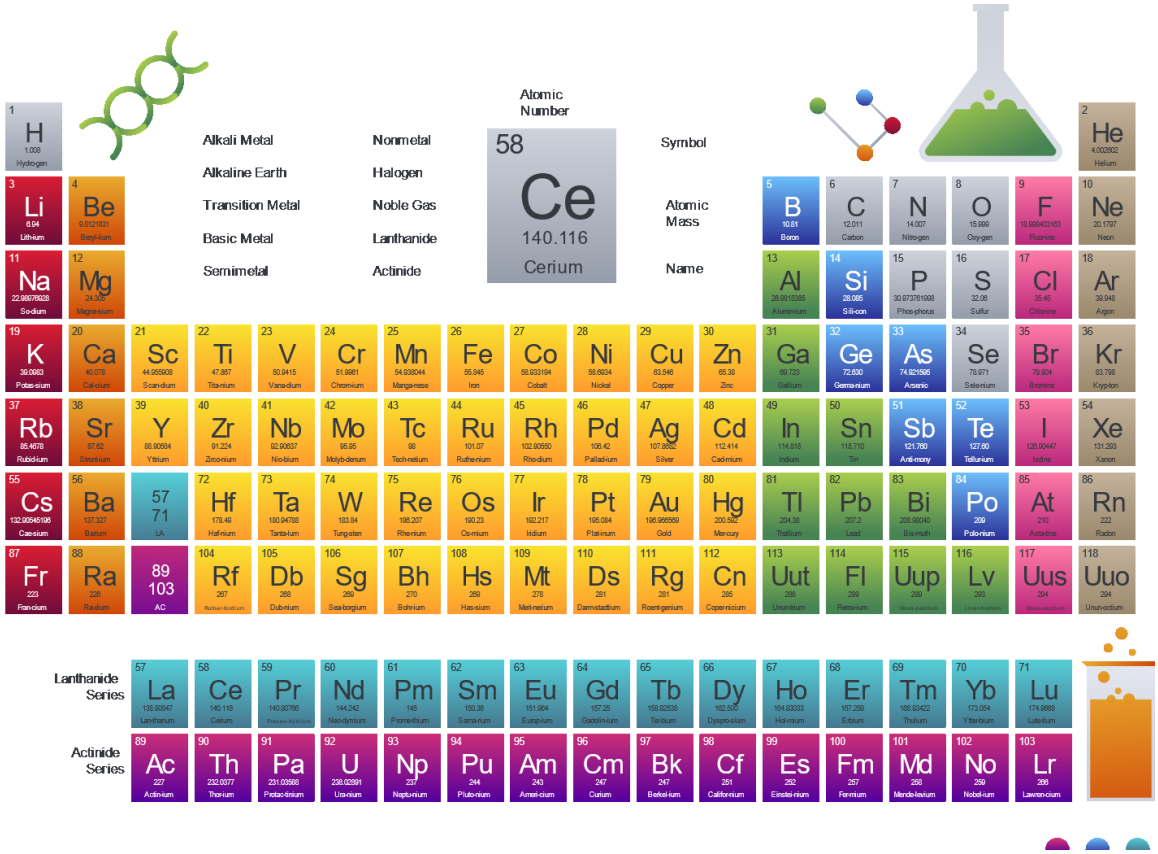
03 METALS AND NON- METALS

Periodic Table:



- Elements ordered by increasing atomic numbers.
- 118 known elements, 92 natural, 26 artificial.
- Classified into Metalloids, Metals, and Non-Metals based on properties.

Physical Properties of Metals:

- Solid at room temp, except bromine.
- Sonorous (ring when hit).
- Good heat and electricity conductors.

- Malleable and ductile.
- High melting and boiling points (except Cesium and Gallium).
- Dense (except alkali metals).
- Lustrous (reflect light).
- Silver-grey color (except gold and copper).

Physical Properties of Non-Metals:

- Exist as solids, liquids, or gases at room temp.
- Brittle, non-malleable, non-ductile, non-sonorous.
- Poor conductors of heat and electricity.
- Some exceptions like alkali metals, mercury, and iodine.

Chemical Properties of Metals:

- Alkali metals react vigorously with water and oxygen.
- Mg reacts with hot water.
- Al, Fe, and Zn react with steam.
- Cu, Ag, Pt, Au don't react with water or dilute acids.

Basic Oxides of Metals:

- Metal oxides react with water to form bases.
- Na2O and KOH examples.

Amphoteric Oxides of Metals:

- React with both acids and bases.
- Examples include Al2O3, ZnO, PbO.

Reactivity Series:

- Arrangement of metals by reactivity.
- Potassium most reactive, gold least reactive.

Roasting and Calcination:

- Processes to convert ores into oxides.
- Remove impurities.

Reaction of Metals with Water or Steam:

- Aluminum, iron, zinc react with steam.
- Lead, copper, silver, gold don't react with water.

Reaction of Metals with Acid:

Most metals react with acids, releasing hydrogen gas.

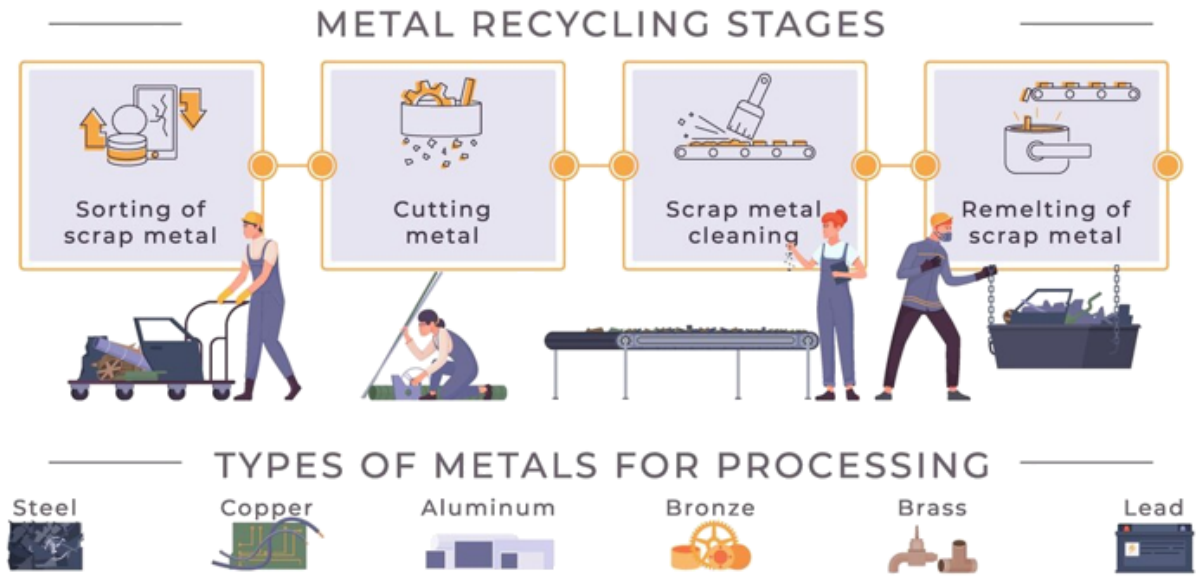
Displacement Reaction:

More reactive metal displaces less reactive metal from a compound.

