

Important Questions for Class 10

Science

Chapter 3 – Metals and Non-Metals

Very Short Answer Questions

1 Mark

1. A mineral is known as ore if metal

- (a) Cannot be produced from it**
- (b) Can be produced from it**
- (c) Can be extracted from it profitably**
- (d) Is very costly**

Ans: (c) Can be extracted from it profitably

2. The earthy impurities associated with minerals used in metallurgy are called

- (a) Slag**
- (b) Flux**
- (c) Gangue**
- (d) Ore**

Ans: (c) Gangue

3. A basic lining is given to a furnace by using

- (a) Calcined dolomite**
- (b) Copper sulphate**
- (c) Haematite**
- (d) Silica**

Ans: (a) Calcined dolomite

4. Malachite is an ore of:

- (a) Iron
- (b) Copper
- (c) Mercury
- (d) Zinc

Ans: (b) Copper

5. Metal always found in free state is:

- (a) Gold
- (b) Silver
- (c) Copper
- (d) Sodium

Ans: (a) Gold

6. A process employed for the concentration of sulphide ore is

- (a) Froth floatation
- (b) Roasting
- (c) Electrolysis
- (d) Bessemerisation

Ans: (a) Froth floatation

7. The slag obtained during the extraction of copper pyrites is composed mainly of

- (a) Cu_2S

(b) FeSiO_3

(c) CuSiO_3

(d) SiO_2

Ans: (b) FeSiO_3

8. The common method for extraction of metals from the oxide ore is

(a) Reduction with carbon

(b) Reduction with hydrogen

(c) Reduction with aluminium

(d) Electrolytic method

Ans: (a) Reduction with carbon

9. An iron nail was suspended in CuSO_4 solution and kept for a while the solution is

(a) Remained blue and coating was found on the nail.

(b) Turned green and a coating was formed on the nail

(c) Remained blue and no coating was formed on the nail

(d) Turned green and no coating was formed on the nail

Ans: (b) Turned green and a coating was formed on the nail

10. The sulphide ore among the following is

(a) Haematite

(b) Bauxite

(c) Argentite

(d) Zinc blende

Ans: (d) Zinc blende

11. Chemically rust is

- (a) Hydrated ferrous oxide**
- (b) Hydrated ferric oxide**
- (c) Only ferric oxide**
- (d) None of these**

Ans: (b) Hydrated ferric oxide

12. Heating pyrites to remove sulphur is called

- (a) Smelting**
- (b) Calcination**
- (c) Liquation**
- (d) Roasting**

Ans: (d) Roasting

13. Setting of Plaster of Paris takes place due to

- (a) Oxidation**
- (b) Reduction**
- (c) Dehydration**
- (d) Hydration**

Ans: (d) Hydration

14. Some crystals of CuSO_4 were dissolved in water. The color of the solution obtained would be

- (a) Green**

- (b) Red
- (c) Blue
- (d) Brown

Ans: (c) Blue

15. Most abundant metal on the surface of the earth

- (a) Iron
- (b) Aluminium
- (c) Calcium
- (d) Sodium

Ans: (b) Aluminium

16. Zone refining is used for the

- (a) Concentration of an ore
- (b) Reduction of metal oxide
- (c) Purification of metal
- (d) Purification of an ore

Ans: (c) Purification of metal

17. Which of the following processes is used for the concentration of Bauxite ($\text{Al}_2\text{O}_3 \cdot 2\text{H}_2\text{O}$)

- (a) Froth floatation
- (b) Leaching
- (c) Liquation
- (d) Magnetic separation

Ans: (b) Leaching

18. During smelting, an additional substance is added which combines with impurities to form a fusible product. It is known as –

- (a) Slag**
- (b) Mud**
- (c) Gangue**
- (d) Flux**

Ans: (d) Flux

19. The luster of a metal is due to

- (a) Its high density**
- (b) Its high polishing**
- (c) Its chemical inertness**
- (d) Presence of free electrons.**

Ans: (d) Presence of free electrons.

20. In the thermite process, the reducing agent is

- (a) Nickel**
- (b) Zinc**
- (c) Sodium**
- (d) Aluminium**

Ans: (d) Aluminium

21. In addition to iron, stainless steel contains:

- (a) Nickel and Chromium**
- (b) Copper and Tin**
- (c) Aluminium and Magnesium**

(d) Carbon and Magnesium

Ans: (a) Nickel and Chromium

22. The correct decreasing order of the metals in the activity series is:

(a) Ca, Mg, Ni, Fe

(b) Ni, Ca, Mg, Fe

(c) Ca, Mg, Fe, Ni

(d) Mg, Ca, Fe, Ni

Ans: (c) Ca, Mg, Fe, Ni

23. Which of the following oxides is amphoteric in nature?

(a) Na_2O

(b) MgO

(c) CaO

(d) Al_2O_3

Ans: (d) Al_2O_3

24. A student adds one big iron nail each in four test tubes containing a solution of zinc sulphate, aluminium sulphate, copper sulphate, and iron sulphate. A reddish-brown coating was observed only on the surface of the iron nail which was added in the solution of:

(a) Zinc Sulphate

(b) Iron Sulphate

(c) Copper Sulphate

(d) Aluminium Sulphate

Ans: (c) Copper Sulphate

25. An iron nail was kept in a solution kept in a test tube. After half an hour it was observed that the color of the solution was changed. The solution in the test tube was that of:

- (a) Zinc Sulphate**
- (b) Iron Sulphate**
- (c) Copper Sulphate**
- (d) Aluminium Sulphate**

Ans: (c) Copper Sulphate

26. Name two metals that are found in nature in the free state.

Ans: Gold and Platinum

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

Ans: The chemical process that is used for obtaining a metal from its oxide is called reduction. Here, the oxide of the metal will be reduced to the metal with the help of reducing agents or with substitution reactions with another highly reactive metal.

