CBSE Important Questions for Class 10 Science Chapter 3: Here are the important questions for Class 10 Chemistry Chapter 3 Metals and Nonmetals along with their answers. This chapter focuses on the properties, reactions and uses of metals and nonmetals. Understanding these concepts is important for grasping the fundamental differences between these two categories of elements.

By studying these important questions students can reinforce their knowledge and prepare effectively for their exams. The questions cover various aspects such as the physical and chemical properties of metals and nonmetals, their reactivity and the applications of these elements in everyday life.

CBSE Important Questions for Class 10 Science Chapter 3 Overview

These questions are prepared by subject experts of Physics Wallah for CBSE Important Questions for Class 10 Science Chapter 3 Metals and Nonmetals.

By solving with these important questions students can enhance their grasp of the properties, reactions, and applications of metals and nonmetals. This detailed approach not only helps in exam preparation but also builds a strong foundation for future studies in chemistry.

CBSE Important Questions for Class 10 Science Chapter 3 PDF

The PDF link for CBSE Important Questions for Class 10 Science Chapter 3 Metals and Nonmetals is available below.

By downloading the PDF students will have easy access to important concepts and can enhance their preparation for the upcoming examinations.

CBSE Important Questions for Class 10 Science Chapter 3 PDF

CBSE Important Questions for Class 10 Science Chapter 3 Metals and Nonmetals

Here we have provided CBSE Important Questions for Class 10 Science Chapter 3 Metals and Nonmetals-

Short Answer Type Questions

Q1. Iqbal treated a lustrous, divalent element M with sodium hydroxide. He observed the formation of bubbles in the reaction mixture. He made the same observations when this element was treated with hydrochloric acid. Suggest how can he identify the produced gas. Write chemical equations for both reactions.

Answer:

Iqbal treated a lustrous, divalent element M with sodium hydroxide and hydrochloric acid, observing the formation of bubbles in both cases. The gas evolved during these reactions is hydrogen gas. To identify this gas, Iqbal can bring a burning matchstick near the evolved gas. If it burns with a pop sound, this confirms the presence of hydrogen gas.

The chemical equations for the reactions are as follows:

Reaction with NaOH:

$M + 2\ NaOH \rightarrow Na_2MO_2 + H_2$

Reaction with HCl:

$M + 2\ HCl \rightarrow MCl_2 + H_2$

Q2. During the extraction of metals, electrolytic refining is used to obtain pure metals.

(a) Which material will be used as anode and cathode for refining silver metal in this process?

(b) Suggest a suitable electrolyte also.

(c) Where do we get pure silver in this electrolytic cell after passing an electric current?

Answer:

During the extraction of metals, electrolytic refining is an essential process used to obtain pure metals.

(a) In this process, the anode will be made of impure silver, while the cathode will consist of pure silver. This setup allows the impurities to oxidize at the anode, leaving behind pure silver at the cathode.

(b) A suitable electrolyte for this process can be a solution of silver sulfate (Ag_2SO_4) or silver nitrate ($AgNO_3$). These electrolytes help facilitate the movement of silver ions during the electrolysis.

(c) After passing an electric current through the electrolytic cell, pure silver will be deposited on the cathode. As the current flows, the electropositive nature of metals causes the silver ions to migrate towards the cathode, where they are reduced and deposited as pure silver.

Q3. Why should the metal sulphides and carbonates be converted to metal oxides in the extraction process of metal?

Answer:

Metal sulfides and carbonates are converted to metal oxides during the extraction process for several reasons:

Ease of Reduction: Metals are generally easier to extract from their oxides than from their carbonates or sulfides. The reduction of metal oxides to their elemental form typically requires lower energy and simpler methods.

Thermal Stability: Metal oxides are more thermally stable compared to their sulfides and carbonates. This stability allows for more efficient and controlled heating during the extraction process.

Q4. Generally, when metals are treated with mineral acids, hydrogen gas is liberated, but when metals (except Mn and Mg) are treated with HNO_3, hydrogen is not liberated. Why?

Answer:

When metals react with mineral acids, hydrogen gas is liberated due to the reaction between the metal and the acid. However, this does not occur when metals (except manganese and magnesium) are treated with nitric acid (HNO_3). The reason for this is that nitric acid is a strong oxidizing agent. Instead of donating protons (H^+ ions) to the metal, HNO_3 oxidizes the metal, leading to the formation of metal nitrates and nitrogen oxides, such as NO or NO_2.