Reaction of Metals with Bases:

Bases produce salts and hydrogen when reacting with metals.

Extraction of Metals:



- Mining to extract ores.
- Ores contain desired metal compound and impurities (gangue).

Enrichment of Ores:

Removal of impurities or gangue from ore.

Extraction of Metals Low in Reactivity Series:

Self-reduction process, e.g., heating sulphide ores.

Extraction of Metals in the Middle of Reactivity Series:

Processes like calcination, smelting.

Extraction of Metals Towards the top of the Reactivity Series:

Electrolytic reduction used for highly reactive metals.

Refining of Metals:

- Removal of impurities from crude metal.
- Electrolytic refining for metals like copper, zinc, etc.

Ionic Cmpounds:

- Made of cations and anions.
- High melting and boiling points.
- Conduct electricity when molten or in solution.
- Mostly soluble in water.
- Exist in regular crystal structures.

Corrosion:

- Gradual deterioration of metal due to moisture, air, or chemicals.
- Examples: rusting, corrosion of copper and silver.

Alloys:

- Homogeneous mixtures of metals or nonmetals with metals.
- Enhance properties like hardness and resistance to corrosion.

Prevention of Corrosion:

- Coating with paints, oil, or grease.
- Alloying.
- Galvanization.
- Electroplating.
- Sacrificial protection using more reactive metals.

NCERT QUESTIONS

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

(a) NaCl solution and copper metal

(b) $MgCl_2$ solution and aluminium metal

(c) $FeSO_4$ solution and silver metal

(d) $AgNO_3$ solution and copper metal

ANSWER:

Option d i.e., $AgNO_3$ solution and copper is the correct answer. Copper displaces the silver cations (reducing them to the elemental metal), in the process copper itself is being oxidised to Copper II cations (Cu^{2+}) and going into solution. So silver metal is seen precipitating out and a copper II nitrate solution will remain.

$Cu(s) + 2AgNO_3\ (aq) \rightarrow Cu(NO_3)_2\ (aq) + 2Ag\ (s)$

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

1. **Applying grease**
2. **Applying paint**
3. **Applying a coating of zinc**
4. **All of the above**

ANSWER:

Answer is (c) Applying a coat of zinc

Though applying grease and applying paint do prevent iron from rusting, we cannot apply these methods on a frying pan. Hence, applying a coat of zinc is the most appropriate method to prevent an iron pan from rusting.

Q3. An element reacts with oxygen to give a compound with a high melting point. This compound is also soluble in water. The element is likely to be

(a) Calcium

(b) Carbon

(c) Silicon

(d) Iron

ANSWER:

Correct answer is option (a) Calcium.

Calcium reacts with oxygen to give calcium oxide. Calcium oxide is soluble in water to give Calcium Hydroxide.

Carbon forms carbon-oxide with oxygen which is gas, hence option B is wrong

Silicon reacts with oxygen and forms silicon dioxide. This is insoluble in water. So option C is not correct.

Iron reacts with oxygen and forms Iron dioxide. This is insoluble in water. So option D is not correct.

Q4. Food cans are coated with tin and not with zinc because

(a) Zinc is costlier than tin.

(b) Zinc has a higher melting point than tin.

(c) Zinc is more reactive than tin.

(d) Zinc is less reactive than tin.

ANSWER:

Answer is c. Food cans are coated with tin and not with zinc because zinc is more reactive, that is electro positive than tin.

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

(a) How could you use them to distinguish between samples of metals and non-metals?

(b) Assess the usefulness of these tests in distinguishing between metals and non-metals.

ANSWER:

(a) To distinguish between samples of metals and non-metals using the given materials:

1. **Conductivity Test**: Connect the wires to the battery, bulb, and switch. Create two separate circuits, one with a metal sample and the other with a non-metal sample. If the bulb lights up when the circuit is completed with the metal sample, it indicates conductivity, which is a characteristic of metals. If the bulb doesn't light up with the non-metal sample, it suggests non-conductivity, a characteristic of non-metals.
2. **Physical Properties Test**: Use the hammer to assess the physical properties of the samples. Metals are typically malleable and ductile, so they can be flattened or drawn into wires without breaking. Non-metals, on the other hand, tend to be brittle and may shatter when hammered.

(b) The tests using the given materials are useful but have limitations:

- **Conductivity Test**: This is a reliable test as metals are generally good conductors, while non-metals are poor conductors. However, there can be exceptions and variations among different metals and non-metals.

- **Physical Properties Test**: While this test provides some information, it may not be definitive. Some metals may be less malleable or ductile than others, and some non-metals may not shatter when hammered. Therefore, additional tests or observations might be needed for a conclusive distinction.

Overall, these tests offer a simple and practical way to differentiate between metals and non-metals, but they should be used in conjunction with other information for a more accurate identification.

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

ANSWER:

Amphoteric oxides are oxides that can react with both acids and bases to form salts and water. They exhibit this dual behavior because they contain elements that can act as both acidic and basic components.

Two examples of amphoteric oxides are:

1. **Aluminum Oxide (Al2O3)**: Aluminum oxide can react with both acids and bases to form salts and water. For example, it can react with hydrochloric acid to form aluminum chloride and water, or with sodium hydroxide to form sodium aluminate and water.
2. **Zinc Oxide (ZnO)**: Zinc oxide is another example of an amphoteric oxide. It can react with both acids and bases to produce corresponding salts and water. For instance, it reacts with hydrochloric acid to form zinc chloride and water, or with sodium hydroxide to form sodium zincate and water.

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

ANSWER:

Two metals that will displace hydrogen from dilute acids are:

1. **Sodium (Na)**: Sodium is highly reactive and can displace hydrogen from dilute acids, forming sodium salts and releasing hydrogen gas.
2. **Magnesium (Mg)**: Magnesium is also reactive and can displace hydrogen from dilute acids, leading to the formation of magnesium salts and the release of hydrogen gas.

Two metals that will not displace hydrogen from dilute acids are:

1. **Copper (Cu)**: Copper is less reactive and will not displace hydrogen from dilute acids. It does not readily react with most dilute acids.
2. **Silver (Ag)**: Silver is even less reactive than copper and will not displace hydrogen from dilute acids. It remains relatively unreactive with most acids.

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

In the electrolytic refining of a metal M:

- **Anode**: The anode should be made of the impure metal M that needs to be refined. It undergoes oxidation, releasing metal ions into the electrolyte.
- **Cathode**: The cathode should be a thin strip of pure metal M. Metal ions from the anode are reduced at the cathode, leading to the deposition of pure metal on the cathode.
- **Electrolyte**: The electrolyte typically consists of a solution of a compound of metal M. This compound serves as a source of metal ions for the electroplating process and allows the transfer of metal ions from the anode to the cathode.