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

- (a) NaCl solution and copper metal**
- (b) MgCl_2 solution and aluminum metal**
- (c) FeSO_4 solution and silver metal**
- (d) AgNO_3 solution and copper metal**

Ans: AgNO_3 solution and copper metal

29. Which of the following method is suitable for preventing an iron fry 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

30. An element reacts with oxygen to give a compound with a high melting point. This compound is also soluble in water. The element is likely to be

- (a) Calcium
- (b) Carbon
- (c) Silicon
- (d) Iron

Ans: (a) Calcium

31. Food cans are coated with tin and not zinc because

- (a) Zinc is costlier than tin
- (b) Zinc has higher melting point
- (c) Zinc is more reactive than tin
- (d) Zinc is less reactive than tin

Ans: (c) Zinc is more reactive than tin

32. What types of oxides are formed when non-metals combine with oxygen?

Ans: When non-metals combine with oxygen they result in the formation of acidic oxides.

33. Royal water is prepared by mixing two acids 'A' and 'B'. It can dissolve gold and platinum. It is a highly corrosive and fuming liquid. Identify 'A' and 'B'. What is the ratio in which 'A' and 'B' are mixed?

Ans: Acid 'A' is Hydrochloric Acid (HCl) and acid 'B' is Nitric Acid (HNO₃). The ratio in which 'A' (HCl) and 'B' (HNO₃) are mixed is 3:1.

Short Answer Questions

2 Marks

1. Which gas is produced when a metal reacts with dilute hydrochloric acid? Write the chemical reaction when iron reacts with dilute H₂SO₄.

Ans: When a metal reacts with dilute hydrochloric acid, hydrogen gas (H₂) is produced.

The chemical reaction when iron reacts with dilute H₂SO₄ is as follows:

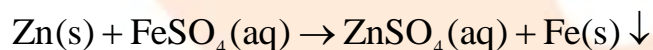


This reaction involves the formation of ferric chloride salt (FeCl₂) and the liberation of hydrogen gas (H₂).

2. What would you observe when Zinc is added to a solution of Iron (II) sulphate? Write chemical reaction that takes place.

Ans: When Zinc is added to a solution of Iron (II) sulphate, the color of the solution changes from green to colorless. This happens because, zinc being more reactive than iron, displaces iron from iron sulphate and form the colorless zinc sulphate solution, and the iron gets precipitated at the bottom, in the form of a grey-colored precipitate.

The chemical reaction when Zinc is added to a solution of Iron (II) sulphate is:



3. Why do ionic compounds have high melting points?

Ans:

- Ionic compounds have a high melting point because of the strong forces of attraction between the oppositely charged cations and anions.
- Typically, ionic compounds have an equal number of cations and anions that are tightly packed and arranged in a three-dimensional lattice to form their crystalline structures, which also attributes to their high melting points.

4. Why sodium is kept immersed in kerosene oil?

Ans: Sodium is highly reactive in nature. It reacts vigorously with both air and water and burns. So it is kept immersed in kerosene oil to avoid contact with air and water.

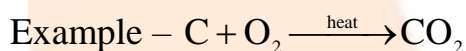
5. State two ways to prevent the rusting of iron.

Ans:

- (i) By coating the surface of iron with oil, grease, or paint
- (ii) By depositing a layer of zinc on the surface of iron, through the process of galvanization.

6. What type of oxide ore is formed when non-metals combine with oxygen?

Ans: The type of oxide formed when non-metals combine with oxygen is acidic in nature. When these oxides are dissolved in water, the resulting solution turns blue litmus red.



7. What are amphoteric oxides? Give examples?

Ans: Amphoteric oxides are oxides that behave as both acidic and basic oxides. They can neutralize both acids and bases.

They undergo neutralization reaction to form water and salt when reacting with acid and form complex salts and water when reacting with base.

Examples – Aluminium oxide (Al_2O_3) and Zinc Oxide (ZnO)

8. Name two metals that can displace hydrogen from dilute acids and two metals which cannot do so?

Ans:

- Metals that can displace hydrogen from dilute acids are Sodium and Calcium.
- Metals that cannot displace hydrogen from dilute acids are Copper and Silver.

9. Give the reason why platinum, gold, and silver are used to make jewelry.

Ans:

- Platinum, gold, and silver are used to make jewelry due to their low reactivity. These metals are placed at the bottom of the activity series and are also called noble metals.
- They do not corrode when exposed to air, water, or chemicals. Thus they do not lose their shine and have a bright luster, which makes them suitable for making jewelry.
- These metals are also highly malleable and ductile, so they can be shaped and designed as required.

10. Why copper is used to make hot water tanks and not steel?

Ans: Copper is used to make hot water tanks, rather than steel because it is a good conductor of heat than steel. Also copper does not react with cold or hot water, or even with steam, while the iron component of steel (steel is an alloy of iron), reacts with steam and forms ferrous oxide. This makes the steel tank weak. Thus copper is used to make hot water tanks and not steel.

11. Can all minerals of a metal act as ores? Justify.

Ans: Ores are minerals that have a higher concentration of certain elements, while a mineral is a naturally occurring inorganic solid with definite chemical composition and crystalline structure.

A mineral can be considered as an ore when a metal can be extracted commercially from that mineral. But not all minerals are ores, because they can contain unwanted substances as well. Thus we can say that all ores are minerals, but not all minerals are ores.

12. How does Galvanization check rusting of iron?

Ans: Galvanization is the method of coating the surface of the iron with a thin layer of zinc preventing iron from coming in contact with moisture.

In the activity series zinc lies above iron, so it acts as a sacrificial metal, i.e. it oxidizes instead of iron when exposed to the moisture, thus prevents iron from rusting.

13. Metals are arranged in the reactivity series. Why hydrogen is kept in the series though it is not a metal?

Ans: Hydrogen being a non-metal is placed in the reactivity series because its reactivity is similar to that of an electropositive element, say metals i.e. can lose electrons to form positive ions. Since hydrogen has one electron in its valence shell, it can lose its electron and become electropositive (H^+).

14. Why are metals generally lustrous?

Ans: Metals are generally lustrous because of the flow of free electrons. These electrons can move freely through the metal, which can absorb the photons from light falling on their surface. After absorption, these electrons then release the energy as light, making the metal lustrous.

Also, the free electrons can reflect the light falling on them in the form of diffuse reflection, making the metal surface appear shiny.

15. Corrosion of metals is not always harmful. Illustrate.

Ans: Corrosion of metals is a harmful process that results in the destruction of metal. But in certain cases, corrosion is actually advantageous.