For example, when copper reacts with concentrated nitric acid, the reaction produces copper nitrate and nitrogen dioxide instead of hydrogen gas. Magnesium and manganese are exceptions; they can react with very dilute nitric acid to liberate hydrogen gas due to their higher reactivity and the low concentration of the acid. Thus, the absence of hydrogen gas liberation in most cases is primarily due to the oxidizing properties of nitric acid, which prevents the formation of hydrogen and results in the creation of nitrogen oxides instead.

Q5. Compound X and aluminium are used to join railway tracks.

(a) Identify the compound X.

(b) Name the reaction.

(c) Write down its reaction.

Answer:

(a) Compound X Is ferrous oxide (Fe_2O_3).

(b) This reaction is called a thermite reaction.

(c) $2\ Al + Fe_2O_3 \rightarrow 2\ Fe + Al_2O_3 + heat$

Q6. When a metal X is treated with cold water, it gives a basic salt Y with the molecular formula XOH (Molecular mass = 40) and liberates a gas Z which easily catches fire. Identify X, Y and Z and also write the reaction involved.

Answer:

X is Na because the molecular mass of NaOH is 40.

Na (23) + O (16) → NaOH (40)

Hence,

- X is Sodium.
- Y is Sodium hydroxide.
- Z is hydrogen, which catches fire when it reacts with water.

$2\ Na + 2\ H_2O \rightarrow 2\ NaOH + H_2$.

Here oxygen is losing hydrogens, so it is oxidised. The Na has gained oxygen, so it is reduced. Therefore, it is a redox reaction and an H_2 displacement reaction. Redox reactions are reactions in which one species is reduced and another is oxidised. Consequently, the oxidation state of the species involved must change.

Q7. A non-metal X exists in two different forms, Y and Z. Y is the hardest natural substance, whereas Z is a good conductor of electricity. Identify X, Y and Z.

Answer:

A non-metal X exists in two different forms, Y and Z. In this case, X is carbon. The two allotropes of carbon are diamond and graphite. Y is diamond, known as the hardest natural substance, while Z is graphite, which is a good conductor of electricity due to its free-moving electrons within its layered structure.

Q8. The following reaction takes place when the aluminium powder is heated with MnO_2

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

(a) Is aluminium getting reduced?

(b) Is MnO_2 getting oxidised?

Answer:

(a) No, aluminium is not getting reduced.

(b) No, MnO_2 is not getting oxidised.

In this reaction, aluminium gets oxidised as oxygen gets combined with it. Since oxygen is removed from MnO_2, it is getting reduced.

Q9. What are the constituents of solder alloy? Which property of solder makes it suitable for welding electrical wires?

Answer:

Solder alloy is composed of lead and tin. The low melting point of solder makes it particularly suitable for welding electrical wires, as it allows for easy application without damaging the components being joined. This property ensures effective electrical conductivity and a strong connection between the wires.

Q10. A metal A, which is used in the thermite process, when heated with oxygen, gives an oxide B, which is amphoteric in nature. Identify A and B. Write down the reactions of oxide B with HI and NaOH.

Answer:

Metal A is aluminium, and B is aluminium oxide (Al_2O_3).

The reaction of aluminium oxide with HCl

$Al_2O_3 + 6\ HCl \rightarrow 2\ AlCl_3 + 3\ H_2O$

The reaction of aluminium oxide with NaOH:

$Al_2O_3 + 2\ NaOH \rightarrow 2\ NaAlO_2 + H_2O$

Q11. A metal that exists as a liquid at room temperature is obtained by heating its sulphide in the presence of air. Identify the metal and its ore and give the reaction involved.

Answer:

The metal that exists as a liquid at room temperature is mercury, obtained from its ore, cinnabar (HgS). To extract mercury, cinnabar is heated in the presence of air, which leads to the following reactions:

The reactions are as follows

$2\ HgS + 3\ O_2 \rightarrow 2\ HgO + 2\ SO_2$

$2\ HgO \rightarrow 2\ Hg + O_2$

Q12. Give the formulae of the stable binary compounds that would be formed by the combination of the following pairs of elements.

