CREST Olympiads

#CRESTInnovator

# CREST Science Olympiad (CSO) Worksheet for Class 10

## Topic

## Occurrence of Metals

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# Worksheet on Occurrence of Metals

1. **In the extraction of aluminium from aluminium oxide ($Al_2O_3$) using the Hall-Héroult process, aluminium ions ($Al^{3+}$) are reduced to form aluminium metal. What is the role of the anode in this process?**

   a. It generates aluminium ions from aluminium oxide.
   b. It reduces aluminium ions to aluminium metal.
   c. It produces oxygen gas from aluminium oxide.
   d. It oxidises aluminium ions to aluminium oxide.

2. **A metallurgist is tasked with preventing the corrosion of iron used in the construction of a bridge. Which practical method is most effective for achieving this goal?**

   a. Coating the iron with a layer of oil.
   b. Using iron that has undergone alloying with chromium.
   c. Ensuring the iron is regularly exposed to air and moisture.
   d. Applying a layer of zinc to the iron.

3. **You are designing an alloy for a specialised application that requires both high-temperature resistance and electrical conductivity. Which alloying elements would you consider incorporating into your alloy? Select the most appropriate combination.**

   a. Chromium (Cr) and aluminium (Al)
   b. Copper (Cu) and nickel (Ni)
   c. Titanium (Ti) and manganese (Mn)
   d. Iron (Fe) and silicon (Si)

4. **Arrange the following steps in the correct order for the extraction of iron from iron ore (hematite):**

   **I. Conversion of iron ore into iron oxide.**
   **II. Reduction of iron oxide to obtain molten iron.**
   **III. Mining and crushing of hematite ore.**
   **IV. Purification and casting of molten iron.**

   **Choose the correct order of these steps:**

   a. I, IV, III, II
   b. III, I, II, IV
   c. III, II, I, IV
   d. IV, II, III, I

5. **In a laboratory experiment, a student wants to demonstrate the reduction of copper oxide using carbon as a reducing agent. Which of the following equations represents the correct reaction?**

   a. $CuO + C \rightarrow Cu + CO_2$
   b. $Cu_2O + C \rightarrow 2Cu + CO_2$
   c. $CuO + CO \rightarrow Cu + CO_2$
   d. $Cu_2O + CO \rightarrow 2Cu + CO_2$

## Answer Key

1. a - In the Hall-Héroult process for extracting aluminium from aluminium oxide ($Al_2O_3$), the anode plays a critical role in the overall electrochemical reaction that takes place. The primary reactions occurring at the anode are: $2O^{2-}$ (from aluminium oxide) $\rightarrow O_2$ (oxygen gas) + $4e^-$

   In other words, at the anode, oxygen ions ($O^{2-}$) from the aluminium oxide are oxidised to form oxygen gas ($O_2$). This process is crucial because it helps in the separation of aluminium metal from the oxygen present in the aluminium oxide.

2. d - The most effective method for preventing the corrosion of iron used in the construction of a bridge is applying a layer of zinc to the iron. This process is known as galvanisation. Galvanisation involves coating iron or steel with a layer of zinc. Zinc is more reactive than iron, so it acts as a sacrificial anode. In the presence of moisture and oxygen, the zinc layer corrodes instead of the iron. This protects the underlying iron from corrosion.

3. b - To create an alloy with both high-temperature resistance and electrical conductivity, the combination of copper (Cu) and nickel (Ni) would be the most appropriate choice. Copper offers excellent electrical conductivity, making it suitable for electrical applications. Nickel, on the other hand, provides high-temperature resistance and also enhances the alloy's overall strength and corrosion resistance.

4. b -
   III. Mining and crushing of hematite ore.
   I. Conversion of iron ore into iron oxide.
   II. Reduction of iron oxide to obtain molten iron.
   IV. Purification and casting of molten iron.

5. a - In the reduction of copper oxide (CuO) using carbon (C) as a reducing agent, the carbon (C) reacts with copper oxide (CuO) to produce copper (Cu) and carbon dioxide ($CO_2$) gas. The reaction can be broken down as follows: $CuO + C \rightarrow Cu + CO_2$

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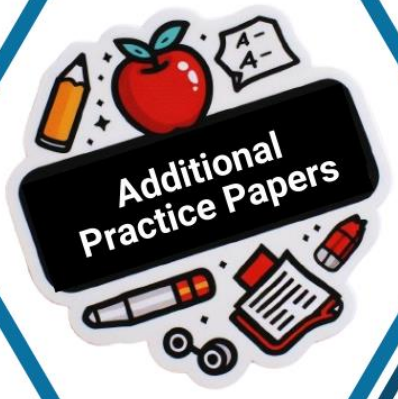


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