Consider the case of corrosion of aluminium. When aluminium corrodes, it forms a layer of aluminium oxide (Al_2O_3) over the metal. This oxide layer deposited on its surface acts as a protective coating and prevents further corrosion of the metal from the attacks of water, air, acids, or alkalis.

16. Why does copper not liberate hydrogen on reacting with dilute sulphuric acid?

Ans: Copper does not liberate hydrogen on reacting with dilute sulphuric acid because copper lies below hydrogen in the activity series. Due to this, copper cannot displace hydrogen from the acid, i.e. it cannot lose electrons to H^+ ions and liberate hydrogen gas as other metals do.

17. Why are non-metals gaseous at room temperature?

Ans: The reason why non-metals are gaseous at room temperature is because of their mostly filled electronic structure. In their molecular form, non-metals exist as

monoatomic or diatomic molecules like $H_2, O_2, N_2, Cl_2, CO_2$, etc. Their atoms are covalently bonded in a molecule, while the intermolecular forces of attraction are weak that can be easily overcome at room temperature. Therefore, they exist as gases at room temperature.

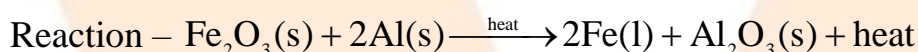
18. Both calcium and magnesium are heavier than water but still float over it. Explain.

Ans: The density of Calcium is $1.74g/cc$ and that of Magnesium is $1.55g/cc$ while the density of water is $1.0g/cc$ at room temperature. And yet, both metals float over the water surface. It is because they react with water to produce metal-hydroxide, $Ca(OH)_2, Mg(OH)_2$ respectively, and hydrogen gas (H_2). The hydrogen gas, in the form of bubbles, sticks on the metal surface and makes them float above water.

19. What is thermit reaction?

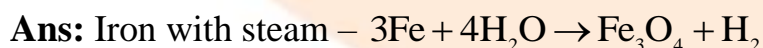
Ans: Thermit reactions are highly exothermic displacement reactions between a metal and metal oxide. The heat released in this exothermic reaction is so large, that the metal is obtained in its molten state.

The most common thermit reaction is between ferric oxide with aluminium metal, which is used to join railway tracks or cracked machine parts.

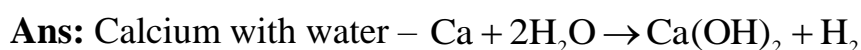


20. Write the equation for the reaction of

(i) Iron with steam



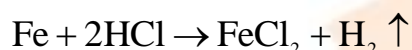
(ii) Calcium and potassium with water



21. Which gas is produced when dilute hydrochloric acid is added to reactive metal?

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

Example – Iron reacts with dilute hydrochloric acid to produce iron sulphate and hydrogen gas.



22. Which metals do not corrode easily?

Ans: Noble metals which are at the bottom of activity series like silver, gold, and platinum do not corrode easily.

23. What are alloys?

Ans: An alloy is a homogeneous mixture of two or more metals, or a metal and a nonmetal. It is prepared by first melting the primary metal, and then, dissolving the other elements in it in definite proportions. It is then cooled to room temperature.

Examples – Brass is an alloy of copper and zinc (Cu and Zn), and bronze is an alloy of copper and tin (Cu and Sn).

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

Ans:

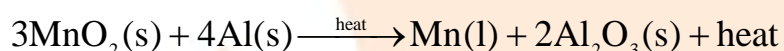
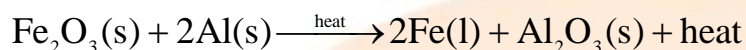
- Anode – a rod of impure metal M.
- Cathode – thin strips of pure metal M.
- Electrolyte – the salt solution of metal M.

25. A metal acts as a good reducing agent. It reduces Fe_2O_3 and MnO_2 . The reaction with Fe_2O_3 is used for welding broken railway tracks. Identify & the metal and write all the chemical reactions.

Ans: The metal that acts as a good reducing agent, reducing Fe_2O_3 and MnO_2 is Aluminum.

The thermit reaction between ferric oxide Fe_2O_3 with aluminium metal is used for welding broken railway tracks.

Reactions –

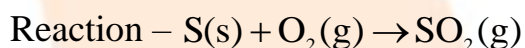


26. A yellow-colored powder 'X' is soluble in carbon disulfide. It burns with a blue flame, forming suffocating smelling gas which turns moist blue litmus red. Identify 'X' and gives a chemical reaction. Identify whether it is a metal or non-metal.

Ans: The yellow-colored powder 'X' is sulfur.

Sulfur is soluble in carbon disulfide.

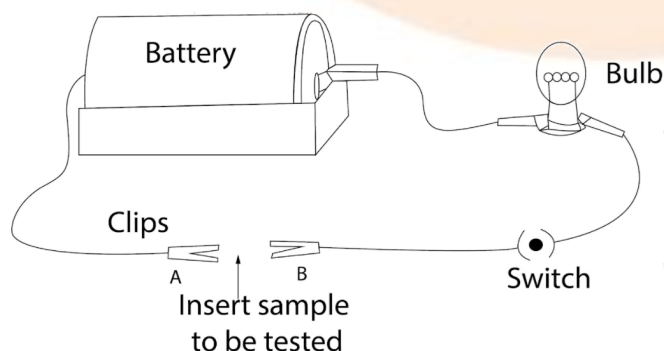
Sulfur burns in oxygen with a blue flame to form sulfur dioxide, which has a suffocating smell.



SO_2 turns moist blue litmus red, as it is acidic in nature.

Sulfur is a non-metal.

27. A student set up an electric circuit as shown in Fig. He placed the metal to be tested in the circuit between terminals A and B as shown.



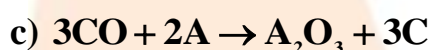
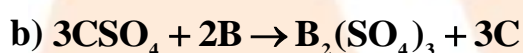
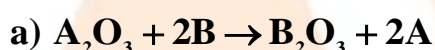
(i) Does the bulb glow? What does this indicate?

Ans: Yes, the bulb glows when a metal is placed between terminals A and B. This indicates that metal is a good conductor of electricity.

