

NCERT QUESTIONS WITH 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 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.

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

Ans. (i) $3\text{Fe(s)} + 4\text{H}_2\text{O(g)} \rightarrow \text{Fe}_3\text{O}_4\text{(s)} + 4\text{H}_2\text{(g)}$
 Iron Steam
 Iron (II, III) oxide Hydrogen
 (ii) $\text{Ca(s)} + 2\text{H}_2\text{O(l)} \rightarrow \text{Ca(OH)}_2\text{(aq)} + \text{H}_2\text{(g)} + \text{Heat}$
 Calcium Water
 Calcium hydroxide Hydrogen
 (iii) $2\text{K(s)} + 2\text{H}_2\text{O(l)} \rightarrow 2\text{KOH(aq)} + \text{H}_2\text{(g)} + \text{Heat}$
 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	FeSO ₄	CuSO ₄	ZnSO ₄	AgNO ₃
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 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. $A + \text{FeSO}_4 \rightarrow$ No reaction, i.e., A is less reactive than iron

$A + \text{CuSO}_4 \rightarrow$ Displacement, i.e., A is more reactive than copper

$B + \text{FeSO}_4 \rightarrow$ Displacement, i.e., B is more reactive than iron

$B + \text{ZnSO}_4 \rightarrow$ No reaction, i.e., B is less reactive than zinc

$C + \text{FeSO}_4 \rightarrow$ No reaction, i.e., C is less reactive than iron

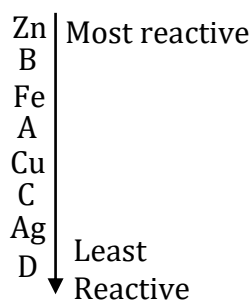
$C + \text{CuSO}_4 \rightarrow$ No reaction, i.e., C is less reactive than copper

$C + \text{ZnSO}_4 \rightarrow$ No reaction, i.e., C is less reactive than zinc

$C + \text{AgNO}_3 \rightarrow$ Displacement, i.e., C is more reactive than silver

$D + \text{FeSO}_4/\text{CuSO}_4/\text{ZnSO}_4/\text{AgNO}_3 \rightarrow$ 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 blue colour of CuSO_4 will discharge.

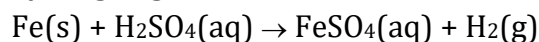
$B + \text{CuSO}_4 \rightarrow$ Displacement

(iii) The arrangement of the metals in the order of decreasing reactivity is-
 $B > A > C > D$

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 .

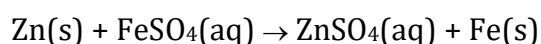
Ans. Hydrogen gas is evolved when dilute hydrochloric acid is added to a reactive metal.

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



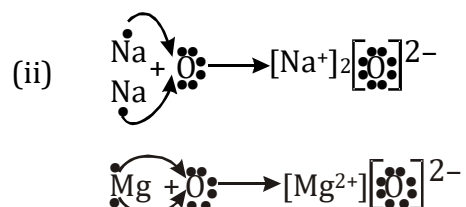
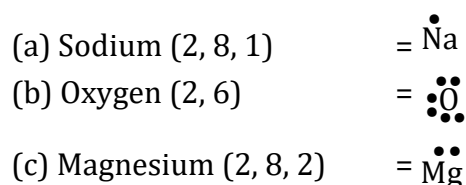
7. What would you observe when zinc is added to a solution of iron (II) sulphate? Write the chemical reaction that takes place.

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.



8. (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.



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

9. 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.

10. 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.

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

Ans. Gold and Silver.

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

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

13. 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

14. Which metals do not corrode easily?

Ans. Gold and Platinum.

15. 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.

16. 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 metal.

Ans. (d) AgNO₃ solution and copper metal

17. 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 iron frying pan is used for cooking food, so applying a coating of zinc is best suitable method.

18. 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.

19. 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.

20. 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.

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

Ans. Those oxides which shows both acidic and basic nature are called amphoteric oxides.

For example, Aluminium oxide (Al_2O_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.

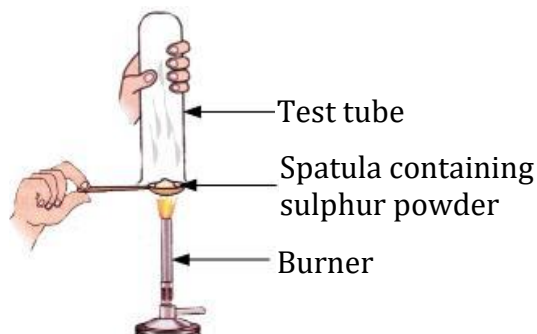
23. In the electrolytic refining of a metal M, what would you take as the anode, the cathode and the electrolyte?

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.

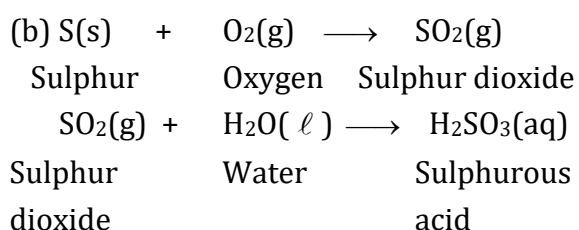


Collection of gas

- (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.



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.

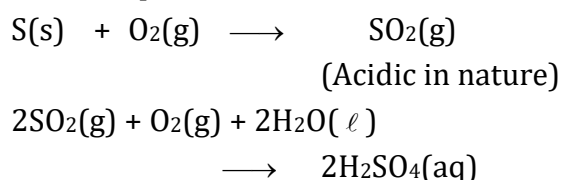
We can get the desired properties by this method.

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 non-metals combine with oxygen?

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

For example,



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 moulded 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 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 bond.

(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 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 bond.

(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.

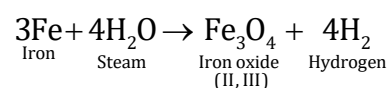
(vii) They act as oxidizing agents (as they can easily gain electrons).

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 ornament 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.