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

(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.

ANSWER:

a) When sulphur powder is burnt in the air sulphur-di-oxide is formed.

(i) Sulphur-di-oxide does not have any effect on dry litmus paper.

(ii) Sulphur-di-oxide turn the moist litmus paper from blue to red as contact of SO_2 with water turns to sulfurous acid.

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

$SO_2(g) + H_2O \rightarrow H_2SO_3$

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

ANSWER:

1. Iron can be prevented from rusting by coating the surface of the iron with rust proof paints
2. By applying oil/grease on the surface of iron objects as it will prevent the iron surface to get in contact with air consisting of moisture.

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

ANSWER:

When non-metals combine with oxygen they form either acidic or neutral oxides. Ex: N_2O_5 or N_2O_3 is an acidic oxide; CO is a neutral oxide.

Q12. Give reasons

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

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

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

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

ANSWER:

(a) Platinum, gold and silver are used to make jewellery as these metals are very less reactive. Hence, they are not affected by air, water or most chemicals. These metals have a lot of luster and they are malleable and ductile in nature, and also high corrosion resistance in nature.

(b) Sodium, potassium and lithium readily react with water to produce a lot of heat. As a result, hydrogen evolved in the reaction results in a fire. On exposure to water they react with moisture (water droplets) present in the atmosphere, in order to prevent contact with water. Hence, these metals are stored under oil.

(c) Aluminium forms on its surface a nonreactive surface of aluminium oxide. Such coating prevents other compounds from reacting to aluminium. So aluminium is used to produce utensils for cooking.

(d) Reducing metal oxide into free metal is easy. Additionally, because it is easier to obtain metals directly from their oxides than from their carbonates or sulphides, the carbonate and sulphide ores are first transformed to oxides to obtain the metals.

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

ANSWER: Tarnished copper vessels are cleaned with lemon or tamarind because this sour substance contains acids which dissolve the coating of copper oxide or basic copper carbonate present on the surface or tarnished copper vessels. This makes them shining red-brown again. Hence, they are very effective in cleaning tarnished copper vessels.

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

ANSWER:

Metals and non-metals can be differentiated based on their chemical properties. Here are some key differences:

1. Reaction with Oxygen:

- **Metals:** Most metals react with oxygen to form metal oxides. This reaction is often called corrosion in the case of metals like iron (formation of rust). Example: $4Fe + 3O2 \rightarrow 2Fe2O3$ (Iron reacts with oxygen to form iron oxide)
- **Non-Metals:** Non-metals generally do not react with oxygen, although some may react with other elements in the air under specific conditions.

2. Reaction with Acids:

- **Metals:** Metals typically react with acids to produce salt and hydrogen gas. This reaction is highly characteristic of metals. Example: $2HCl + Zn \rightarrow ZnCl2 + H2$ (Zinc reacts with hydrochloric acid)
- **Non-Metals:** Non-metals generally do not react with acids, except for some non-metals like hydrogen and carbon.

3. Conductivity:

- **Metals:** Metals are good conductors of heat and electricity due to the presence of free electrons in their structure.
- **Non-Metals:** Non-metals are poor conductors of heat and electricity. They lack the free electrons present in metals.

4. Ionic vs. Covalent Bond Formation:

- **Metals:** Metals tend to form ionic bonds by losing electrons and becoming positively charged cations.
- **Non-Metals:** Non-metals often form covalent bonds by sharing electrons, resulting in the formation of molecules rather than ions.

5. Physical State:

- **Metals:** Metals are typically solids at room temperature, with the exception of mercury (which is a liquid).
- **Non-Metals:** Non-metals can exist as solids, liquids, or gases at room temperature.

These differences in chemical properties are fundamental in classifying and distinguishing between metals and non-metals in chemistry.

Q15. 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?

ANSWER:
The goldsmith used a solution called Aqua regia which is referred to as royal water in Latin. It is the mixture of concentrated hydrochloric acid and concentrated nitric acid in the ratio of 3:1. Aqua regia is capable of dissolving noble metals like gold and platinum. When upper-layer of dull gold ornament is dissolved they lose their weight.

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

ANSWER:

Copper is used to make hot water tanks and not steel (an alloy of iron) because copper does not react with either water or steam, whereas iron reacts with steams to corrode the tank.

EXTRA QUESTIONS

MULTIPLE CHOICE QUESTIONS:

1. In the periodic table, elements are arranged based on their:

a) Atomic weight **b) Increasing atomic numbers**

c) Number of neutrons **d) Electronegativity**

2. How many known elements are there on the periodic table?

a) 92 **b) 118** **c) 26** **d) 64**

3. Which group of elements can be classified as Metalloids, Metals, and Non-Metals?

a) Group 1 **b) Noble gases** **c) Transition metals** **d) Alkali metals**

4. Which physical property is characteristic of metals?

a) Brittle

b) Good conductors of heat and electricity

c) Exist as gases at room temperature

d) Non-malleable

5. Which non-metal is known for being sonorous?

a) Oxygen **b) Hydrogen** **c) Carbon** **d) Bromine**

6. Which of the following is NOT a property of metals?

a) High melting and boiling points **b) Non-sonorous**

c) Dense **d) Lustrous**

7. Among the metals, which one has the highest density?

a) Gold **b) Copper** **c) Osmium** **d) Lithium**

8. Which non-metal is lustrous in certain forms like diamond and graphite?

a) Hydrogen **b) Oxygen** **c) Iodine** **d) Nitrogen**

9. Which group of elements is known for reacting vigorously with water and oxygen?

a) Noble gases **b) Alkali metals** **c) Halogens** **d) Transition metals**

10. What is the process called when metal oxides react with water to form bases?

a) Oxidation **b) Reduction** **c) Neutralization** **d) Dissociation**

11. Which metal is used for sacrificial protection due to its reactivity with air and moisture?

a) Gold **b) Silver** **c) Magnesium** **d) Aluminum**

12. What is the process of heating ore in the absence of air called?

a) Roasting **b) Calcination** **c) Smelting** **d) Electrolysis**

13. Which method is used for extracting highly reactive metals at the top of the reactivity series?

a) Roasting **b) Calcination** **c) Smelting** **d) Electrolytic reduction**

14. What is the name of the process for removing impurities or gangue from ore?

a) Enrichment of ores **b) Electroplating**

c) Calcination **d) Roasting**

15. Which type of bonding is formed in ionic compounds?

a) Covalent bonding **b) Metallic bonding**

c) Ionic bonding **d) Hydrogen bonding**

ANSWERS:

1. b) Increasing atomic numbers	2. b) 118	3. a) Group 1
4. b) Good conductors of heat and electricity	5. c) Carbon	6. b) Non-sonorous
7. c) Osmium	8. c) Iodine	9. b) Alkali metals
10. c) Neutralization	11. c) Magnesium	12. b) Calcination
13. d) Electrolytic reduction	14. a) Enrichment of ores	15. c) Ionic bonding

FILL IN THE BLANKS:

1. **In a periodic table, elements are ordered based on their increasing _____.**
2. **There are a total of _____ elements known to us.**
3. **Metals, Metalloids, and Non-Metals are the three groups based on their physical and chemical _____.**
4. **Metals are typically _____ at room temperature.**
5. **Metals produce a typical ringing sound when hit by something, which is known as being _____.**

6. **Graphite is a good conductor of _____.**
7. **Metals have the quality of reflecting light from their surface and can be polished, making them _____.**
8. **Non-metals occur as solids, liquids, and gases at _____.**
9. **Alkali metals like Na, K, Li can be cut using _____.**
10. **The process of extracting metal ores buried deep underground is called _____.**
11. **Alloys are homogeneous mixtures of a metal with other metals or _____.**
12. **Ionic compounds are made up of positively charged _____ and negatively charged _____.**
13. **When molten or in solution, ionic compounds can _____ electricity.**
14. **Corrosion is the gradual deterioration of a material, usually a _____, by the action of moisture, air, or chemicals.**
15. **_____ is a process of coating molten zinc on iron articles to prevent corrosion.**

ANSWER:

1. Atomic numbers	2. 118	3. Properties
4. Solid	5. Sonorous	6. Electricity
7. Lustrous	8. Room temperature	9. Knife
10. Mining	11. Nonmetals	12. Cations, Anions
13. Conduct	14. Metal	15. Galvanization

ASSERTION REASON QUESTIONS:

Question 1:

Assertion: Metals are good conductors of heat and electricity.

Reason: This is because they have a high density.

Options:

A. Both Assertion and Reason are true, and Reason is the correct explanation of the Assertion.

B. Both Assertion and Reason are true, but Reason is not the correct explanation of the Assertion.

C. Assertion is true, but Reason is false.

D. Assertion is false, but Reason is true.

Question 2:

Assertion: Alloys are used to enhance the desirable properties of metals.

Reason: Alloys are homogeneous mixtures of metals or nonmetals.

Options:

A. Both Assertion and Reason are true, and Reason is the correct explanation of the Assertion.

B. Both Assertion and Reason are true, but Reason is not the correct explanation of the Assertion.

C. Assertion is true, but Reason is false.

D. Assertion is false, but Reason is true.

Question 3:

Assertion: Roasting is a process that converts sulphide ores into oxides.

Reason: Roasting removes volatile impurities from ores.

Options:

A. Both Assertion and Reason are true, and Reason is the correct explanation of the Assertion.

B. Both Assertion and Reason are true, but Reason is not the correct explanation of the Assertion.

C. Assertion is true, but Reason is false.

D. Assertion is false, but Reason is true.

Question 4:

Assertion: Ionic compounds conduct electricity in the molten or aqueous state.

Reason: In the solid state, ions in ionic compounds are free to move.

Options:

A. Both Assertion and Reason are true, and Reason is the correct explanation of the Assertion.

B. Both Assertion and Reason are true, but Reason is not the correct explanation of the Assertion.

C. Assertion is true, but Reason is false.

D. Assertion is false, but Reason is true.

Question 5:

Assertion: Galvanization involves coating iron articles with molten zinc.

Reason: Zinc forms a protective layer that prevents corrosion.

Options:

A. Both Assertion and Reason are true, and Reason is the correct explanation of the Assertion.

B. Both Assertion and Reason are true, but Reason is not the correct explanation of the Assertion.

C. Assertion is true, but Reason is false.

D. Assertion is false, but Reason is true.

Question 6:

Assertion: The reactivity series arranges metals from high to low reactivity.

Reason: Gold is the most reactive metal in the reactivity series.

Options:

A. Both Assertion and Reason are true, and Reason is the correct explanation of the Assertion.

B. Both Assertion and Reason are true, but Reason is not the correct explanation of the Assertion.

C. Assertion is true, but Reason is false.

D. Assertion is false, but Reason is true.

Question 7:

Assertion: Ionic compounds have high melting and boiling points.

Reason: The strong electrostatic forces between ions require a lot of energy to break.

Options:

A. Both Assertion and Reason are true, and Reason is the correct explanation of the Assertion.

B. Both Assertion and Reason are true, but Reason is not the correct explanation of the Assertion.

C. Assertion is true, but Reason is false.

D. Assertion is false, but Reason is true.

Question 8:

Assertion: Corrosion is a process that causes metals to deteriorate gradually.

Reason: Corrosion is primarily caused by the action of heat.

Options:

A. Both Assertion and Reason are true, and Reason is the correct explanation of the Assertion.

B. Both Assertion and Reason are true, but Reason is not the correct explanation of the Assertion.

C. Assertion is true, but Reason is false.

D. Assertion is false, but Reason is true.

Question 9:

Assertion: Electrolytic refining is used to remove impurities from metals.

Reason: In this process, a thin strip of pure metal serves as the cathode.

Options:

A. Both Assertion and Reason are true, and Reason is the correct explanation of the Assertion.

B. Both Assertion and Reason are true, but Reason is not the correct explanation of the Assertion.

C. Assertion is true, but Reason is false.

D. Assertion is false, but Reason is true.

Question 10:

Assertion: Alkali metals react vigorously with water.

Reason: This is because alkali metals have low densities.

Options:

A. Both Assertion and Reason are true, and Reason is the correct explanation of the Assertion.

B. Both Assertion and Reason are true, but Reason is not the correct explanation of the Assertion.

C. Assertion is true, but Reason is false.

D. Assertion is false, but Reason is true.

ANSWERS:

Question 1: Solution: B. Both Assertion and Reason are true, but Reason is not the correct explanation of the Assertion.

Question 2: Solution: A. Both Assertion and Reason are true, and Reason is the correct explanation of the Assertion.

Question 3: Solution: A. Both Assertion and Reason are true, and Reason is the correct explanation of the Assertion.

Question 4: Solution: B. Both Assertion and Reason are true, but Reason is not the correct explanation of the Assertion.

Question 5: Solution: A. Both Assertion and Reason are true, and Reason is the correct explanation of the Assertion.

Question 6: Solution: D. Assertion is false, but Reason is true.

Question 7: Solution: A. Both Assertion and Reason are true, and Reason is the correct explanation of the Assertion.

Question 8: Solution: C. Assertion is true, but Reason is false.

Question 9: Solution: A. Both Assertion and Reason are true, and Reason is the correct explanation of the Assertion.

Question 10: Solution: D. Assertion is false, but Reason is true.