(ii) Why are electric wires coated with rubber-like materials?

Ans: Electric wires are coated with rubber-like materials because rubber is a poor conductor of electricity/ it acts as an insulator, which protects the person from getting electric shock due to current flow.

28. A, B and C are 3 elements that undergo chemical reactions according to the following equations:



Answer of the following:

(i) Which element is most reactive?

Ans: Hint – a more reactive element will replace a lesser reactive element.

From reactions (a) and (b), we can say that the most reactive element is B because it can replace both A and C from their compounds.

(ii) Which element is least reactive?

Ans: From reactions (b) and (c), we can say that element C is the least reactive as it has been replaced both by A and B.

29. An element X on reacting with O_2 forms the oxide(XO_2). This oxide dissolves in water and turns blue litmus paper red. Predict the nature of the element whether it is a metal or a non-metal.

Ans: The oxide is acidic in nature because it turns blue litmus to red.

Thus element X is a non-metal.

30. An element E combines with O_2 to form an oxide E_2O , which is a good conductor of electricity. Answer the following:

(i) How many electrons will be present in the outermost shell of E?

Ans: The number of electrons in the outermost shell of element E is 1. Here, the valency of oxygen is 2. Since the oxide formed is E_2O , it means that the valency of E is 1, i.e. E has only one electron in the valence shell.

(ii) Write the formula of the compound formed when it combines with Chlorine.

Ans: It is known that the valency of Chlorine is 1 and since the valency of E is also 1, the resultant compound is ECl .

Reaction – $E^+ + Cl^- \rightarrow ECl$

Short Answer Questions

3 Marks

1. Arrange the following metals in decreasing order of their reactivity:

(1) Cu, Ca, Mg, Na, Zn

Ans: The decreasing order of reactivity is – $Na > Ca > Mg > Zn > Cu$

(2) You are provided with three metals: sodium, magnesium, and copper. Using only water as the reactant, how will you identify each of them?

Ans: With water as the only reactant we can distinguish Sodium, Magnesium, and Copper:

- Sodium reacts vigorously with cold water and burns.
- Magnesium is not reactive with cold water, but reacts with hot water and produces hydrogen gas bubbles, and floats to the surface.
- Copper remains unaffected or unreactive with neither cold nor hot water.

(3) Which metal listed in (1) is most likely to occur in the native state?

Ans: Copper metal is the one that is most likely to occur in the native state, because it is at the bottom of the activity series, meaning it is least reactive.

2. Which method of concentration of ore is preferred in the following cases and why?

(1) The ore has higher density particles mixed with a large bulk of low-density impurities.

Ans: The concentration of ore can be done by gravity separation method or hydraulic washing, because of the difference in densities, the low-density impurities can be washed away, while the high-density ore particles would settle down.

(2) The ore consists of copper sulphide intermixed with clay particles.

Ans: The concentration of ore is done by froth floatation process because of the difference in the wetting characteristic of the metal and clay particles with oil and water.

(3) Give an example of amalgam.

Ans: An alloy, with one of the metals as mercury, is called amalgam. An example of amalgam is the mixture of mercury with silver which is used to fill dental cavities.

3.

(a) Why is ZnO called an amphoteric oxide? Name another amphoteric oxide.

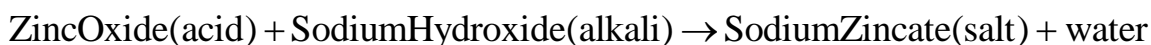
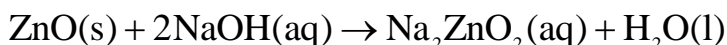
Ans: Amphoteric oxides are oxides that behave as both acidic and basic oxides. They can neutralize both acids and bases.

They undergo neutralization reaction to form water and salt when reacting with acid and form complex salts and water when reacting with base.

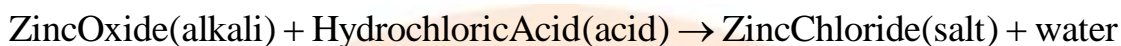
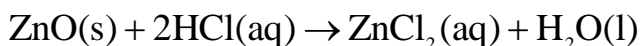
Zinc oxide (ZnO) is an amphoteric oxide because it behaves both as acidic and basic oxide.

Reaction:

As acidic oxide –



As basic oxide –



(b) What are alkalis? Give one example of alkali.

Ans: Alkalis are bases that are completely soluble in water or they are the water-soluble hydroxides of metals.

Examples – Sodium Hydroxide (NaOH)

4. 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?

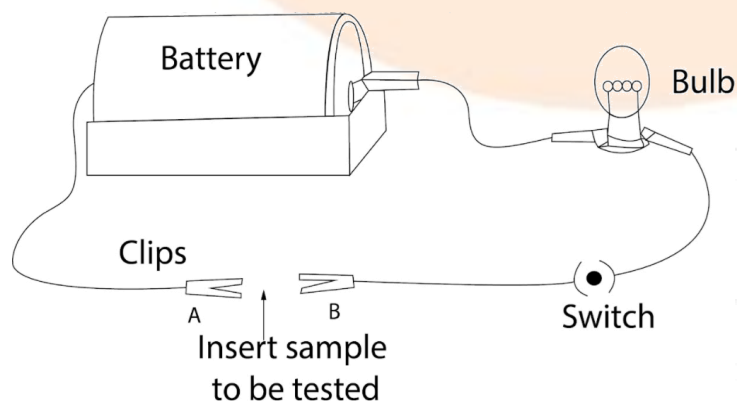
Ans: To distinguish between metals and non-metals –

- With a hammer: Checking for malleability.

By beating the sample with a hammer we can find if the sample is a metal or non-metal. Metals exhibit the property of malleability, where they can be beaten into thin sheets, while non-metals being brittle, tend to break.

- With a battery, bulb, wires, and switch: Checking for conductivity.

Set up the circuit below.



By placing the sample between terminals A and B, we can find if the sample is metal or non-metal. Metals are good conductors of electricity, while non-metals are not. So if by placing the sample between the terminals the bulb glows, it is a metal; if the bulb does not glow, then it is a non-metal.

(b) Assess the usefulness of these tests to distinguish between metals and non-metals.