EXERCISE-01**Multiple choice questions**

1. Which is the poorest conductor of heat?
(1) Gold (2) Platinum
(3) Silver (4) Lead
2. The most malleable metal is
(1) sodium (2) mercury
(3) gold (4) lead
3. Which metal is used for making foils used in packing of food materials?
(1) Copper (2) Platinum
(3) Aluminium (4) Sodium
4. Which of the following property is generally not shown by metals?
(1) Electrical conduction
(2) Sonorous in nature
(3) Dullness
(4) Ductility
5. The ability of metals to be drawn into thin wire is known as
(1) ductility (2) malleability
(3) sonority (4) conductivity
6. Generally, metals are solid in nature. Which one of the following metals is found in liquid state at room temperature?
(1) Na (2) Fe (3) Cr (4) Hg
7. An element A is soft and can be cut with a knife. It is very reactive with air and cannot be kept open in air. It reacts vigorously with water. Identify the element from the following.
(1) Mg (2) Na (3) P (4) Ca
8. The sodium metal is stored in
(1) benzene (2) alcohol
(3) kerosene (4) toluene
9. Which non-metal is a liquid at room temperature?
(1) Oxygen (2) Fluorine
(3) Sulphur (4) Bromine
10. Which non-metal is a good conductor of electricity?
(1) Phosphorus (2) Fluorine
(3) Graphite (4) Bromine
11. Generally, non-metals are not lustrous. Which of the following non-metal is lustrous?
(1) Sulphur (2) Oxygen
(3) Nitrogen (4) Iodine
12. Although metals form basic oxides, which of the following metals form an amphoteric oxide?
(1) Na (2) Ca (3) Al (4) Cu
13. Which of the following metal react vigorously with oxygen?
(1) Zinc (2) Magnesium
(3) Sodium (4) Copper
14. Which among the following statements is incorrect for magnesium metal?
(1) It burns in oxygen with a dazzling white flame.
(2) It reacts with cold water to form magnesium oxide and evolves hydrogen gas.
(3) It reacts with hot water to form magnesium hydroxide and evolves hydrogen gas.
(4) It reacts with steam to form magnesium oxide and evolves hydrogen gas.

- | | |
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| <p>15. Which metal does not react with water?
 (1) Cu (2) Au
 (3) Both (1) and (2) (4) Fe</p> <p>16. When alkali metals react with water, they give
 (1) $\text{MOH} + \text{O}_2$ (2) $\text{MOH} + \text{H}_2\text{O}$
 (3) $\text{MOH} + \text{H}_2$ (4) $\text{MH} + \text{H}_2$</p> <p>17. Which one of the following metals do not react with cold as well as hot water?
 (1) Na (2) Ca (3) Mg (4) Fe</p> <p>18. What happens when calcium is treated with water?
 (i) It does not react with water.
 (ii) It reacts violently with water.
 (iii) It reacts less violently with water.
 (iv) Bubbles of hydrogen gas formed stick to the surface of calcium.
 (1) (i) and (iv) (2) (ii) and (iii)
 (3) (i) and (ii) (4) (iii) and (iv)</p> <p>19. Which of the following metals is less reactive than hydrogen?
 (1) Cu (2) Ba (3) Mg (4) Pb</p> <p>20. Metals above hydrogen in activity series
 (1) react with acids to liberate hydrogen ions
 (2) react with acids to liberate hydrogen gas
 (3) react with water at ordinary temperature
 (4) None of these</p> <p>21. Which one of the following four metals would be displaced from the solution of its salts by other three metals?
 (1) Mg (2) Ag (3) Zn (4) Cu</p> <p>22. Which of the following can undergo a chemical reaction?
 (1) $\text{MgSO}_4 + \text{Fe}$ (2) $\text{ZnSO}_4 + \text{Fe}$
 (3) $\text{MgSO}_4 + \text{Pb}$ (4) $\text{CuSO}_4 + \text{Fe}$</p> | <p>23. Which one of the following properties is not generally exhibited by ionic compounds?
 (1) Solubility in water.
 (2) Electrical conductivity in solid state.
 (3) High melting and boiling points.
 (4) Electrical conductivity in molten state.</p> <p>24. Cinnabar is an ore of
 (1) mercury (2) copper
 (3) calcium (4) lead</p> <p>25. Which of the following statements is correct?
 (1) All minerals are ores.
 (2) All ores are minerals.
 (3) Some ores are minerals.
 (4) None is correct</p> <p>26. Which of the following metals exist in their native state in nature?
 (i) Fe (ii) Au (iii) Zn (iv) Ag
 (1) (i) and (ii)
 (2) (ii) and (iii)
 (3) (ii) and (iv)
 (4) (iii) and (iv)</p> <p>27. Which metal is used in thermite process?
 (1) C (2) Co
 (3) Al (4) Both (1) and (2)</p> <p>28. The most abundant metal in the Earth crust is
 (1) Al (2) Fe (3) O (4) Cu</p> <p>29. Silver articles become black on prolonged exposure to air. This is due to the formation of
 (1) Ag_3N (2) Ag_2O
 (3) Ag_2S (4) Ag_2S and Ag_3N</p> <p>30. Galvanisation is a method of protecting iron from rusting by coating with a thin layer of
 (1) gallium (2) aluminium
 (3) zinc (4) silver</p> |
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31. Amalgam is the homogeneous mixture of
 (1) metal and metal
 (2) metal and mercury
 (3) metal and non-metal
 (4) all of these
32. Which of the following is a ferrous alloy?
 (1) Solder (2) Brass
 (3) Magnesium (4) Steel
33. Stainless steel is very useful material for our life. In stainless steel, iron is mixed with
 (1) Ni and Cr (2) Cu and Cr
 (3) Ni and Cu (4) Cu and Au
34. An alloy is
 (1) an element
 (2) a compound
 (3) a homogeneous mixture
 (4) a heterogeneous mixture
35. Which among the following alloys contain mercury as one of its constituents?
 (1) Stainless steel (2) Alnico
 (3) Solder (4) Zinc amalgam

Fill in the blanks

- _____ is the best conductor of electricity
- Out of Al, Zn and Ag, only _____ cannot displace hydrogen from dil. HCl.
- The minerals from which metals can be extracted economically are called _____.
- The processes involved in the production of a metal from the ore are collectively known as _____.
- Cinnabar is an ore of _____.
- _____ is the most abundant metal in the earth's crust.
- The reactive metals occur in nature in the _____ state.
- Process of heating sulphide ore with oxygen is called _____.
- Process of heating carbonate ore without oxygen is called _____.
- Solder is an alloy of _____ and _____.