VERY SHORT ANSWER TYPE QUESTIONS:

1. **How many elements are there in the periodic table?**
2. **What are the three main groups into which elements are classified based on their properties?**
3. **Give one physical property of metals.**
4. **Name the only non-metal that is solid at room temperature.**
5. **What is the term for the typical sound produced when metals are struck?**
6. **Which non-metal is a good conductor of heat and electricity?**
7. **Name the property of metals that allows them to be beaten into thin sheets.**
8. **What is the term for the property of metals that allows them to be drawn into thin wires?**
9. **Which metal has the highest density among all metals?**
10. **Which non-metal exhibits lustrous properties in certain forms?**
11. **What is the color of most metals, except for gold and copper?**
12. **Name a metal that reacts vigorously with both water and oxygen.**
13. **Which process converts sulphide ores into oxides in the presence of excess air?**
14. **What is the term for the removal of impurities or gangue from ore?**
15. **Which process involves the heating of ore in the absence of air?**

ANSWERS:

1. 118 elements are in the periodic table.
2. The three main groups are Metalloids, Metals, and Non-Metals.
3. One physical property of metals is that they are solid at room temperature.
4. Carbon is the only non-metal that is solid at room temperature.
5. The typical sound produced when metals are struck is called "sonorous."
6. Graphite is a non-metal that is a good conductor of heat and electricity.

7. Malleability is the property of metals that allows them to be beaten into thin sheets.
8. Ductility is the property of metals that allows them to be drawn into thin wires.
9. Osmium has the highest density among all metals.
10. Carbon is a non-metal that exhibits lustrous properties in certain forms.
11. Most metals are silver-grey in color, except for gold and copper.
12. Potassium reacts vigorously with both water and oxygen.
13. Roasting converts sulphide ores into oxides in the presence of excess air.
14. Enrichment of ores involves the removal of impurities or gangue from ore.
15. Calcination is the process that involves heating ore in the absence of air.

SHORT ANSWER TYPE QUESTIONS:

1. **How are elements arranged in the periodic table?**
2. **How many known elements are there in total?**
3. **How many elements occur naturally, and how many are artificially created?**
4. **Name the three main groups into which elements are classified based on their properties.**
5. **What are the physical properties of metals?**
6. **Name one non-metal that is a liquid at room temperature.**
7. **What is the significance of the term "sonorous" in relation to metals?**
8. **Which non-metal is a good conductor of heat and electricity?**
9. **Define "malleability" and "ductility" in the context of metals.**
10. **Give an example of a metal with a low melting point.**
11. **Which metal has the highest density, and which has the least density?**
12. **Explain the term "lustrous" in the context of metals. Provide examples.**
13. **What is the general color of metals, and name two exceptions.**

14. What are the physical properties of non-metals?

15. Explain the term "brittle" as it applies to non-metals.

16. Which non-metal conducts electricity, and in what form(s)?

17. List two exceptions to the poor conductivity of non-metals.

18. What happens when alkali metals react with water?

19. Name two metals that do not react with water or dilute acids.

20. What is the reactivity series, and which metal is the most reactive in it?

ANSWERS:

1. Elements are arranged in the periodic table based on their increasing atomic numbers.
2. There are a total of 118 known elements.
3. There are 92 naturally occurring elements, and 26 elements are created artificially in the laboratory.
4. Elements can be classified into three main groups based on their properties: Metalloids, Metals, and Non-Metals.
5. The physical properties of metals include being solid at room temperature (except for mercury), sonorous, good conductors of heat and electricity, malleable, ductile, having high melting and boiling points (with exceptions), dense (except for alkali metals), lustrous, and usually silver-grey in color (except for gold and copper).
6. Bromine is a non-metal that is a liquid at room temperature.
7. "Sonorous" means that metals produce a typical ringing sound when struck.
8. Graphite is a non-metal that is a good conductor of heat and electricity.
9. Malleability refers to the ability of metals to be beaten into thin sheets, while ductility refers to their ability to be drawn into thin wires.
10. Sodium (Na) has a low melting point.
11. Osmium has the highest density among metals, while lithium has the least density.
12. "Lustrous" means that metals have the quality of reflecting light from their surface and can be polished. Examples include gold, silver, and copper. Note that carbon (a non-metal) is lustrous only in certain forms like diamond and graphite.

13. Metals usually have a silver or grey color, with exceptions like gold and copper.
14. The physical properties of non-metals include existing as solids, liquids, or gases at room temperature, brittleness, non-malleability, non-ductility, non-sonorous, and being poor conductors of heat and electricity.
15. "Brittle" means that non-metals are prone to breaking or shattering when subjected to stress.
16. Graphite is a non-metal that can conduct electricity.
17. Some exceptions to the poor conductivity of non-metals include alkali metals, mercury, and iodine.
18. Alkali metals react vigorously with water, producing hydrogen gas and metal hydroxides.
19. Lead, copper, silver, and gold do not react with water.
20. The reactivity series is an arrangement of metals in descending order of their reactivities. Potassium is the most reactive, while gold is the least reactive in the reactivity series.

LONG ANSWER TYPE QUESTIONS:

Q1. Explain the classification of elements on the periodic table based on their physical and chemical properties. Provide examples for each category.

ANSWER:

The periodic table classifies elements based on their increasing atomic numbers and arranges them into three main categories: Metalloids, Metals, and Non-Metals.

Metalloids: These elements exhibit properties of both metals and non-metals. Examples include silicon (Si), germanium (Ge), and arsenic (As).

Metals: Metals are typically hard, have high tensile strength, are good conductors of heat and electricity, and are malleable and ductile. Examples of metals are iron (Fe), copper (Cu), and gold (Au).

Non-Metals: Non-metals are generally poor conductors of heat and electricity, brittle, and lack the typical metallic properties. Examples include oxygen (O), sulfur (S), and carbon (C).

Q2. Discuss the physical properties of metals and non-metals, highlighting the exceptions. How do these properties impact their usability in various applications?

ANSWER:

Physical properties of metals include high electrical and thermal conductivity, malleability, ductility, and luster. Exceptions like mercury (a liquid metal) and iodine (a lustrous non-metal) exist but are generally consistent with these properties. These properties make metals valuable in electrical wiring, construction, and decorative applications.

Physical properties of non-metals encompass poor conductivity, brittleness, and lack of luster. Some exceptions include graphite (conducts electricity) and iodine (exhibits luster). These properties make non-metals suitable for applications such as insulators in electronics and certain chemical reactions.

Q3. Describe the chemical properties of metals, including their reactions with water, acids, and other substances. Provide examples to illustrate these reactions.

ANSWER:

Metals exhibit various chemical properties:

- Reaction with water: Most metals react with water to form metal hydroxides and release hydrogen gas. For example, sodium (Na) reacts vigorously with water to form sodium hydroxide (NaOH) and hydrogen gas (H2).
- Reaction with acids: Metals also react with acids to form salts and release hydrogen gas. For instance, when hydrochloric acid (HCl) is added to zinc (Zn), it forms zinc chloride (ZnCl2) and hydrogen gas (H2).
- Reaction with oxygen: Metals can burn in oxygen to form metal oxides. For instance, magnesium (Mg) burns in oxygen to produce magnesium oxide (MgO).
- Reaction with non-metals: Metals can react with non-metals to form ionic compounds. Sodium (Na) reacts with chlorine (Cl) to form sodium chloride (NaCl).

Q4. Explain the process of extraction of metals from their ores, differentiating between the methods used for metals low in reactivity and those at the top of the reactivity series.