Ans: These tests are useful in distinguishing between metals and non-metals:

- Beating the sample with a hammer, we can check for its malleability, i.e. checking the physical property of the sample. Metals exhibit the property of malleability, where they can be beaten into thin sheets, while non-metals being brittle, tend to break.
- Using an electric circuit we can check for the conductivity of the sample to determine whether it is a metal or a non-metal. Metals are good conductors of electricity, while non-metals are not.

5. Name an alloy of

(i) Aluminium used in the construction of aircraft.

Ans: Duralumin is a strong, hard, lightweight alloy of aluminum that is widely used in aircraft construction.

Composition of Duralumin – Al(95%),Cu(4%),Mg(0.5%),Mn(0.5%)

(ii) Lead used in joining metals for electric work.

Ans: Solder is an alloy of lead and tin that has a low melting point and is used for welding electrical wires together.

Composition of Solder – Pb(50%),Sn(50%)

(iii) Copper used in household vessels.

Ans: Brass is an alloy of copper and zinc that is used for making household vessels.

Composition of Brass – Cu(80%),Zn(20%)

6. What are the three important properties of aluminium which are responsible for its great demand in the industry?

Ans:

- a) Aluminium is a good conductor of electricity.
- b) It is not attacked by water, i.e. it is resistant to corrosion.
- c) It is a powerful reducing agent.
- d) It is malleable and ductile.

7. Which of the following metals would give hydrogen when added to dilute HCl?

(1) Iron

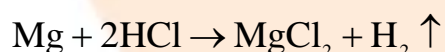
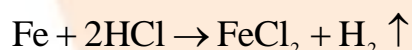
(2) Copper

(3) Magnesium

Ans:

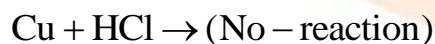
Iron and magnesium would liberate hydrogen gas on reacting with dilute HCl. These are active metals that are placed above hydrogen in the activity series.

Reaction –



Since copper is placed below hydrogen in the activity series, it has lower reactivity and will not evolve hydrogen gas when added to dilute HCl.

Reaction –



8. Define an alloy and an amalgam. State the main constituents of the following alloys – Stainless steel, Bronze. In which property, each of them is different from its main constituent?

Ans:

- An alloy is a homogeneous mixture of two or more metals, or a metal and a nonmetal. It is prepared by first melting the primary metal, and then, dissolving the other elements in it in definite proportions. It is then cooled to room temperature.

Examples of Alloys – Brass is an alloy of copper and zinc (Cu and Zn), and bronze is an alloy of copper and tin (Cu and Sn).

- An alloy, with one of the metals as mercury, is called amalgam.

An example of amalgam is the mixture of mercury with silver which is used to fill dental cavities.

Main constituents of:

- Stainless steel – Stainless steel is an alloy of iron, chromium, carbon, and nickel. It exhibits a higher level of resistance to corrosion by rust formation than compared to its major constituent iron.
- Bronze – Bronze is an alloy of copper and tin (Cu and Sn). It has a lower electrical conductivity than its constituents and is less malleable than copper.

9. A group of students looked at different metals and metal sulphate solutions are given in a tabular form. From the data, answer the following:

Metal	Metal sulphate solution	Colour
1. Chromium	Chromium sulphate	Green
2. Cobalt	Cobalt sulphate	Pink
3. Copper	Copper sulphate	Blue
4. Magnesium	Magnesium sulphate	Colourless

(a) Which metal reacted with all other sulphate solutions?

Ans: Magnesium (Mg) reacted with all other sulphate solutions.

(b) Which metal did not react with any other metal sulphate solution?

Ans: Copper (Cu) did not react with any other metal sulphate solution.

(c) Arrange the metals in decreasing order of reactivity.

Ans: The decreasing order of reactivity of metals is $Mg > Cr > Co > Cu$.

10. Choose the appropriate element from the following:

(1) A metal that gets covered with a protective film of its oxide (Al, Cu, Ag).

Ans: Aluminium (Al)

(2) A metal that burns in air with golden flame (Zn, K, Na).

Ans: Sodium (Na)

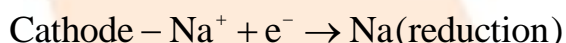
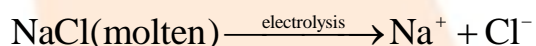
(3) A metal that can displace hydrogen from boiling water as well as steam (K, Zn, Fe).

Ans: Zinc (Zn)

11. Write one point of difference between electrolytic reduction and reduction with carbon. Give one example of each.

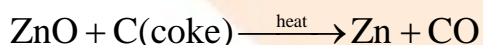
Ans: In the case of electrolytic reduction, electrolysis is used for reduction, i.e. the reduction takes place at the cathode by the gain of electrons during electrolysis.

Example –



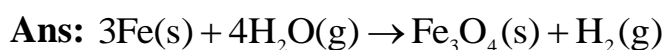
While reduction with carbon, carbon acts as the reducing agent, i.e. reduction is carried out by heating a metal oxide with coke.

Example –

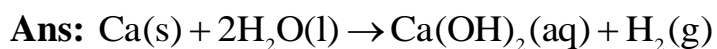


12. Write the equation for the reaction of

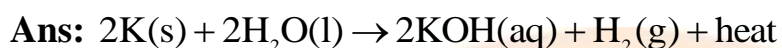
(a) Iron with steam.



(b) Calcium with water.



(c) Potassium with water.



13. Define the following terms:

(a) Minerals

Ans: Minerals – Minerals are substances that are formed naturally on Earth. They are usually solid and inorganic with a crystal structure and are formed naturally by geological processes. These are combined states of metals with other materials like soil, sand, rocks, etc.

(b) Ores

Ans: Ores – Ores are minerals that have a higher concentration of a certain element. A mineral can be considered as an ore when a metal can be extracted commercially and profitably from that mineral.

(c) Gangue

Ans: Gangue – Gangue is the earthy impurities such as mud, sand, clay, rock, or any other material that is associated with ores.

14. Pratyush took sulphur powder on a spatula and heated it. He collected the gas evolved by inverting a test tube over it. What will be the action of gas in –

(1) Dry litmus paper?

