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NCERT CLASS 10 SCIENCE - CHAPTER 3: METALS AND NON-METALS
COMPLETE EXERCISE SOLUTIONS

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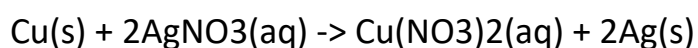
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Q1. Which of the following pairs will give displacement reactions?

- (a) NaCl solution and copper metal
- (b) MgCl₂ solution and aluminium metal
- (c) FeSO₄ solution and copper metal
- (d) AgNO₃ solution and copper metal

Answer: (d) AgNO₃ solution and copper metal

Explanation: Copper is more reactive than silver on the reactivity series, so it displaces silver from silver nitrate solution:



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

- (a) Applying grease
- (b) Applying paint
- (c) Applying a coating of zinc
- (d) All of the above

Answer: (c) Applying a coating of zinc

Explanation: Zinc coating (galvanisation) is ideal for a frying pan because grease and paint will melt, burn off, or contaminate food when heated.

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: (a) calcium

Explanation: Calcium reacts with oxygen to form calcium oxide (CaO), an ionic compound with a high melting point. CaO dissolves in water to form lime water.

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: (c) zinc is more reactive than tin.

Explanation: Because zinc is highly reactive, it can react with organic acids present in food items, producing toxic compounds. Tin is unreactive and safe.

Q5. You are given a hammer, a battery, 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) Physical & Electrical Testing:

- Hammer Test: Strike the samples with the hammer. If a sample flattens into a thin sheet without breaking, it is a malleable metal. If it

shatters into pieces, it is a brittle non-metal.

- Circuit Test: Set up an electric circuit by connecting the battery, bulb, wires, and switch. Place the sample between the free terminals of the circuit. If the bulb glows, the sample is a conducting metal. If it does not glow, it is a non-metal insulator.

(b) Assessment of Usefulness:

- The hammer test is highly reliable, though some metals like sodium are soft, and diamond (a non-metal) is incredibly hard.
- The circuit test clearly shows conductivity, but exceptions exist, such as graphite (a non-metal carbon allotrope) which conducts electricity.

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

Answer: Amphoteric oxides are metal oxides that react with both acids and bases to form salt and water. They display both acidic and basic behaviors.

Examples: Aluminium oxide (Al_2O_3) and Zinc oxide (ZnO).

Equations with Al_2O_3 :

- With Acid: $\text{Al}_2\text{O}_3 + 6\text{HCl} \rightarrow 2\text{AlCl}_3 + 3\text{H}_2\text{O}$
- With Base: $\text{Al}_2\text{O}_3 + 2\text{NaOH} \rightarrow 2\text{NaAlO}_2 + \text{H}_2\text{O}$

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

Answer:

- Will displace hydrogen: Zinc (Zn) and Magnesium (Mg) [More reactive than H]
- Will not displace hydrogen: Copper (Cu) and Gold (Au) [Less reactive than H]

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

Answer:

- Anode: A thick block of the impure metal M.
 - Cathode: A thin strip of the pure metal M.
 - Electrolyte: A water-soluble salt solution of the same metal M (acidified).
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Q9. Pratyush took sulphur powder on a spatula and heated it. He collected the gas evolved by inverting a test tube over it.

(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.

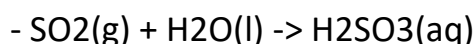
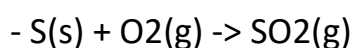
Answer:

(a) Action on Litmus:

(i) Dry litmus paper: No change in color occurs because gases require moisture to generate ions.

(ii) Moist litmus paper: The blue litmus paper turns red. Sulphur burns to form sulphur dioxide (SO₂), an acidic non-metal oxide that reacts with moisture to form sulphurous acid (H₂SO₃).

(b) Balanced Chemical Equations:



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

Answer:

1. Galvanisation: Coating the iron article with a protective thin layer of zinc metal.
2. Painting or Greasing: Applying paint, oil, or grease to establish a barrier that blocks air and moisture.

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

Answer: Non-metals combine with oxygen to form acidic oxides (such as SO_2 , CO_2) or neutral oxides (such as H_2O , N_2O , CO).

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) These metals are highly malleable, ductile, and extremely unreactive. They do not corrode or tarnish in the presence of air or moisture, keeping their bright, metallic luster.
 - (b) These alkali metals are exceptionally reactive. They react violently with moisture and oxygen in the air, catching fire instantly. Kerosene oil cuts off contact with air and water.
 - (c) Aluminium reacts quickly with oxygen to form a thin, stable, non-porous layer of aluminium oxide (Al_2O_3) on its surface. This layer seals the underlying metal, preventing further corrosion. It is also an excellent conductor of heat.
 - (d) Extracting a metal from its oxide ore via reduction (using carbon) is far easier and more energy-efficient than isolating it directly from carbonate or sulphide forms.
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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 develop a green coating of basic copper carbonate $[\text{CuCO}_3 \cdot \text{Cu}(\text{OH})_2]$ due to reaction with moist air. Lemon or tamarind juice contains citric/tartaric acids. These acids dissolve the basic green carbonate layer, converting it into soluble salts that rinse away, restoring the bright metallic copper look.

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

Answer:

Property	Metals	Non-Metals
Nature of Ions (anions)	Form positive ions (cations)	Form negative ions
Nature of Oxides	Form basic or amphoteric oxides	Form acidic or neutral oxides
Reaction with Acid	Displace H_2 gas from dil. acids	Do not react with acid
Reaction with Water	Form metal oxides/hydroxides	Do not react with water
Oxidising/Reducing agents	Act as strong reducing agents	Act as strong oxidising agents

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 fraudulent solution was Aqua Regia (royal water). Aqua Regia is a freshly prepared mixture containing concentrated Hydrochloric acid (HCl) and concentrated Nitric acid (HNO₃) in a 3:1 ratio. It is a highly corrosive acid capable of dissolving noble metals like gold. The liquid dissolved the outer, dull gold layers, revealing fresh gold beneath while drastically reducing the total weight of the bangles.

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

Answer: Copper is a far superior conductor of heat compared to steel, making it energy efficient. Additionally, copper does not react with water or steam at high temperatures. In contrast, iron present in steel reacts with hot steam to form iron oxide, causing the tank to rust and degrade over time.