(a) Mg and N_2

(b) Li and O_2

(c) Al and Cl_2

(d) K and O_2

Answer:

(a) Magnesium nitride (Mg_3N_2)

(b) Lithium oxide (Li_2O)

(c) Aluminium chloride ($AlCl_3$)

(d) Potassium oxide (K_2O)

Q13. What happens when

(a) $ZnCO_3$ is heated without oxygen?

(b) A mixture of Cu_2O and Cu_2S is heated?

Answer:

(a) When zinc carbonate is heated without oxygen, we get zinc oxide and carbon dioxide.

$ZnCO_3 \rightarrow ZnO + CO_2$

(b) When a mixture of copper oxide and copper sulphide is heated. We get the pure copper.

$2\ Cu_2O + Cu_2S \rightarrow 6\ Cu + SO_2$

Q14. A non-metal A is an important constituent of our food and forms two oxides, B and C. Oxide B is toxic. In contrast, C causes global warming

(a) Identify A, B, and C

(b) To which Group of Periodic Table does A belong?

Answer:

(a) A is Carbon. B is Carbon monoxide, and C is Carbon-dioxide.

(b) Carbon belongs to Group 14.

16. Give two examples of the metals that are good conductors and poor conductors of heat, respectively.

Answer:

Iron and copper are good conductors of heat and electricity.

Lead and mercury are poor conductors of heat and electricity.

Q17. Name one metal and one non-metal that exist in the liquid state at room temperature. Also, name two metals having a melting point of less than 310 K (37°C)

Answer:

Mercury (metal) and bromine (non-metal) exist in the liquid state at room temperature. Caesium and gallium are metals with a melting point of less than 310 K.

Q18. An element A reacts with water to form a compound B used in whitewashing. The compound B on heating forms an oxide C which gives back B on treatment with water. Identify A, B and C and give the reactions involved.

Answer:

- A is calcium. It reacts with water to give calcium hydroxide.
- B is calcium hydroxide. It is used for whitewashing.
- C is calcium oxide.

The reactions are as follows:

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

$Ca(OH)_2 \rightarrow CaO + H_2O$

$CaO + H_2O \rightarrow Ca(OH)_2$

Q19. An alkali metal A gives a compound B (molecular mass = 40) on reacting with water. The compound B gives a soluble compound C on treatment with aluminium oxide. Identify A, B and C and give the reaction involved.

Answer:

Given

- $x + 16 + 1 = 40$
- $x = 40 – 17 = 23$

It is the atomic weight of sodium.

Therefore, the alkali metal (A) is sodium, and the reaction is

$2\ Na + 2\ H_2O \rightarrow 2\ NaOH + H_2$.

So, compound B is sodium hydroxide (NaOH).

Sodium hydroxide reacts with aluminium oxide (Al_2O_3) to give sodium aluminate ($NaAlO_2$). Thus, C is sodium aluminate (NaAlO2). The reaction involved is

$Al_2O_3 + 2\ NaOH \rightarrow 2\ NaAlO_2 + H_2O$.

Hence

- A is sodium
- B is sodium hydroxide
- C is sodium aluminate

Q20. Give the reaction involved during extraction of zinc from its ore by

(a) Roasting of zinc ore

(b) Calcination of zinc ore

Answer:

(a) $2\ ZnS + 3\ O_2 \rightarrow 2\ ZnO + 2\ SO_2$

(b) $ZnCO_3 \rightarrow ZnO + CO_2$

Q21. A metal M does not liberate hydrogen from acids but reacts with oxygen to give a black colour product. Identify M and black coloured products and explain M's reaction with oxygen.

Answer:

Copper does not react with acids. But copper gives black coloured copper oxide when it reacts with oxygen. Hence, M is copper, and the black coloured product is copper oxide.

$2\ Cu + O_2 \rightarrow 2\ CuO$

Q22. An element forms an oxide A_2O_3 which is acidic in nature. Identify A as metal or non-metal.

Answer:

Oxides of non-metals are acidic. Hence, A is a non-metal.

Q23. We kept a solution of $CuSO_4$ in an iron pot. After a few days, the iron pot was found to have several holes in it. Explain the reason in terms of reactivity. Write the equation of the reaction involved.