(2) Moist litmus paper?

Write a balanced chemical equation for the reaction taking place.

Ans:

Sulfur burns in oxygen with a blue flame to form sulfur dioxide SO_2 , which has a suffocating smell.

Balanced Chemical Equation – $\text{S(s)} + \text{O}_2(\text{g}) \rightarrow \text{SO}_2(\text{g})$

- (1) SO_2 with dry litmus paper – SO_2 in its gaseous state does not change the color of dry litmus.
- (2) SO_2 with moist litmus paper – SO_2 turns moist blue litmus red, as it forms sulphurous acid with water, which is acidic in nature.

Balanced Chemical Equation – $\text{SO}_2(\text{g}) + \text{H}_2\text{O}(\text{aq}) \rightarrow \text{H}_2\text{SO}_3(\text{aq})$

15. Write any three differences between metals and non-metals on the basis of chemical properties?

Ans:

Metals	Non-metals
They dissolve in mineral acids to form salt and liberate some gas.	They generally do not react with mineral acids.
They are good reducing agents.	They are good oxidizing agents.
Their oxides are basic in nature.	Their oxides are acidic in nature.
They usually form unstable hydrides.	They usually form stable hydrides.
They displace hydrogen from water (or steam).	They do not react with water (or steam).

16. Why is titanium metal called strategic metal? Mention two of its properties that make it so special.

Ans: Titanium metal is called strategic metal because it is used in the production of spacecraft, aircraft and missiles, and other war equipment.

Properties that make titanium special are:

- (i) It is light in weight but at the same time stronger than the other metals.
- (ii) It is not affected by corrosion even after being exposed to the atmosphere for a long duration.

17.

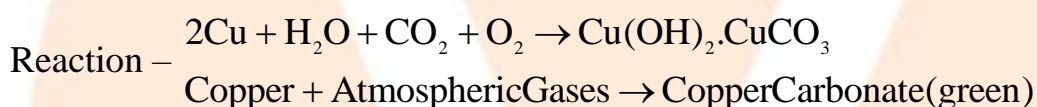
(a) What is corrosion?

Ans: Corrosion is the process that causes damage to the metal, due to the eating up of the surface of the metal when kept exposed to air and moisture for a long time. It is a natural process that results in the transformation of pure metals into undesirable substances when they react with air and water.

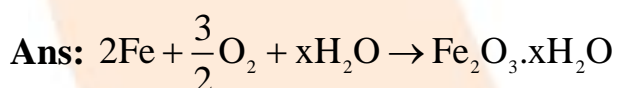
(b) How is corrosion caused?

Ans: Corrosion is mainly caused by a chemical or electrochemical reaction of the metal with its environment that results in its gradual destruction. It converts the metal into a more chemically stable oxide or hydroxide or sulphide.

Example – Copper metal reacts with moist carbon dioxide in the air and results in the formation of a green coat of copper carbonate over the metal surface.



(c) Complete the reaction – $2\text{Fe} + \frac{3}{2}\text{O}_2 + x\text{H}_2\text{O} \rightarrow$



Here, $\text{Fe}_2\text{O}_3 \cdot x\text{H}_2\text{O}$ is hydrated ferric oxide, i.e. rust.

18.

(1) Choose metal from the reactivity series which will not react with steam.

Ans: Gold (Au)

(2) Choose one metal that will safely react with dilute sulphuric acid.

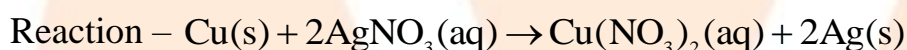
Ans: Zinc (Zn)

(3) Name the salt formed when metal chosen in (2) reacts with sulphuric acid.

Ans: The salt formed is zinc sulphate ZnSO_4 and it is colorless.

19. A copper plate was dipped into a solution of AgNO_3 . After some time a black layer was deposited on the copper plate. State the reason for it. Write the chemical equation for the reaction involved.

Ans: When a copper plate is dipped in a solution of silver nitrate AgNO_3 , a black layer of silver will be deposited over the copper plate. This is because copper is above silver in the activity series, meaning copper is more reactive than silver. Thus, a displacement reaction occurs between copper (more reactive) and silver (less reactive), that copper displaces silver from its solution AgNO_3 and forms copper nitrate $\text{Cu}(\text{NO}_3)_2$. This results in the deposition of silver over the plate that can be seen as a black layer.



20. Give an example of metal which

(i) is a liquid at room temperature.

Ans: Mercury

(ii) can be easily cut with a knife.

Ans: Sodium

(iii) is the best conductor of heat.

Ans: Silver

(iv) is a poor conductor of heat.

Ans: Lead

21. Explain the meaning of malleable and ductile.

Ans:

- Malleable – The ability of metals to be beaten into thin sheets is called malleability.

Example: Iron, Copper.

- Ductile – The ability of metals to be drawn into thin wires is called ductility.

Example: Gold, Silver.

22.

(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.

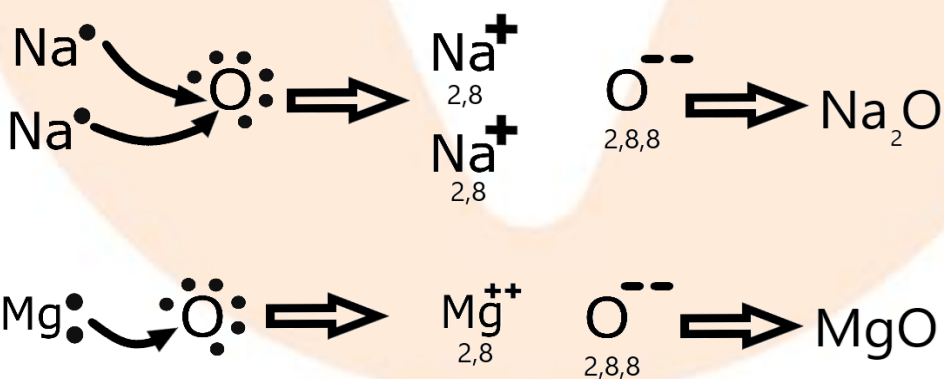
(iii) What are the ions present in these compounds?