True or False

- Mercury is a liquid non-metal.
- Silver metal acts as non-conductor of electric current.
- Iron can liberate H_2 from dil. H_2SO_4 but copper cannot liberate H_2 from dil. H_2SO_4 .
- Sodium is less reactive than copper.
- Oxygen is the most abundant metal in the earth's crust.
- The reactive metals do not occur in nature in the free state.
- In electrorefining of copper, impure copper is made anode.
- Thermite process is used for joining railway tracks.
- Electroplating of zinc is known as galvanisation.
- Brass is an alloy of copper and tin.

Match the column

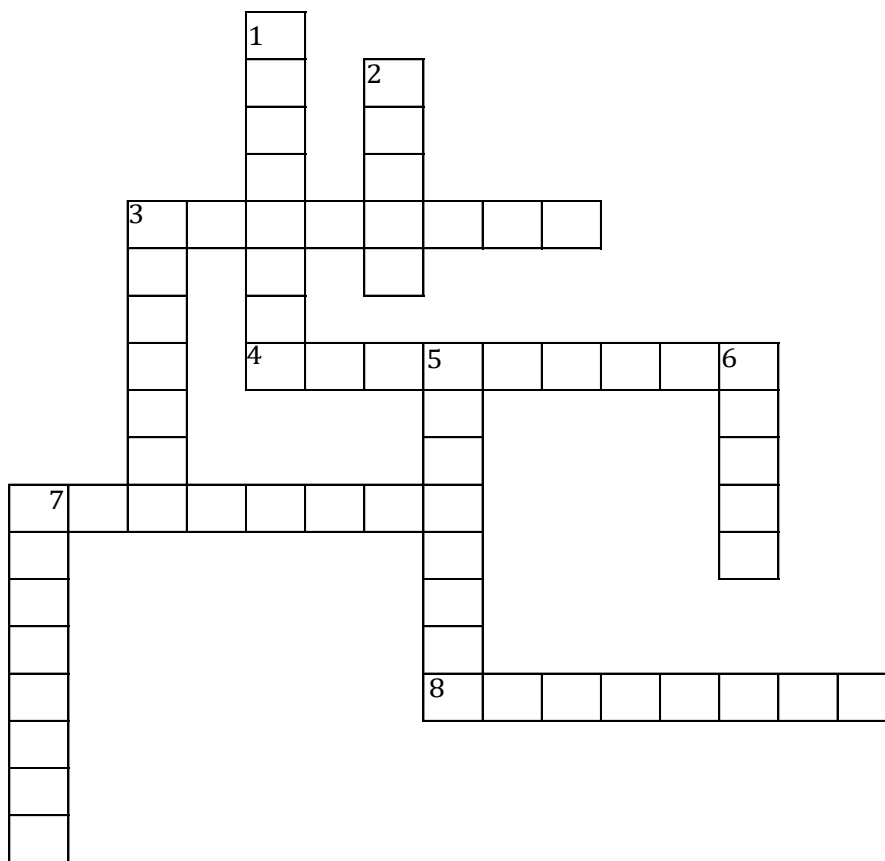
1.

Column-I		Column-II	
(A)	Liquid metal	(i)	Silver
(B)	Best conductor of heat	(ii)	Sodium
(C)	Poorest conductor of heat	(iii)	Lead
(D)	Metal can be cut with knife	(iv)	Mercury

2.

Column-I		Column-II	
(A)	Most reactive	(i)	Copper
(B)	Least reactive	(ii)	Potassium
(C)	Metal less reactive than hydrogen	(iii)	Bromine
(D)	Non-metal	(iv)	Gold

Crossword puzzle



Complete the puzzle using the clues about the words.

Across

3. It is also known as a rogue element.
4. It burns with a dazzling white flame in air.
7. They show electronegative nature.
8. Property by virtue of which metals produce sound when struck.

Down

1. An element with atomic number 21.
2. An element preceded by atomic number 4 and followed by atomic number 6.
3. Non-metals with 7 electrons in valence shell.
5. These show zero valency.
6. They show electropositive nature.
7. A gas used to flush packets of chips.

Use appropriate words on physical properties of metals to complete this passage.

1. _____ is the metal used to make drinks cans.
2. The metal that is needed for healthy bones and teeth is _____.
3. The metal that is used in thermometers is _____.
4. _____ is the metal used for electrical wiring.
5. The metal used to produce nuclear power and is radioactive is _____.
6. A shiny unreactive metal used to make jewellery is _____.
7. _____ is stored in kerosene oil due to reactive nature.
8. Metal can be squashed into any shape, this is called _____.

Formulae of ionic compounds

Use the cross - over method (where needed) to properly combine the positive and negative ions in the table below.

	Negative ion				
Positive ion	Br ⁻	OH ⁻	NO ₃ ⁻	O ²⁻	SO ₄ ²⁻
H ⁺					
Li ⁺					
NH ₄ ⁺					
Pb ²⁺					
Al ³⁺					

ANSWER KEY

Multiple choice questions

Question	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Answer	4	3	3	3	1	4	2	3	4	3	4	3	3	2	3
Question	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Answer	3	4	4	1	2	2	4	2	1	2	3	3	1	3	3
Question	31	32	33	34	35										
Answer	2	4	1	3	4										

