FeSO_4(aq) + H_2(g)$

8. **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 the green colour of $FeSO_4$ solution will fade.
$Zn(s) + FeSO_4(aq) \rightarrow ZnSO_4(aq) + Fe(s)$

9. **(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 the electron-dot structure for elements.
(a) Sodium (2, 8, 1) = Na•
(b) Oxygen (2, 6) = •O•
(c) Magnesium (2, 8, 2) = Mg•
(ii) [Diagram showing the formation of Na_2O and MgO by electron transfer would be inserted here in a proper document format. This would typically involve showing the transfer of valence electrons from Sodium to Oxygen and Magnesium to Oxygen, resulting in charged ions.]
(iii) The ions present in these compounds are:
In Na_2O: Sodium ions (Na^+) and Oxide ions (O^{2-})
In MgO: Magnesium ions (Mg^{2+}) and Oxide ions (O^{2-})



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

10. **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.

11. **Define the following terms.**
(i) Mineral
(ii) Ore
(iii) Gangue
Ans. (i) Mineral : The earth's crust is the major source of metals. Seawater also contains some soluble salts such as sodium chloride, magnesium chloride, etc. The elements or compounds, which occur naturally in the earth's crust, are known as minerals.
(ii) Ore : At some places, minerals contain a very high percentage of a particular metal and the metal can be profitably extracted from it. These minerals are called ores.
(iii) Gangue : The gangue particles are the unwanted materials or impurities like sulphide, oxides, silica etc. which are mixed in minerals and which are removed during extraction of pure metals.

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

Ans. Gold and Silver.

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

Ans. The reduction process is used for obtaining a metal from its oxide.

14. **Metallic oxides of zinc, magnesium and copper were heated with the following metals.**
Metal Zinc Magnesium Copper
Zinc oxide - - -
Magnesium - - oxide
Copper
oxide

15. **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

16. **Which metals do not corrode easily?**

Ans. Gold and Platinum.

17. **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.

18. **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

19. **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) Because an iron frying pan is used for cooking food, applying a coating of zinc is the best suitable method.

19. **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.

20. **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.

21. **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.
What are amphoteric oxides? Give two examples of amphoteric oxides.
Ans. Those oxides which show both acidic and basic nature are called amphoteric oxides. For example, Aluminium oxide ($Al2O_3$), Zinc oxide (ZnO).

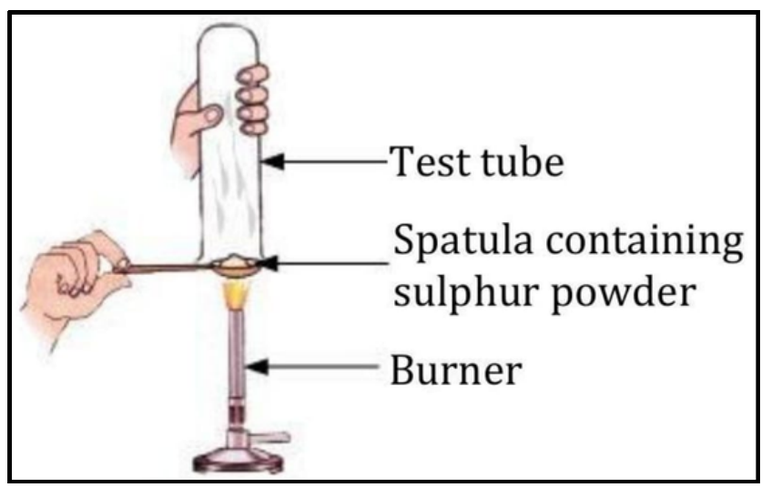
22. **Name two metals which will displace hydrogen from dilute acids, and two metals which will not.**

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.

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

Ans. Anode: impure metal of M
Cathode: pure metal of M
Electrolyte: solution of compound of metal M

24. **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) $S(s)+O_2(g) \rightarrow SO_2(g)$

Sulphur	Oxygen	Sulphur dioxide
$SO_2(g)+$	$H_2O(\ell)$	$\rightarrow H_2SO_3(aq)$
Sulphur	Water	Sulphurous
dioxide		acid

25. **State two ways to prevent the rusting of iron.**

Ans. Galvanisation is a method of protecting steel and iron from rusting by coating them with a thin layer of zinc. The galvanised article is protected against rusting even if the zinc coating is broken. Alloying is a very good method of improving the properties of a metal. We can get the desired properties by this method.
For example, iron is the most widely used metal. But it is never used in its pure state. This is because pure iron is very soft and stretches easily when hot. But, if it is mixed with a small amount of carbon (about 0.05%), it becomes hard and strong.

26. **What type of oxides is formed when nonmetals 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)
$2SO_2(g) + O_2(g) + 2H_2O(l) \rightarrow 2H_2SO_4(aq)$

27. **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.

ans. (a) Platinum, gold and silver are used to make jewellery because these are less reactive and not affected by air, water or chemicals. These are very malleable, ductile and lustrous also.
(b) Sodium, potassium and lithium are stored under oil because these are highly reactive metals. On exposure to air they catch fire, in order to prevent fire these metals are stored in oil.
(c) Aluminium is a highly reactive metal, yet it is used to make utensils for cooking because aluminium is a light metal and can be mould into different shapes also it can prevent its surface from other chemicals to form aluminium oxide layer.

(d) Carbonate and sulphide ores are usually converted into oxides during the process of extraction because it is easier to obtain metals directly from their oxides than from their carbonates and sulphide ores.

28. **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. Tarnished copper vessels are cleaned with lemon or tamarind juice because acids can dissolve basic coating of copper oxides or copper carbonate present on the surface of tarnished copper vessels. This makes them shiny red brown again.

29. **Differentiate between metal and nonmetal 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 and Hg do not react.
(vi)They react with the salt solution of other metals. Depending on their reactivity, displacement reactions 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 displacing hydrogen.
(vi) These react with the salt solution of other non-metals.
(vii) They act as oxidizing agents (as they can easily gain electrons).

30. **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. He must have dipped the gold metal in the solution of aqua regia - a 3:1 mixture of conc. HCl and conc. HNO3. Aqua regia is a fuming, highly corrosive liquid. It dissolves gold in it. After dipping the gold ornaments in aqua regia, the outer layer of gold gets dissolved and the inner shiny layer appears. That is why the weight of gold ornaments is reduced.

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

Ans. Copper does not react with cold water, hot water or steam. However, iron reacts with steam. If the hot water tanks are made of steel (an alloy of iron), then iron would react vigorously with the steam formed from hot water.

$3Fe + 4H_2O \rightarrow Fe_3O_4 + 4H_2$

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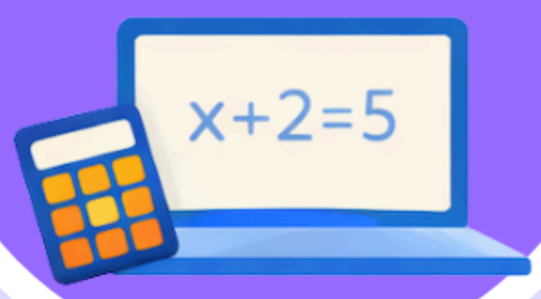

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