Ans:

(i)



(ii)



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

Ions present in MgO are Mg^{2+} and O^{2-}

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

Metal	Zinc	Magnesium	Copper
Zinc oxide			
Magnesium oxide			
Copper oxide			

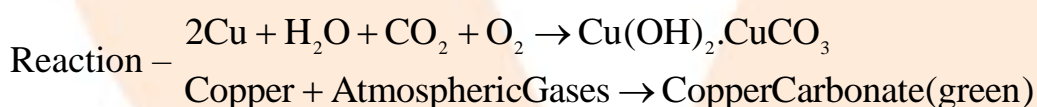
In which case will you find displacement reactions taking place?

Ans: Based on the activity series of metals, the displacement reactions will take place as below:

Metal	Zinc	Magnesium	Copper
Zinc oxide	No reaction	Displacement	No reaction
Magnesium oxide	No reaction	No reaction	No reaction
Copper oxide	Displacement	Displacement	No reaction

24. 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 metal reacts with moist carbon dioxide in the air and results in the formation of a green coat of copper carbonate over the metal surface. Thus it loses its shiny brown appearance.



To remove the green layer of copper carbonate, lemon juice or tamarind juice is used. The citric acid and/or tartaric acid present in these juices dissolves the copper carbonate and converts it into soluble copper citrate or copper tartrate, which can be easily removed from the surface and hence restoring the shiny brown appearance of copper.

25. A man went door to door posing as a goldsmith. He promised to bring back the glitter of the old and dull ornaments. An unsuspecting lady gave a set of gold bangles to him which he dipped in a particular solution. The bangles sparkled like new but their weight was reduced drastically. The lady was

upset but after a futile argument, the man beat a hasty retreat. Can you play the detective to find out the nature of the solution he had used?

Ans: The man used the Aqua-regia solution, which is a 3:1 ratio mixture of concentrated hydrochloric acid and concentrated nitric acid. This solution has the ability to dissolve gold. Thus, when the man dipped the gold bangles in this solution, it had dissolved a significant amount of gold from the bangles, which explains the drastic loss in weight of the bangles. But by dissolving the outer layer, the inner shiny layer appears that gives off the appearance that the bangles were cleaned.

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

Ans:

Metals	Non-metals
They dissolve in mineral acids to form salt and liberate some gas.	They generally do not react with mineral acids.
They are good reducing agents.	They are good oxidizing agents.
Their oxides are basic in nature.	Their oxides are acidic in nature.
They usually form unstable hydrides.	They usually form stable hydrides.
They displace hydrogen from water (or steam).	They do not react with water (or steam).

27. An element reacts with oxygen to form an oxide which dissolves in dilute hydrochloric acid. The oxide formed also turns a solution of red litmus blue. Is the element metal or non-metal? Explain with the help of a suitable example.

Ans: The element is metal because the oxides of metals are basic in nature, which can turn red litmus solution blue. Also since the oxide seems to have dissolved in dilute hydrochloric acid, this also suggests that the oxide is basic.

Since metallic oxides are typically basic in nature, we can conclude that the element is a metal.

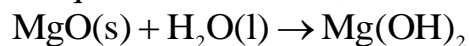
Example – Consider the metal to be Magnesium.

Reactions –

With oxygen to form an oxide: $2\text{Mg(s)} + \text{O}_2\text{(g)} \rightarrow 2\text{MgO(s)}$

Oxide dissolving in hydrochloric acid: $\text{MgO(s)} + 2\text{HCl(aq)} \rightarrow \text{MgCl}_2\text{(aq)} + \text{H}_2\text{O(l)}$

In aqueous conditions, it forms a base that turns red litmus blue:



28. Nikita took Zn, Al, Cu, Fe, Mg, and Na metals, and put each metal in cold water and then hot water. She then reacted the metal with steam.

(i) Name the metal which reacts with cold water.

Ans: Na

(ii) Which of the above metals react with steam?

Ans: Zn, Al, Fe

(iii) Name the metal which reacts with hot water

Ans: Mg

(iv) Arrange these metals in order of increasing reactivity

Ans: $\text{Na} > \text{Mg} > \text{Al} > \text{Zn} > \text{Fe} > \text{Cu}$

29. A student was given Mg, Zn, Fe, and Cu metals. He put each of them in dilute HCl contained in different test tubes. Identify which of them

(i) will not displace H_2 from dilute HCl.

Ans: Cu, because it is less reactive than hydrogen in the activity series.

(ii) forms a pale green substance.

Ans: Fe, because it forms ferrous chloride in hydrochloric acid.

(iii) will give H_2 with 5% HNO_3 .

Ans: Mg gives off hydrogen gas upon reacting with nitric acid.

(iv) will be displaced from its salt solution by all other metals.

Ans: Cu, because it has lower activity than compared to the other three metals.

30. A metal 'X' is found in the form of filings which burns vigorously when sprinkled on flame. When these filings are treated with sulphur, a black colored compound 'Y' is formed which is not attracted by a magnet. 'X' reacts with dilute HCl to liberate hydrogen gas. 'X' reacts with steam to form 'Z' along with hydrogen gas. Identify 'X', 'Y', and 'Z'. Write the reactions involved.

Ans: We can say that X is a metal that can react with steam and with hydrochloric acid to liberate hydrogen gas. Since 'X' is magnetic but its sulphide is non-magnetic, we can say that 'X' is iron and 'Y' is iron sulphide.

When iron reacts with steam it forms 'Z', which is iron (ii, iii) oxide.

Reactions –

Iron filings with sulphur: $\text{Fe} + \text{S} \rightarrow \text{FeS}$

Iron filings with hydrochloric acid: $\text{Fe} + 2\text{HCl} \rightarrow \text{FeCl}_2 + \text{H}_2$

Iron filings with steam: $3\text{Fe} + 4\text{H}_2\text{O} \rightarrow \text{Fe}_3\text{O}_4 + 4\text{H}_2$

Thus – X is Fe, Y is FeS and Z is Fe_3O_4 .

Long Answer Questions

5 Marks

1.

(a) Name a metal that does not stick to glass?

Ans: Mercury

(b) Name a non-metal which is a good conductor of electricity?

Ans: Graphite

(c) Name the metal which is commonly used in thermit welding?