Fill in the blanks

1. Silver 2. Ag 3. ores 4. metallurgy 5. Mercury
 6. Aluminium 7. combined 8. Roasting 9. Calcination 10. Lead, Tin

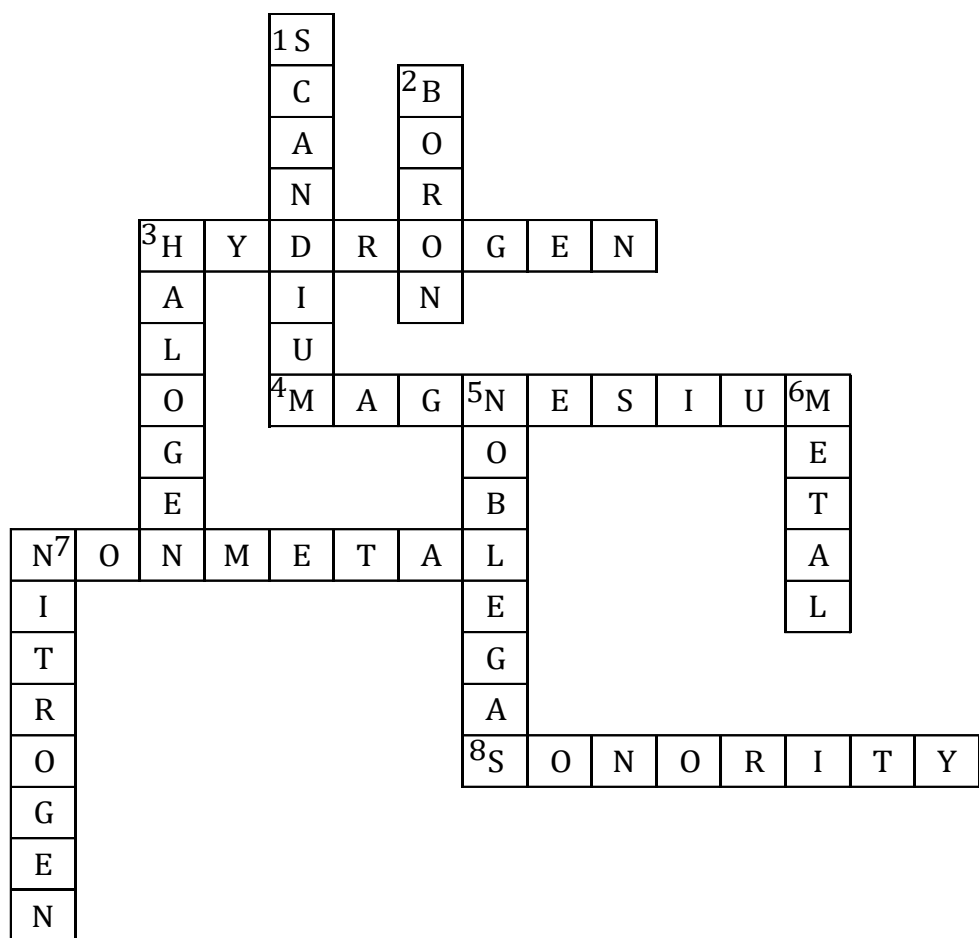
True or False

1. False 2. False 3. True 4. False 5. False
 6. True 7. True 8. True 9. True 10. False

Match the column

1. (A) – (iv), (B) – (i), (C) – (iii), (D) – (ii)
 2. (A) – (ii), (B) – (iv), (C) – (i), (D) – (iii)

Crossword puzzle



Use appropriate words on physical properties of metals to complete this passage.

1. Aluminium 2. Calcium 3. Mercury 4. Copper 5. Uranium
 6. Gold 7. Potassium 8. Malleability

Formulae of ionic compounds

	Negative ion				
Positive ion	Br ⁻	OH ⁻	NO ₃ ⁻	O ²⁻	SO ₄ ²⁻
H ⁺	HBr	HOH (H ₂ O)	HNO ₃	H ₂ O	H ₂ SO ₄
Li ⁺	LiBr	LiOH	LiNO ₃	Li ₂ O	Li ₂ SO ₄
NH ₄ ⁺	NH ₄ Br	NH ₄ OH	NH ₄ NO ₃	(NH ₄) ₂ O	(NH ₄) ₂ SO ₄
Pb ²⁺	Pb(Br) ₂	Pb(OH) ₂	Pb(NO ₃) ₂	PbO	PbSO ₄
Al ³⁺	Al(Br) ₃	Al(OH) ₃	Al(NO ₃) ₃	Al ₂ O ₃	Al ₂ (SO ₄) ₃

EXERCISE-02**Very short answer type questions**

1. Name one non-metal and one metal which are liquid at room temperature.
2. Name a metal that offers higher resistance to the passage of electricity than copper.
3. Name two metals both of which are very ductile as well as very malleable.
4. From the following metals sodium, calcium, aluminium, copper and magnesium, name the metal
 - (i) which reacts with water only on boiling and
 - (ii) another which does not react even with steam.
5. Which one of the following is –
Au, Na, Cu, Ca
 - (a) the most reactive metal,
 - (b) the least reactive metal?
6. Which property of graphite is utilised in making electrodes?
7. What is the nature of metal oxides?
8. What happens when calcium is treated with water?
9. What is thermite reaction?
10. What is corrosion?
11. What would happen to copper vessel if it is left for a few days in humid atmosphere without being cleaned?

12. Why do shopkeepers apply oil on tools made of iron while storing them?

OR

Why do we apply oil on iron tools kept in storage?

13. What is galvanization?
14. What is the name of alloy of mercury?
15. Which element is alloyed with copper to make bronze?

Short answer type questions

1. Give two examples each of the metals that are good conductors and poor conductors of heat respectively.
2. An element reacts with oxygen to form an oxide which dissolves in dilute hydrochloric acid. The oxide also turns a solution of red litmus blue. Is the element a metal or a non-metal? Explain with the help of a suitable example.
3. Name three non-metallic oxides which are acidic in nature.
4. A metal A, which is used in thermite process, when heated with oxygen gives an oxide B, which is amphoteric in nature. Identify A and B. Write down the reactions of oxide B with dilute HCl and dilute NaOH.
5. Give the formulae of the stable binary compounds that would be formed by the combination of following pairs of elements.