Answer:

Iron is more reactive than copper. Due to this, iron displaced copper from copper sulphate to form iron sulphate. A portion of the iron pot got dissolved, causing holes in it.

$CuSO_4 + Fe \rightarrow FeSO_4 + Cu$

Long Answer Type Questions

Q1. A non-metal A, the largest constituent of air, when heated with H2 in a 1:3 ratio in the presence of a catalyst (Fe), gives a gas B. On heating with Oz, it gives an oxide C. If this oxide is passed into the water in the presence of air, it gives an acid D which acts as a strong oxidising agent.

(a) Identify A, B, C, and D

(b) To which group of periodic tables does this non-metal belong?

Answer:

(a) The non-metal A is nitrogen (N), which is the largest constituent of air. When nitrogen is heated with hydrogen in a 1:3 ratio in the presence of a catalyst (iron), it produces ammonia (B). The reaction is as follows:

When nitrogen is heated with hydrogen in the presence of a catalyst, the following reaction occurs.

$N_2 + 3\ H_2 \rightarrow 2\ NH_3$.

When nitrogen is heated with oxygen, we get nitrogen dioxide.

$N_2 + 2\ O_2 \rightarrow 2\ NO_2$

When nitrogen dioxide is treated with water, we get nitric acid.

$NO_2 + H_2O \rightarrow HNO_3$

(b) This non-metal belongs to Group 15.

Q2. Give the steps involved in extracting low and medium reactivity metals from their respective sulphide ores.

Answer:

When low and medium reactivity metals are extracted, an individual sulphide ore is first heated in the air. This helps in obtaining the oxide of the metal. It is easier to extract a metal from its oxide than sulphide.

Mercury is a metal of low reactivity. Mercury sulphide (cinnabar) is heated in the air. Mercury sulphide gets oxidised to produce mercury oxide.

$2\ HgS + 3\ O_2 \rightarrow 2\ HgO + 2\ SO_2$.

After that, mercury oxide is reduced to obtain mercury.

$2\ HgO \rightarrow 2\ Hg + O_2$

Zinc is a metal of medium reactivity. It is found as a zinc blende (ZnS).

Zinc blende is roasted to be converted into zinc oxide. Zinc spar is put under calcination to be converted into zinc oxide.

$2\ ZnS + 3\ O_2 \rightarrow 2\ ZnO + 2\ SO_2$

$ZnCO_3 \rightarrow ZnO + CO_2$

Zinc oxide obtained is reduced to zinc metal by heating with carbon (a reducing agent).

$ZnO + C \rightarrow Zn + CO$

Q3. Explain the following

(a) Reactivity of Al decreases if it is dipped in HNO_3

(b) Carbon cannot reduce the oxides of Na or Mg

(c) NaCl is not a conductor of electricity in solid-state, whereas it does conduct electricity in aqueous solution as well as in the molten state

(d) Iron articles are galvanised.

(e) Metals like Na, K, Ca and Mg are never found in their free state in nature.

Answer:

(a) When aluminum (Al) is dipped in nitric acid (HNO_3), it forms a protective layer of aluminum oxide (Al_2O_3) on its surface. Nitric acid is a strong oxidizing agent, which reacts with aluminum to create this oxide layer. Once formed, this layer prevents further reaction of aluminum with the acid, thus decreasing its reactivity. This phenomenon is known as passivation, where a metal becomes less reactive due to the formation of an inert oxide coating.

(b) Sodium (Na) and magnesium (Mg) are highly reactive metals that have a strong affinity for oxygen. Because of their high reactivity, they tend to form stable oxides. Carbon, which is a reducing agent, is unable to reduce the oxides of sodium and magnesium because these metals are more reactive than carbon itself. In simpler terms, sodium and magnesium prefer to remain in their oxidized states and do not allow carbon to displace them from their oxides.

(c) Sodium chloride (NaCl) is an ionic compound that consists of sodium ions (Na^+) and chloride ions (Cl). In the solid state, these ions are fixed in a crystal lattice structure, preventing them from moving freely; therefore, NaCl cannot conduct electricity. However, when dissolved in water (aqueous solution) or melted, the ionic bonds break, allowing the ions to move freely. This mobility of ions enables the conduction of electricity in both aqueous and molten states.