ANSWER:

The extraction of metals from their ores involves various processes, which vary depending on the metal's reactivity.

Metals Low in Reactivity (e.g., Copper):

- Crushing and grinding the ore.
- Roasting or calcination to remove impurities.
- Reduction using carbon or another reducing agent.

Metals High in Reactivity (e.g., Sodium): Electrolytic reduction using electricity to separate the metal from its compounds due to their high reactivity.

Q5. Discuss the reactivity series of metals, listing the metals in descending order of reactivity. Provide real-life examples of how this reactivity series is applied in various industries.

ANSWER:

The reactivity series lists metals in descending order of reactivity from most reactive to least reactive:

1. Potassium (K)
2. Sodium (Na)
3. Calcium (Ca)
4. Magnesium (Mg)
5. Aluminum (Al)
6. Zinc (Zn)
7. Iron (Fe)
8. Copper (Cu)
9. Silver (Ag)

10. Gold (Au)

The reactivity series is essential in industries such as metallurgy for selecting suitable extraction methods, in galvanization to protect iron and steel from corrosion, and in determining the compatibility of metals in alloy formation.

Q6. Elaborate on the concept of ionic compounds, including their properties and how they form. Use examples to illustrate the behavior of ionic compounds in different states.

ANSWER:

Ionic compounds are formed when atoms transfer electrons to achieve a stable, full outer electron shell. They consist of positively charged cations and negatively charged anions. Ionic compounds have several properties:

- They are typically crystalline solids.
- They have high melting and boiling points.
- They conduct electricity in molten or aqueous form but not as solids.
- They are usually soluble in water due to their polar nature.

For example, sodium chloride (NaCl) is an ionic compound. In its solid state, it forms a crystal lattice. When dissolved in water, NaCl dissociates into sodium ions (Na+) and chloride ions (Cl-), allowing it to conduct electricity.

Q7. Corrosion is a common issue in the context of metals. Explain the process of corrosion and its prevention methods, including coating, alloying, and sacrificial protection. Provide real-world examples where these methods are applied.

ANSWER:

Corrosion is the gradual deterioration of metals due to exposure to moisture, air, or chemicals. For example, rusting is a common form of corrosion in iron and steel due to the presence of moisture and oxygen.

Prevention methods include:

- Coating: Applying paint, oil, or grease to metal surfaces to create a barrier against moisture and air. For instance, cars are coated with paint to prevent rusting.

- Alloying: Mixing metals with other elements to create alloys that are more resistant to corrosion. Stainless steel is an example, containing chromium to resist rust.
- Galvanization: Coating iron or steel with a layer of zinc to create a protective barrier. Galvanized steel is used in roofing and construction.
- Sacrificial Protection: Placing a more reactive metal (e.g., zinc) in contact with the metal to be protected (e.g., iron). The sacrificial metal corrodes instead of the protected metal. For instance, zinc-coated steel (galvanized steel) protects pipelines and boat hulls.

These methods are widely used in various industries to extend the lifespan of metal structures and equipment.

CASE BASED QUESTIONS:

Passage 1: Elements and Properties

In the world of chemistry, the periodic table stands as a remarkable organization of elements, each uniquely defined by its increasing atomic number. This table comprises a total of 118 known elements, with 92 of them occurring naturally while the remaining 26 are synthetically created in laboratories. Based on their physical and chemical attributes, these elements are categorized into three main groups: Metalloids, Metals, and Non-Metals. Metals, generally solid at room temperature, exhibit properties such as malleability, ductility, and conductivity. In contrast, Non-Metals, which can exist in various states at room temperature, tend to lack these properties and often display brittleness.

Questions for Passage 1:

1. How many elements are known to us in total, and how are they classified on the periodic table?
2. What are some typical physical properties of metals?
3. Explain why some elements are categorized as non-metals.
4. Can you provide examples of elements that are metalloids?

Passage 2: Chemical Properties of Metals

The chemical properties of metals are intriguing and diverse. For instance, alkali metals like sodium, potassium, and lithium react vigorously with water and oxygen. In contrast, metals like magnesium, aluminum, and zinc slowly form a protective layer when exposed to air, preventing corrosion. Basic oxides formed by metal oxides react with water to create bases, while amphoteric oxides like aluminum oxide can react with both acids and bases. In addition, metals

can displace each other in a solution of metal salts through displacement reactions, which play a vital role in various applications, including metal extraction and manufacturing processes.

Questions for Passage 2:

1. Describe the reactivity of alkali metals with water and oxygen.
2. How do metals like magnesium and aluminum protect themselves from corrosion?
3. What are basic oxides, and how do they react with water?
4. How can displacement reactions involving metals be applied in practical processes?

Passage 3: Corrosion and Alloys

One of the challenges faced by metals is corrosion, a gradual deterioration process caused by exposure to moisture, air, or chemicals. Rusting, for example, is a common form of corrosion observed in iron and steel. To combat corrosion, various preventive measures are employed, including coating metals with paints, oils, or alloys, and sacrificial protection using more reactive metals. Alloys, on the other hand, are engineered mixtures of metals or nonmetals with metals. They are created to enhance properties such as hardness, tensile strength, and corrosion resistance. Popular alloys include brass, bronze, and stainless steel, widely used in industries for their superior attributes.

Questions for Passage 3:

1. What is corrosion, and why is it a concern for metals like iron and steel?
2. Explain the concept of sacrificial protection in preventing corrosion.
3. How do alloys contribute to improving the properties of metals?
4. Provide examples of commonly used alloys and their applications.

ANSWERS:

1. There are 118 known elements in total, and they are classified on the periodic table based on their increasing atomic number.
2. Some typical physical properties of metals include being solid at room temperature, malleability, ductility, conductivity, sonorousness, and luster.
3. Elements are categorized as non-metals based on their lack of properties like malleability, ductility, and conductivity.
4. Examples of metalloids include silicon and germanium.

Answers for Passage 2:

1. Alkali metals like sodium, potassium, and lithium react vigorously with water and oxygen.
2. Metals like magnesium and aluminum slowly form a protective layer when exposed to air, preventing corrosion.
3. Basic oxides are formed by metal oxides and react with water to create bases.
4. Displacement reactions involving metals are applied in metal extraction, manufacturing steel, and various industrial processes.

Answers for Passage 3:

1. Corrosion is the gradual deterioration of metals due to exposure to moisture, air, or chemicals, and rusting is a common form of corrosion in iron and steel.
2. Sacrificial protection involves using more reactive metals to protect less reactive metals from corrosion.
3. Alloys are engineered mixtures of metals or nonmetals with metals that enhance properties like hardness, tensile strength, and corrosion resistance.
4. Examples of commonly used alloys include brass, bronze, and stainless steel, which are utilized in various industries for their superior properties.