(a) Mg and N ₂	(b) Li and O ₂
(c) Al and Cl ₂	(d) K and O ₂

- | | |
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| <p>6. Sodium and potassium are stored under kerosene oil, why?</p> <p>7. What is activity series of metals? Arrange the following metals in the increasing order of their reactivity:
Aluminium, Zinc, Mercury.</p> <p>8. Choose the metal (from the list given below) which can displace zinc from zinc sulphate solution.
Lead, Copper, Magnesium, Silver. Write the equation of the chemical reaction involved.</p> <p>9. Sodium hydroxide should not be stored in aluminium containers. Why?</p> <p>10. A solution of CuSO_4 was kept in an iron pot. After few days the iron pot was found to have a number of holes in it. Explain the reason in terms of reactivity. Write the equation of the reaction involved.</p> <p>11. (i) Write the electron dot structure for sodium, oxygen, magnesium and chlorine.
(ii) Show the formation of potassium chloride (KCl) and magnesium chloride (MgCl_2) by the transfer of electrons. Name the ions present in these compounds.</p> <p>12. Explain why sodium is not found in the native state.</p> <p>13. "All ores are minerals but all minerals are not ores". Justify the statement with examples.</p> <p>14. A metal that exists as a liquid at room temperature is obtained by heating its sulphide ore in the presence of air. Identify the metal and its ore and give the reaction involved.</p> | <p>15. What happens when
(a) ZnCO_3 is heated in the absence of oxygen?
(b) a mixture of Cu_2O and Cu_2S is heated?</p> <p>16. Give the reaction involved during extraction of zinc from its ore by
(a) roasting of zinc ore
(b) calcination of zinc ore</p> <p>17. During extraction of metals, electrolytic refining is used to obtain pure metals. (a) Which material will be used as anode and cathode for refining of silver metal by this process? (b) Suggest a suitable electrolyte also. (c) In this electrolytic cell, where do we get pure silver after passing electric current?</p> <p>18. State two ways to prevent the rusting of iron.</p> <p>19. What do you mean by corrosion of metals?</p> <p>20. What are the constituents of solder alloy? Which property of solder makes it suitable for welding electrical wires?</p> <p>Long answer type questions</p> <p>1. Of the three metals X, Y and Z, X reacts with cold water, Y with hot water and Z with steam only. Identify X, Y and Z and also arrange them in order of increasing reactivity.</p> <p>2. An element A burns with golden yellow flame in air. It reacts with another element B, having atomic number 17 to give a product C. An aqueous solution of product C on electrolysis gives a compound D and liberates hydrogen. Identify A, B, C and D. Also write down the equations for the reactions involved.</p> |
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- | | |
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| <p>3. Explain physical properties of ionic compounds.</p> <p>4. Give reason</p> <p>(i) Ionic compounds have high melting points.</p> <p>(ii) Electric wires are covered with rubber like material.</p> <p>5. (a) Name the main ore of mercury. How is mercury obtained from its ore? Give balanced chemical equations.</p> <p>(b) What is thermite reaction? How is it used to join the railway tracks or cracked machine parts?</p> <p>(c) Name the method used to extract metals of high reactivity.</p> <p>6. (i) How is copper obtained from its ore (sulphide ore)? Write balanced chemical equations.</p> <p>(ii) How is impure copper purified by electrolytic refining? Draw a labelled diagram to illustrate it.</p> | <p>7. Give the steps involved in the extraction of metals of low and medium reactivity from their respective sulphide ores.</p> <p>8. (i) Given below are the steps for extraction of copper from its ore. Write the reaction involved.</p> <p>(a) Roasting of copper (I) sulphide</p> <p>(b) Reduction of copper (I) oxide with copper (I) sulphide.</p> <p>(c) Electrolytic refining of impure copper</p> <p>(ii) Draw a neat and well labelled diagram for electrolytic refining of copper.</p> <p>9. What do you meant by corrosion? Explain its preventive methods.</p> <p>10. Name a metal/non-metal:</p> <p>(a) Which makes iron hard and strong?</p> <p>(b) Which is alloyed with any other metal to make an amalgam?</p> <p>(c) Which is used to galvanise iron articles?</p> <p>(d) Whose articles when exposed to air form a black coating?</p> |
|---|--|

Exercise-01 Solutions

Multiple choice questions

1. **Option (4)**
Lead is the poorest conductor of heat.
2. **Option (3)**
Gold has strong metallic bond that's why it is most malleable.
3. **Option (3)**
It is malleable in nature so makes very thin sheets. It is used for packing food materials.
4. **Option (3)**
Metals are lustrous in nature.
5. **Option (1)**
The ability of metals to be drawn into thin wire is known as ductility.
6. **Option (4)**
Mercury is the only common metal which is liquid at ordinary temperatures.
7. **Option (2)**
Sodium is very soft metal and can be cut with a knife. It reacts vigorously with water, because it is highly reactive.
8. **Option (3)**
Sodium metal is stored in kerosene.
9. **Option (4)**
Bromine is a liquid non-metal.
10. **Option (3)**
Graphite (carbon) is a good conductor of electricity.
11. **Option (4)**
Iodine, is a lustrous non- metal.
12. **Option (3)**
Aluminium oxide reacts with acids as well as base.
13. **Option (3)**
Sodium is highly reactive and comes above zinc, magnesium and copper in activity series.
14. **Option (2)**
Magnesium reacts with hot boiling water to form Mg(OH)_2 and hydrogen gas. It does not react with cold water.
15. **Option (3)**
Copper and Gold comes below hydrogen in the activity series so not able to displace hydrogen from water.
16. **Option (3)**
 MOH and hydrogen forms.
17. **Option (4)**
Iron reacts only with steam.
18. **Option (4)**
Calcium reacts fairly vigorously with cold water is an exothermic reaction. Bubbles of hydrogen gas are given off, and a white precipitate (of calcium hydroxide) is formed, together with an alkaline solution (of calcium hydroxide - which is slightly soluble).
19. **Option (1)**
Copper comes below hydrogen in activity series.
20. **Option (2)**
Metals above hydrogen in the activity series are more reactive than hydrogen, so they liberate hydrogen gas from dilute acids.

21. Option (2) Silver is least reactive from the given elements. 22. Option (4) Iron is more reactive than copper so it will displace copper from its salt. 23. Option (2) When solid, the strong electrostatic forces keep the ions immobile. Since there are no mobile charged particles, electrical conduction is not possible. When molten, sufficient energy is provided and taken in by the ions to overcome the electrostatic forces. The crystal lattice breaks apart, the ions are free to move and thus conduct current. 24. Option (1) Cinnabar (HgS) is ore of mercury. 25. Option (2) Minerals are those substance that occur naturally in the earth's crust whereas those minerals which have high percentage of a particular metal and from which metal can be extracted profitably are called ores. 26. Option (3) Gold and silver are noble metals. They don't react with air and water so they occur in native state in nature. 27. Option (3) Reduction of metal oxides with aluminium powder in which a huge amount of heat is liberated is called thermite process.	28. Option (1) The most abundant metal on earth is aluminium. Aluminium is the third most abundant element in the Earth's crust. 29. Option (3) Due to reaction with sulphur in the air to form Ag_2S. 30. Option (3) Zinc is used in galvanisation method to protect the iron from rusting. 31. Option (2) Alloy of mercury with one or more metals is known as amalgam. 32. Option (4) Steels are alloys of iron and carbon, widely used in construction and other applications because of their high tensile strengths and low costs. 33. Option (1) Stainless steel is an alloy of iron with nickel and chromium. 34. Option (3) An alloy is made by combining two or more metallic elements, especially to give greater strength or resistance to corrosion. 35. Option (4) In amalgam one constituent will be mercury. True or False 1. False Mercury is metal which is in liquid state. 2. False Silver is a good conductor of electricity.
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3. True

Copper comes under hydrogen in the activity series

4. False

Sodium is more reactive than copper and sodium comes above copper in the activity series.