(d) Galvanization is the process of applying a protective zinc coating to iron or steel to prevent rusting. The layer of zinc acts as a barrier that protects the iron from moisture and oxygen, which are the primary agents of corrosion. Moreover, if the zinc layer gets scratched, it still provides protection because zinc is more reactive than iron and will corrode preferentially, thus protecting the underlying metal.

(e) Sodium (Na), potassium (K), calcium (Ca), and magnesium (Mg) are highly reactive metals. Due to their strong reactivity, they readily react with other elements, particularly oxygen and water, to form stable compounds. As a result, these metals are never found in their elemental (free) state in nature; instead, they are found in mineral deposits as salts or oxides. Their reactivity makes them too unstable to exist in their pure form in the environment.

Q4. (i) Given below are the steps for extraction of copper from its ore.

Write the reaction involved.

(a) Roasting of copper (1) sulphide

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

(c) Electrolytic refining.

Answer:

(a) $2\ Cu_2S + 3\ O_2 \rightarrow 2\ Cu_2O + 2\ SO_2$

(b) $2\ Cu_2O + Cu_2S \rightarrow 6\ Cu + SO_2$

(c) At cathode: $Cu^{2+} + 2\ e^- \rightarrow Cu$

Q5. Of the three metals, X, Y and Z. X react with cold water, Y with hot water and Z with steam. Identify X, Y and Z and also arrange them in order of increasing reactivity.

Answer:

X is sodium, Y is magnesium, and Z is iron.

$2\ Na + 2\ H_2O \rightarrow 2\ NaOH + H_2$

$Mg + 2\ H_2O \rightarrow Mg(OH)_2 + H_2$

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

Their sequence in reactivity series is: Fe < Mg < Na.

Q6. An element A burns with golden flame in the air. It reacts with another element B, atomic number 17, to give a product C. An aqueous solution of product C on electrolysis gives a compound D and liberates hydrogen. Identify A, B, C and D. Also, write down the equations for the reactions involved.

Answer:

Element A is sodium metal (Na) as it burns with a golden flame.

Element B with atomic number 17 is chlorine (Cl).

Sodium and chlorine combine to form sodium chloride, NaCl(compound C).

We can write the reaction as

$2\ Na + Cl_2 \rightarrow 2\ NaCl.$

An aqueous solution of NaCl on electrolysis gives the compound D, sodium hydroxide(NaOH). We can write the reaction as

$2\ NaCl\ (aq) + 2\ H_2O\ (l) \rightarrow 2\ NaOH\ (aq) + Cl_2\ (g) + H_2\ (g)$

Q7. Two ores A and B were taken. On heating, ore A gives CO, whereas ore B gives SO_2. What steps will you take to convert them into metals?

Answer:

A carbonate ore is calcinated to obtain the oxide of the metal. When a carbonate ore is heated, we get carbon dioxide. The following equation shows the calcination of zinc carbonate.

$ZnCO_3 \rightarrow ZnO + CO_2$

When a sulphide ore is roasted, we get Sulphur dioxide. Zinc sulphide is roasted to obtain zinc oxide.

$2\ ZnS + 3\ O_2 \rightarrow 2\ ZnO + 2\ SO_2.$

After any of the above steps, zinc oxide is reduced to obtain pure zinc.

$ZnO + C \rightarrow Zn + CO$

Benefits of CBSE Important Questions for Class 10 Science Chapter 3

- **Focused Study**: These questions cover the main topics of the chapter helping students concentrate on what's important for the exam.
- **Better Understanding**: Practicing these questions helps students understand the properties and reactions of metals and nonmetals more clearly.
- **Improved Problem-Solving**: The variety of questions helps students learn how to solve problems, which is essential for exams.
- **Exam Preparation**: Working on important questions helps students get familiar with the exam format and the types of questions they might face.
- **Finding Weak Areas**: By solving these questions students can discover which topics they need to study more. This allows them to focus on improving those areas.
- **Time Management**: Practicing helps students learn how to manage their time during the exam, ensuring they can complete all questions.
- **Complete Preparation**: Studying these questions prepares students for both board exams and other competitive exams that may cover metals and nonmetals.
- **Group Study**: Discussing and solving these questions with friends can make studying more enjoyable and effective.
- **Boosting Confidence**: Mastering important questions increases students confidence in their knowledge and abilities encouraging them to tackle more difficult topics.