Ans: Aluminum

(d) What gets deposited at the cathode, a pure or impure metal?

Ans: A pure metal is always deposited at the cathode

(e) What is the nature of Zinc oxide?

Ans: Zinc oxide (ZnO) is an amphoteric oxide.

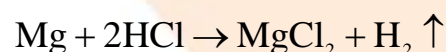
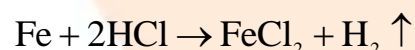
2. Name three common forms in which metals occur in nature. Explain the interaction between metals and dilute acid?

Ans: The three common forms in which metals occur in nature are:

- Sulphide form – e.g. copper pyrite (CuFeS_2)
- Oxide form – e.g. Bauxite ($\text{Al}_2\text{O}_3 \cdot 2\text{H}_2\text{O}$)
- Carbonate form – e.g. Calamine (ZnCO_3)

Active metals generally interact with dilute hydrochloric acid or dilute sulphuric acid and liberate hydrogen gas. Also, those metals that are below hydrogen in the activity series neither liberate hydrogen gas nor react with the dilute acid.

Example reactions of metals with dilute hydrochloric acid –



3. Sample pieces of five metals A, B, C, D, and E were added to the tabulated solutions separately. The results observed are shown in the table:

Metal	FeSO_4	CuSO_4	ZnSO_4	AgNO_3	$\text{Al}_2(\text{SO}_4)_3$
A	No Change	No Change	No Change	Coating On metal	No Change
B	Grey Deposit on metal	Brown coating on metal	No Change	Coating on metal	No Change
C	No Change	No Change	No	No	No Change

			Change	Change	
D	No Change	---	No Change	Coating on metal	No Change
E	---	Brown coating	New coating	New coating	No Change

Based on the observations recorded in the table, answer the following:

(1) Which is the most reactive metal?

Ans: E is the most reactive because it displaces almost all of the elements from their solutions

(2) Which is the least reactive metal?

Ans: C is the least reactive because it does not react with any of the solutions to undergo displacement.

(3) What would be observed if metal D were added to a solution of copper (II) sulphate?

Ans: It is clear that D is more reactive than silver but less reactive than iron. Thus it can displace copper from CuSO_4

(4) What would be observed if metal E were added to a solution of iron (II) sulphate?

Ans: Metal E is more reactive than zinc because it can displace zinc from its solution. Since iron is less reactive than zinc, we can conclude that E would displace iron from FeSO_4

(5) Arrange the metals A, B, C, D, and E in decreasing order to their reactivity?

Ans: The decreasing order of reactivity – $E > B > D > A > C$.

4. Hydrogen gas is evolved by reacting a piece of magnesium ribbon with water:

(1) Describe how it could be shown that the gas collected is hydrogen.

Ans: If a lighted splint is brought near the collected gas, it will burn very brightly, along with a 'pop' sound. This shows that the gas evolved by a magnesium ribbon upon its reaction with water is hydrogen.

(2) Write a chemical equation for the reaction taking place between magnesium and water using symbols.

Ans: The chemical equation for the reaction is:



(3) Suggest how the appearance of magnesium would change after a week.

Ans: After a week's time, magnesium will lose all its shine and a deposit of magnesium hydroxide will be formed on the surface of the metal.

(4) A few drops of universal indicator solution were added to water in the beaker. What colour would expect to see and what pH would this colour indicate?

Ans: The indicator will become blue, indicating that the solution is basic. The pH of the solution would be more than seven.

5. 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	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 table given above to answer the following questions about metals A, B, C, and D.

(i) Which is the most reactive metal?

Ans: B is the most reactive metal because it displaces the iron from its solution, which is the most reactive of all the elements.

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

Ans: It is clear that B is more reactive than iron, and since copper is less reactive than iron, B can displace copper from CuSO_4 .

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

Ans: The decreasing order of reactivity is $B > A > C > D$.

6. Give reasons:

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

Ans: Platinum, gold, and silver are used to make jewelry due to their low reactivity. These metals are placed at the bottom of the activity series and are also called noble metals. They do not corrode when exposed to air, water, or chemicals. Thus they do not lose their shine and have a bright luster, which makes them suitable for making jewelry. These metals are also highly malleable and ductile, so they can be shaped and designed as required.

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

Ans: Sodium, potassium, and lithium are highly reactive in nature. They can react vigorously with both air and water and burn. So they are kept immersed in oil to avoid contact with air and water.

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

Ans: Aluminium, despite being a highly reactive metal is typically used to make cooking utensils because the corrosion of aluminium has an advantage. When aluminium corrodes, it forms a layer of aluminium oxide (Al_2O_3) over the metal. This oxide layer deposited on its surface acts as a protective coating and prevents further corrosion of the metal from the attacks of water, air, acids or alkalis, or even from heat. Also, aluminium is a good conductor of heat, which helps in the cooking process. It is easily available, malleable, and ductile as well. These factors make it suitable for cooking utensils.

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

Ans: Carbonate and sulphide ores are usually converted into oxides during the process of extraction because it is easier to extract the metal from its oxide than compared to carbonates and sulphides. This is also economically feasible and profitable.

7. Four metals A, B, C, and D are, in turn, added to the following solutions one by one. The observations made are tabulated below:

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

Answer the following questions based on the above information.

(i) Which is the most active metal and why?

Ans: B is the most reactive metal because it displaces the iron from its solution, which is the most reactive of all the elements.

(ii) What would be observed if B is added to a solution of copper (II) sulphate and Why?

Ans: It is clear that B is more reactive than iron, and since copper is less reactive than iron, B can displace copper from CuSO₄.

(iii) Arrange the metals A, B, C, and D in order of increasing reactivity.

Ans: The decreasing order of reactivity is B > A > C > D.

(iv) Container of which metal can be used to store both zinc sulphate solution and silver nitrate solution.

Ans: Metal D can be used to make containers because out of all four elements, it is the least reactive. Also, it shows no displacement reactions with both zinc sulphate solution and silver nitrate solution.

(v) Which of the above solutions can be easily stored in a container made up of any of these metals?

Ans: Zinc sulphate can be easily stored in a container made up of any of these metals, because it shows no reaction with these metals.