5. False

Oxygen is a non metal most abundant metal in the earth's crust is aluminium.

6. True

Reactive metals react with the oxygen and moisture present in the air and forms respective oxides and hydroxides.

7. True

In electrorefining process of copper impure copper is made anode and pure copper is made cathode.

8. True

Thermite process is used for joining railway tracks.

9. True

Electroplating of zinc is known as galvanisation.

10. False

Brass is an alloy of Copper and Zinc.

Exercise-02 Solutions

Very short answer type questions

1. Metal → Mercury,
Non metal → Bromine.
2. Tungsten, Aluminium etc. metals offer higher resistance to the passage of electricity.
3. Gold and silver are very ductile as well as malleable.
4. (i) Magnesium (ii) Copper
5. (a) Na (b) Au.
6. Graphite conducts electricity.
7. Metal oxides are generally basic in nature.
8. Calcium reacts less violently with water to produces hydrogen gas along with lime water.
9. Reaction between Aluminium powder and Fe_2O_3 is known as thermite reaction.
$$2\text{Al} + \text{Fe}_2\text{O}_3 \rightarrow \text{Al}_2\text{O}_3 + 2\text{Fe}$$
10. Corrosion is natural process that converts a metal into its chemically stable oxide, hydroxide or sulphide.
11. Copper reacts with CO_2 in the air and slowly loses its shiny brown surface and acquires a green coating of basic copper carbonate in moist air.
12. To protect the surface of iron against moisture and chemicals etc. Also oiling prevents the surface from getting scratched.
13. Galvanisation is the process of applying a protective zinc coating to iron article to prevent rusting.
14. Amalgam is an alloy of mercury.
15. Tin.

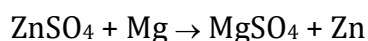
Short answer type questions

1. Good conductors of heat- silver and copper.
Bad conductors of heat- lead and mercury.
2. The element is metal because it is reacting with oxygen to form a basic oxide.
e.g $4\text{Na} + \text{O}_2 \rightarrow 2\text{Na}_2\text{O}$
 $\text{Na}_2\text{O} + \text{H}_2\text{O} \rightarrow 2\text{NaOH}$
 $\text{NaOH} + \text{HCl} \rightarrow \text{NaCl} + \text{H}_2\text{O}$
3. Carbon dioxide (CO_2), sulphur dioxide (SO_2), nitrogen oxide (NO_2)
4. A= Aluminium
B= Al_2O_3
 $\text{Al}_2\text{O}_3 + 6\text{HCl} \rightarrow 2\text{AlCl}_3 + 3\text{H}_2\text{O}$
 $\text{Al}_2\text{O}_3 + 2\text{NaOH} \rightarrow 2\text{NaAlO}_2 + \text{H}_2\text{O}$
5. (a) Mg_3N_2 (b) Li_2O
(c) AlCl_3 (d) K_2O
6. Sodium and Potassium are very highly reactive metals. When these metals are kept open or exposed to air, they react violently with oxygen and start burning instantly. So to protect them, these metals are stored under kerosene.

7. The arrangement of metals in decreasing order of reactivity is called reactivity series or activity series of metals.

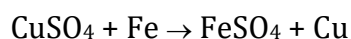
Mercury < zinc < aluminium

8. Magnesium can displace Zinc from zinc sulphate solution.



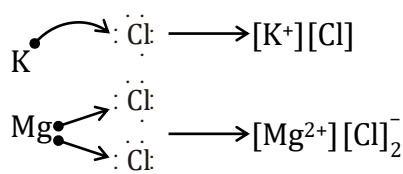
9. Sodium hydroxide reacts with aluminium, corroding the metal and producing highly flammable hydrogen gas. That's why NaOH cannot be stored in aluminium containers.

10. Iron is more reactive than copper. Hence, iron displaced copper from copper sulphate solution. This reaction resulted in formation of holes in the iron pot. The following equation shows this reaction.



11. (i) Sodium (2, 8, 1) Na Na[•]
 Oxygen (2, 6) O :Ö:
 Magnesium (2, 8, 2) Mg Mg^x
 Chlorine (2, 8, 7) Cl :Cl:

(ii)



Ions in KCl → potassium ion [K⁺] and chloride ion [Cl⁻]

Ions in MgCl₂ → Magnesium ion [Mg²⁺] and chloride ion [Cl⁻]

12. Sodium is extremely reactive. It reacts spontaneously with air, water, so it is not found in the native state.

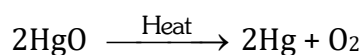
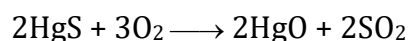
The metals at the top of reactivity series are not expected to occur in free state due to their reactive nature. They exist in combination with other elements as oxides, carbonates, halides, sulphates, sulphides, etc.

For example, Sodium, potassium, calcium, aluminium, magnesium, etc. are very reactive metals. All of these are lying at the top of activity series. These are never found in the free state.

13. Minerals are those substances that occur naturally in the earth's crust whereas those minerals which have high percentage of a particular metal and from which metal can be extracted profitably are called ores. Hence, all ores are called minerals. But, metals cannot be extracted from all minerals profitably. Only some minerals have a high concentration of the metal. Therefore all minerals are not ores. Aluminium metal is found in both minerals: clay and bauxite. Aluminium metal is extracted only from bauxite in a convenient way. So, bauxite is an ore of aluminium. On the other hand, it is not extracted from clay so clay remains only as mineral not ore of aluminium.

14. Since the given metal exists as liquid at room temperature, hence it is mercury. Cinnabar (HgS) is an ore of mercury.

The first step of extraction of mercury is heating cinnabar ore in air to get mercury oxide. After that, mercury oxide is reduced to obtain mercury. The following equations show the reactions involved.