PREVIOUS YEAR QUESTIONS:

1. **A green layer is gradually formed on a copper plate left exposed to air for a week in a bathroom. What could this green substance be? [CBSE 2012]**
2. **A non-metal X exist in two different forms Y and Z. Y is the hardest natural substance, whereas Z is good conductor of electricity. Identify X, Y and Z. [CBSE 2011]**
3. **Name a non-metal which is lustrous and a metal is non-lustrous. [CBSE 2011]**
4. **Why gas is liberated when a metal reacts with acid? How will you check the presence of this gas? [CBSE 2011]**
5. **Name the metal which react with a very dilute HNO3 to evolved hydrogen gas. [CBSE 2011]**
6. **What is the valency of silicon with atomic number 14? [CBSE 2010]**

7. **Name the following: (a) A metal, which is preserved in kerosene. (b) A lustrous coloured non-metal. (c) A metal, which can metal while kept on palm. (d) A metal, which is a poor conductor of heat. [CBSE 2012]**
8. **Explain why calcium metal after reacting with water starts floating on its surface. Write the chemical equation for the reaction. Name one more metal that starts floating after some time when immersed in water. [CBSE 2012]**
9. **The way, metals like sodium, magnesium and iron react with air and water is an indication of their relative positions in the 'reactive series'. Is this statement true? Justify your answer with examples. [CBSE 2011]**
10. **X + YSO4→XSO4 + Y and Y + XSO4→ No Reaction. Out of the two element X and Y which is more reactive and why? [CBSE 2011]**
11. **What is an alloy? State the constituent of solder. Which property of solder makes it suitable for welding electrical wires. [CBSE 2011]**
12. **Using the electronic configuration, explain how magnesium atom combines with oxygen atom to form magnesium oxide by transfer of electron? [CBSE 2011]**
13. **Write balanced equations for the reaction of: (i) Aluminium when heated in air. Write the name of the product. (ii) Iron with steam. Name the product obtained. (iii) Calcium with water. Why does calcium start floating in water? [CBSE 2012]**
14. **Write balanced chemical equations for the following reactions: (a) Dilute sulphuric acid reacts with Aluminium powder. (b) Dilute hydrochloric acid reacts with sodium carbonate. (c) Carbon dioxide is passed through lime water. [CBSE 2012]**
15. **What is meant by reactivity series of metals? State which of the following chemical reactions will take place giving suitable reasons for each. (I) $Zn + CuSO_4 \rightarrow ZnSO_4 + Cu$ (II) $Fe + ZnSO_4 \rightarrow FeSO_4 + Zn$ (III) $Zn + FeSO_4 \rightarrow ZnSO_4 + Fe$ [CBSE 2009]**
16. **An ore on heating in air produces Sulphur dioxide. Which process would you suggest for its concentration? Describe briefly any two steps involved in the conversion of this concentrated ore into related metal. [CBSE 2009]**
17. **(a) What do you see when a magnesium ribbon is burn? Is magnesium oxidised reduced in this reaction? (b) Define corrosion? [CBSE 2011]**
18. **With reference to the electro refining of impure copper, Answer the following? (a) What is the electrolyte used? (b) name the cathode and anode used. (c) What happens at cathode and anode. [CBSE 2011]**
19. **What are atmospheric oxides? Give two examples of atmospheric oxide with balanced chemical equation. [CBSE 2011]**
20. **What is concentration of an ore? Why is it necessary to concentrate an ore before processing? Name an ore of mercury and copper? [CBSE 2012]**
21. **Give reasons: (i) Silver metal does not easily combine with oxygen but silver jewellery tarnished after sometime. (ii) Iron grills are frequently painted. (iii) Gold ornaments retain their luster even after several years of use. [CBSE 2013]**

22. **Explain the following: (a) Reactivity of Al decreases if it is dipped in HNO3. (b) Carbon cannot reduce the oxides of Na or Mg. (c) NaCl is not a conductor of electricity in solid state whereas it conducts electricity in aqueous as well as in molten state. (d) Iron articles are galvainished. (e) Metal like Na, K, Ca, N, Mg are never found in their free state in nature. [CBSE 2014]**
23. **(a) Describe an activity to show that metals are good conductor of electricity. (b) Account for the following: (i) Hydrogen gas is not evolved when a metal reacts with nitric acid. (ii) For storing sodium metal it is kept immersed in kerosene. (iii) The reaction of iron oxide with Aluminium. [CBSE 2015]**
24. **(a) When calcium metal is added to water, the gas evolved does not catch fire but the same gas evolved on adding potassium metal to water catches fire. Explain why? (b) Name a metal for each case: (i) It displaces hydrogen gas from nitric acid. (ii) It does not react with any physical state of water. (iii) It does not react with cold as well as hot water but reacts with steam. [CBSE 2015]**
25. **Give reasons for the following: (i) Carbonate and Sulphide ores are usually converted into oxides during the process of extraction of metals. (ii) Ionic compounds have generally high melting points. (iii) Hydrogen is not a metal, but it has been assigned a place in the reactivity series of metals. (iv)The galvanized iron articles is protected against rusting even if the zinc layer is broken. (v) The wires carrying current in homes have a coating of PVC. [CBSE 2016]**
26. **(a) Define corrosion, what name is given to the corrosion of iron? (b) Name the colour of coating formed on silver and copper articles, when exposed to air? (c) List two damages caused by corrosion and suggest how corrosion can be prevented. [CBSE 2016]**

ANSWERS:

1. A green layer formed on a copper plate exposed to air for a week in a bathroom is likely copper oxide. Copper reacts with oxygen in the air to form a greenish layer of copper oxide, commonly known as patina.

2. Non-metal X exists in two different forms Y and Z. Y is the hardest natural substance, which is diamond. Z is a good conductor of electricity, which is graphite. So, X is carbon.

3. A non-metal that is lustrous is iodine, while a metal that is non-lustrous is sodium.

4. Gas is liberated when a metal reacts with an acid because the metal displaces hydrogen ions from the acid, forming hydrogen gas. To check the presence of this gas, you can perform the "pop" test. Collect the gas in a test tube, and bring a burning splint near the mouth of the test tube. If you hear a "pop" sound, it indicates the presence of hydrogen gas.

5. The metal that reacts with very dilute HNO3 to evolve hydrogen gas is copper.

6. The valency of silicon with atomic number 14 is 4.

7. (a) A metal preserved in kerosene is sodium. (b) A lustrous colored non-metal is iodine. (c) A metal that can melt while kept on the palm is gallium. (d) A metal that is a poor conductor of heat is bismuth.

8. Calcium starts floating on water because it reacts with water to produce hydrogen gas, which gets trapped on the surface of the calcium, causing it to float. The chemical equation for the reaction is:

$Ca + 2H_2O \rightarrow Ca(OH)_2 + H_2(g)$

Another metal that starts floating after some time when immersed in water is potassium.

9. The statement that the way metals like sodium, magnesium, and iron react with air and water is an indication of their relative positions in the 'reactive series' is true. This reactive series is often referred to as the activity series of metals. The metals at the top of the series are more reactive and readily react with air and water, while those at the bottom are less reactive and may not react as easily.

10. Element X is more reactive than Y because it displaces Y from its sulfate. In the given reaction, X displaces Y, indicating its higher reactivity.