15. (a) When zinc carbonate is heated in the absence of oxygen, zinc oxide and carbon dioxide are produced.

$$\text{ZnCO}_3 \longrightarrow \text{ZnO} + \text{CO}_2$$
 (b) When a mixture of copper oxide and copper sulphide is heated, pure copper is obtained.

$$2\text{Cu}_2\text{O} + \text{Cu}_2\text{S} \longrightarrow 6\text{Cu} + \text{SO}_2$$
16. (a) $2\text{ZnS} + 3\text{O}_2 \longrightarrow 2\text{ZnO} + 2\text{SO}_2$
 (b) $\text{ZnCO}_3 \longrightarrow \text{ZnO} + \text{CO}_2$

$$\text{ZnO} + \text{CO} \longrightarrow \text{Zn} + \text{CO}_2$$
17. (a) In electrolytic refining, impure metal is always used as anode and pure metal is used as cathode. Metals are electropositive in nature and hence they are released from anode and get deposited on cathode. Hence, impure silver will be used as anode and pure silver will be used as cathode.
 (b) Silver chloride
 (c) At cathode
18. (1) Galvanization: In this method, for preventing the rusting of iron and steel, they are coated with a thin layer of a Zinc. The galvanised iron article is protected against rusting as layer of zinc isolate the iron surface with moist air hence prevent rusting or corrosion due to oxidation.
 (2) Painting: In this method, for preventing the rusting of iron and steel, they are coated with a thin layer of paint. The painted iron article is protected against rusting as layer of paint isolate the iron surface with moist air hence prevent rusting or corrosion due to oxidation. The galvanised article is protected against rusting even if the zinc coating is broken.
19. Corrosion is the gradual destruction of materials (usually metals) by chemical reaction with their environment. In the most common use of the word, this means electrochemical oxidation of metals in reaction with an oxidant such as oxygen.
20. Solder is an alloy of lead and tin. The low melting point makes it suitable for welding electrical wires.
- Long answer type questions**
1. X is sodium, Y is magnesium and Z is iron. Order in reactivity series: $\text{Na} > \text{Mg} > \text{Fe}$
2. A is sodium (burns with golden flame), B is chlorine (atomic number 17), C is sodium chloride and D is sodium hydroxide.
 When sodium reacts with chlorine, it gives sodium chloride.

$$2\text{Na} + \text{Cl}_2 \longrightarrow 2\text{NaCl}$$
 Electrolysis of sodium chloride gives sodium hydroxide.

$$2\text{NaCl} + 2\text{H}_2\text{O} \longrightarrow 2\text{NaOH} + \text{Cl}_2 + \text{H}_2$$
3. **Physical properties of ionic compounds**
(a) Physical state
 Ionic compounds are solids and relatively hard because of the strong force of attraction between the positive and negative ions. This force of attraction is also known as strong electrostatic force of attraction. These compounds are generally brittle and break into pieces when pressure is applied.

(b) Solubility

Electrovalent compounds are generally soluble in water (because of their polar nature) and insoluble in solvents such as kerosene, petrol, etc.

(c) Melting and boiling points

Ionic compounds have high melting and boiling points, due to the strong electrostatic force of attraction between the oppositely charged ions. Therefore, large amount of energy is needed to break these bonds.

Ionic Compound	Melting Point (K)	Boiling Point (K)
NaCl	1074	1738
LiCl	878	> 1655
KBr	1007	1708
KI	953	1600
CaCl ₂	1055	1870
CaO	2845	3123
MgCl ₂	987	1685

(d) Conduction of electricity

Ionic compounds in the solid state do not conduct electricity because movement of ions in the solid state is not possible due to their rigid structure. But they can conduct electricity in molten or aqueous state.

(e) Colour to the flame

Most of the salts when brought into the flame, impart characteristic colour to the flame.

Flame colours are produced from the movement of the electrons in the metal ions present in the compounds.

Metal	Colour of flame
--------------	------------------------

Sodium	Yellow
Barium salts	Green
Potassium	Lilac/violet

4. (i) Ionic compounds have high melting and boiling points, due to the strong electrostatic force of attraction between the oppositely charged ions. Therefore, large amount of energy is needed to break these bonds.
- (ii) Rubber is an insulator and does not allow electricity to pass through it, which makes electrical wires safe to hold or carry and the involved person does not get shock if he comes into contact with the wire.
5. (a) Main ore of mercury is cinnabar(HgS). Mercury can be obtained from its ore by heating the cinnabar ore in current of air and condensing the mercury vapour formed. Due to its relatively low boiling point mercury can be easily purified by vacuum distillation. The reaction of mercury sulphide with oxygen is given below:

$$2\text{HgS} + 3\text{O}_2 \longrightarrow 2\text{HgO} + 2\text{SO}_2$$

$$2\text{HgO} \xrightarrow{\Delta} 2\text{Hg} + \text{O}_2$$
- (b) A thermite reaction is basically iron oxide (rust) reacting with aluminium to produce molten iron. The reaction is initiated by the heat from burning magnesium ribbon which is placed in the iron oxide/aluminium mixture.

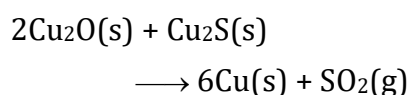
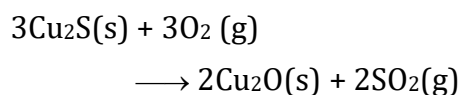
This works because the thermite mixture is aluminum powder and iron oxide (rust) powder. When the mixture is heated, it starts reacting: the aluminium is more reactive than the iron, so it "pinches" the oxygen from the iron to make aluminum oxide and iron.

A balanced equation for the reaction is

$$\text{Fe}_2\text{O}_3 + 2\text{Al} \longrightarrow \text{Al}_2\text{O}_3 + 2\text{Fe} + \text{Heat}$$

(c) Electrolysis

6. (i) Copper metal can be extracted by just heating its sulphide ore in air.

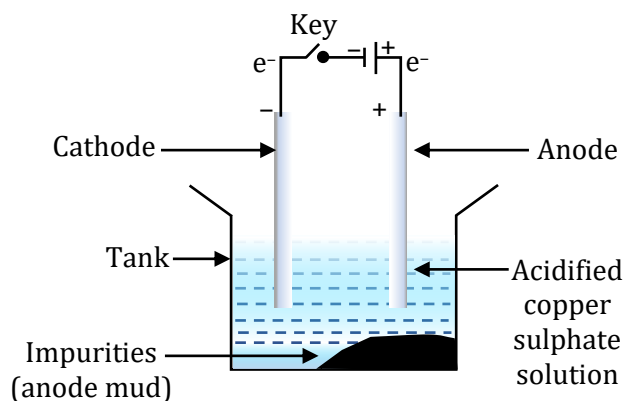


Cu_2S itself acts as reducing agent.

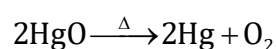
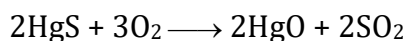
(ii) Electrolytic refining of copper

In this process, the positive electrode (the anode) is made of the impure copper which is to be purified. The negative electrode (the cathode) is a bar of pure copper. The two electrodes are placed in a solution of copper (II) sulfate.

The diagram shows what happens when electrolysis begins. Copper ions leave the anode and are attracted to the cathode, where they are deposited as copper atoms. The pure copper cathode increases greatly in size, while the anode dwindles away. The impurities left behind at the anode form a sludge beneath it.

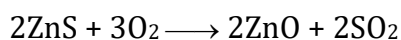


7. Extraction of Mercury: Mercury is a metal of low reactivity. Cinnabar, i.e. mercury (II) sulphide is the ore of mercury. It is heated in air so that it is oxidized to produce mercury (II) oxide. After that, mercury oxide is reduced to obtain mercury. The following reactions are involved in this process.



Extraction of metals of medium reactivity series: The metals in the middle of the reactivity series are also extracted by roasting; followed by reduction but the methods are somewhat different.

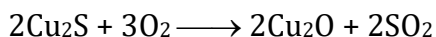
Extraction of Zinc: Zinc lies in the middle of the reactivity series. It is found in the form of zinc blende which is zinc sulphide. It is first heated in the presence of air to obtain zinc oxide. This process can be shown by following equation.



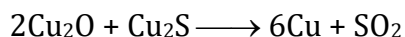
After that, zinc oxide is reduced to obtain pure zinc metal. The reduction is done in the presence of carbon. This can be shown by following equation.



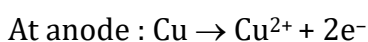
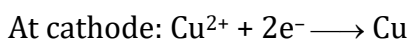
8. (i) (a) Roasting of copper (1) sulphide



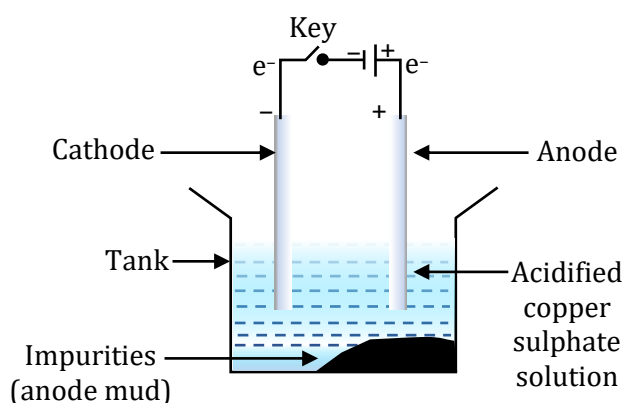
(b) Reduction of copper (1) oxide with copper (1) sulphide.



(c) Electrolytic refining



(ii)



9. The process of slowly eating up of metals due to their conversion into oxides, carbonates, sulphide, sulphates, etc. by the action of atmospheric gases and moisture is called corrosion.

In case iron is the metal involved in the chemical process, then corrosion is called **rusting**.

Prevention of corrosion

(i) By painting : The corrosion of a metal can be prevented simply by painting the metal surface by grease or varnish that forms a protective layer on the surface of the metal which protect the metal from moisture and air.

(ii) Self prevention : Some metals form protective layers.

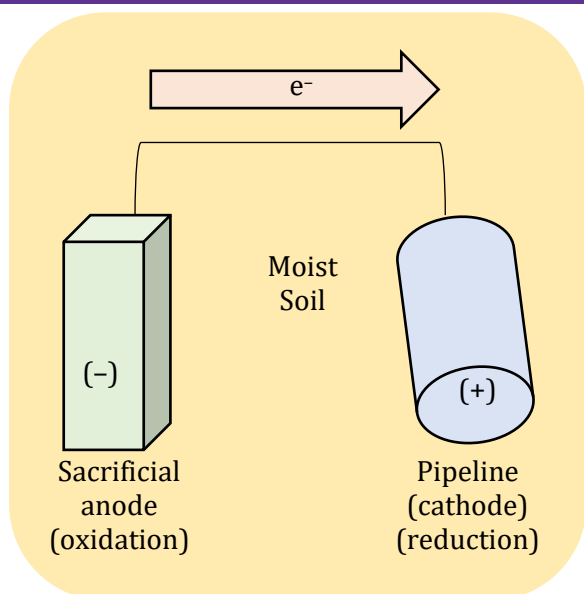
For example, When zinc is left exposed to the atmosphere, it combines with the oxygen of air to form a layer of zinc oxide over its surface. The oxides layer does not allow air to go inside the metal. Thus, zinc is protected from corrosion by its own protective layer.

Similarly, aluminium combines with oxygen to form a dull layer of aluminium oxide on its surface which protects aluminium from further corrosion.

(iii) Cathodic protection : In this method, the more reactive metal which is more corrosion-prone is connected to a bar of another metal which is less reactive and to be protected. In this process, electron flows from more reactive metal to the less reactive metal. The metal to be protected becomes the cathode and the more reactive metal becomes the anode.

In this way, the two metals form an electrochemical cell and oxidation of the metal is prevented.

For example, The pipelines (iron) under the surface of the earth are protected from corrosion by connecting them to a more reactive metal (magnesium or Zn) which is buried in the earth and connected to the pipelines by a wire.



Cathodic protection

(iv) Oiling and greasing : Both protect the surface of metal against moisture and chemicals, etc. In addition the oil and grease prevent the surface from getting scratched.

(v) Electroplating : It is a very common and effective method to check corrosion. The surface of metal is coated with chromium, nickel or aluminium, etc. by electrolysis also called **electroplating**. They are quite resistant to the attack by both air and

water and check corrosion. If the surface of metal is electroplated by zinc, it is known as **galvanisation** and in case tin metal is used, then the process is called **tinning**.

(vi) By alloying : It is a very good method of improving the properties of a metal.

An alloy is a homogeneous mixture of two or more metals or non-metal. It can be prepared by first melting the metal and then dissolving the other elements (metal or non-metal) in proper proportions. The physical properties of an alloy are different from the constituent metals (from which it is made).

10. (a) Carbon is added to make iron hard and strong .
- (b) Mercury (Hg) is alloyed with any other metal to make an amalgam.
- (c) Zinc is used to galvanise iron articles.
- (d) Silver articles when exposed to air form a black coating.