11. An alloy is a homogeneous mixture of two or more metals or a metal and a non-metal. The constituent of solder is typically a mixture of lead and tin. Solder is suitable for welding electrical wires because it has a low melting point, allowing it to melt and bond the wires without overheating them.

12. Magnesium atom combines with an oxygen atom to form magnesium oxide by transferring two electrons. Magnesium loses two electrons to oxygen, which gains them. The resulting ionic compound, magnesium oxide (MgO), has a stable electron configuration.

13. (i) Balanced equation for the reaction of aluminum when heated in air: $4Al + 3O_2 \rightarrow 2Al_2O_3$ (product is aluminum oxide). (ii) Balanced equation for the reaction of iron with steam: $3Fe + 4H_2O \rightarrow Fe_3O_4 + 4H_2$ (product is iron(II,III) oxide and hydrogen gas). (iii) Balanced equation for the reaction of calcium with water was already mentioned in question 8.

14. Balanced chemical equations: (a) Dilute sulfuric acid reacts with aluminum powder: $2Al + 3H_2SO_4 \rightarrow Al_2(SO_4)_3 + 3H_2(g)$ (b) Dilute hydrochloric acid reacts with sodium carbonate: $2HCl + Na_2CO_3 \rightarrow 2NaCl + H_2O + CO_2(g)$ (c) Carbon dioxide is passed through lime water: $Ca(OH)_2 + CO_2 \rightarrow CaCO_3 + H_2O$

15. The reactivity series of metals is a list of metals arranged in order of their reactivity, with the most reactive metal at the top and the least reactive metal at the bottom. The chemical reactions that will take place in the given cases are: (I) $Zn + CuSO_4 \rightarrow ZnSO_4 + Cu$ (Zinc displaces copper from copper sulfate because it is more reactive than copper.) (II) $Fe + ZnSO_4 \rightarrow$ No reaction (Iron is less reactive than zinc, so it cannot displace zinc from zinc sulfate.) (III) $Zn + FeSO_4 \rightarrow$ No reaction (Zinc is more reactive than iron, but in this case, it cannot displace iron from iron sulfate.)

16. To concentrate an ore, you can use the process of froth flotation or magnetic separation, depending on the nature of the ore. Two steps involved in the conversion of concentrated ore into related metal are reduction and refining. Reduction involves the removal of oxygen from the ore, typically by heating it with a reducing agent. Refining involves further purification of the metal.

17. (a) When a magnesium ribbon burns, it produces a bright white light and white ashes. Magnesium is oxidized in this reaction. (b) Corrosion is the gradual degradation of a metal due to its reaction with oxygen and moisture in the environment, leading to the formation of metal oxides.

18. In the electrorefining of impure copper: (a) The electrolyte used is a solution of copper sulfate (CuSO4). (b) The cathode is a pure copper electrode, and the anode is the impure copper electrode. (c) At the cathode, copper ions from the electrolyte are reduced and deposited as pure copper metal. At the anode, impure copper dissolves into the electrolyte as copper ions.

19. Atmospheric oxides are oxides that are formed as a result of reactions involving atmospheric gases. Two examples of atmospheric oxides are: (i) Nitrogen dioxide (NO_2): $2NO_2 + O_2 \rightarrow 2NO_3$ (ii) Sulfur dioxide (SO2): $2SO_2 + O_2 \rightarrow 2SO_3$

20. Concentration of an ore refers to the process of removing unwanted materials and impurities from an ore to obtain a concentrated form of the desired metal. It is necessary to concentrate an ore before processing because it reduces the volume of the ore to be processed and increases the percentage of the desired metal in the ore. An ore of mercury is cinnabar, and an ore of copper is chalcopyrite.

21. (i) Silver metal does not easily combine with oxygen because it is a relatively unreactive metal. However, silver jewelry tarnishes over time due to the reaction with sulfur compounds in the air. (ii) Iron grills are frequently painted to protect them from corrosion, as the paint acts as a barrier between the iron and the environment. (iii) Gold ornaments retain their luster because gold is highly resistant to corrosion and does not react with air or water.

22. (a) Reactivity of Al decreases when it is dipped in HNO3 because nitric acid is a strong oxidizing agent and can passivate the surface of aluminum, preventing further reaction. (b) Carbon cannot reduce the oxides of Na or Mg because sodium and magnesium are more reactive than carbon, and carbon cannot displace them from their oxides. (c) NaCl is not a conductor of electricity in the solid state because it consists of ions held in a fixed lattice, which does not allow for the movement of charged particles. In the aqueous and molten states, the ions are free to move, allowing for conductivity. (d) Iron articles are galvanized to protect them from corrosion. A layer of zinc is applied to the iron's surface, which acts as a sacrificial anode, corroding instead of the iron. (e) Metals like Na, K, Ca, N, Mg are not found in their free state in nature because they are highly reactive and readily combine with other elements to form compounds.

23. (a) To demonstrate that metals are good conductors of electricity, you can set up a simple circuit with a metal wire connected to a battery and a bulb. When the circuit is complete, the bulb will light up, showing that electricity can flow through the metal wire. (b) (i) Hydrogen gas is not evolved when a metal reacts with nitric acid because nitric acid is a strong oxidizing agent and oxidizes hydrogen gas to water. (ii) Sodium metal is kept immersed in kerosene to prevent its reaction with air and moisture. (iii) The reaction of iron oxide with aluminum is a thermite reaction used for welding and is highly exothermic.

24. (a) When calcium metal is added to water, the gas evolved does not catch fire because calcium reacts less vigorously with water compared to potassium. The gas evolved is hydrogen. (b) (i) It displaces hydrogen gas from nitric acid: Zinc. (ii) It does not react with any physical state of water: Copper. (iii) It does not react with cold as well as hot water but reacts with steam: Iron.

25. (i) Carbonate and sulfide ores are usually converted into oxides during the process of extraction of metals because oxides are easier to reduce to obtain the metal. (ii) Ionic compounds generally have high melting points due to strong electrostatic forces of attraction between ions. (iii) Hydrogen is not a metal, but it is included in the reactivity series because it can displace metals from their salts under certain conditions. (iv) Galvanized iron articles are protected against rusting because even if the zinc layer is broken, zinc acts as a sacrificial anode and corrodes instead of the iron. (v) Wires carrying current in homes have a coating of PVC (polyvinyl chloride) to insulate them and prevent electrical shocks and short circuits.

26. (a) Corrosion is the gradual degradation of a metal due to its reaction with oxygen and moisture in the environment. The corrosion of iron is commonly known as rusting. (b) The color of the coating formed on silver and copper articles when exposed to air is black or brownish-black due to the formation of silver sulfide (Ag2S) and copper oxide (Cu2O), respectively. (c) Two damages caused by corrosion are the weakening of metal

structures and the deterioration of appearance. Corrosion can be prevented by using protective coatings, such as paint or galvanization, and by keeping the metal dry and free from moisture and oxygen.