

Chemical Reactions and Equations

Class 10 - CBSE Science | Chapter 1 | Worksheet & Test Paper

16 MCQs | 8 board questions | 6 practice problems

Video lesson, notes and an interactive quiz: learn.ultimatetools.io

SECTION A - Multiple Choice Questions (1 mark each)

1. Which of the following is NOT a sign that a chemical reaction has taken place?

- (a) Change in colour
- (b) Evolution of a gas
- (c) Change in temperature
- (d) Change in the container's shape

2. Why is a magnesium ribbon cleaned with sandpaper before burning?

- (a) To make it shine
- (b) To remove the magnesium oxide layer so the fresh metal burns readily
- (c) To heat it up
- (d) To make it thinner

3. A balanced chemical equation obeys the law of:

- (a) Constant proportions
- (b) Conservation of mass
- (c) Conservation of energy
- (d) Multiple proportions

4. $\text{CaO} + \text{H}_2\text{O} \rightarrow \text{Ca(OH)}_2$ is a:

- (a) Decomposition reaction
- (b) Displacement reaction
- (c) Combination reaction (and exothermic)
- (d) Double displacement reaction

5. On heating green ferrous sulphate crystals, the smell produced resembles:

- (a) Rotten eggs
- (b) Burning sulphur
- (c) Vinegar
- (d) Ammonia

6. In the electrolysis of water, the ratio of hydrogen to oxygen collected (by volume) is:

- (a) 1:1
- (b) 1:2
- (c) 2:1
- (d) 3:1

7. White silver chloride kept in sunlight turns grey due to:

- (a) Combination with oxygen
- (b) Photolytic decomposition into silver and chlorine
- (c) Displacement by sunlight
- (d) Rusting

8. An iron nail dipped in copper sulphate solution: what is observed?

- (a) Solution turns colourless
- (b) Solution turns green and a brown coating forms on the nail
- (c) Solution turns red and bubbles appear
- (d) Nothing happens

9. The white precipitate formed when sodium sulphate reacts with barium chloride is:

- (a) NaCl
- (b) BaCl_2
- (c) BaSO_4
- (d) Na_2SO_4

10. In $\text{CuO} + \text{H}_2 \rightarrow \text{Cu} + \text{H}_2\text{O}$, the substance that is OXIDISED is:

- (a) CuO

- (b) H₂
- (c) Cu
- (d) H₂O

11. Respiration is considered a/an:

- (a) Endothermic reaction
- (b) Exothermic reaction
- (c) Neutralisation reaction
- (d) Displacement reaction

12. Chips packets are flushed with nitrogen gas to:

- (a) Make the packet look bigger
- (b) Prevent oxidation of the oils (rancidity)
- (c) Keep the chips crisp by cooling
- (d) Add flavour

13. Coating iron with a layer of zinc to prevent rusting is called:

- (a) Alloying
- (b) Painting
- (c) Galvanisation
- (d) Crystallisation

14. To balance $\text{Fe} + \text{H}_2\text{O} \rightarrow \text{Fe}_3\text{O}_4 + \text{H}_2$, the coefficients of Fe and H₂O are:

- (a) 2 and 3
- (b) 3 and 4
- (c) 4 and 3
- (d) 3 and 2

15. Rusting of iron requires:

- (a) Only air
- (b) Only water
- (c) Both air (oxygen) and moisture
- (d) Only sunlight

16. $\text{Fe}_2\text{O}_3 + 2\text{Al} \rightarrow \text{Al}_2\text{O}_3 + 2\text{Fe}$ is an example of a:

- (a) Combination reaction
- (b) Double displacement reaction
- (c) Displacement reaction
- (d) Decomposition reaction

SECTION B - Board-style Questions

1. Why should a magnesium ribbon be cleaned before burning in air? [2 marks]

2. Balance the following chemical equations: (i) $\text{Fe} + \text{H}_2\text{O} \rightarrow \text{Fe}_3\text{O}_4 + \text{H}_2$ (ii) $\text{NaOH} + \text{H}_2\text{SO}_4 \rightarrow \text{Na}_2\text{SO}_4 + \text{H}_2\text{O}$ (iii) $\text{BaCl}_2 + \text{H}_2\text{SO}_4 \rightarrow \text{BaSO}_4 + \text{HCl}$ [3 marks]

3. Why is respiration considered an exothermic reaction? Explain. [2 marks]

4. Why does the colour of copper sulphate solution change when an iron nail is dipped in it? Write the equation and name the reaction type. [3 marks]

5. What is a precipitation reaction? Explain with an example. [2 marks]

6. Define oxidation and reduction. In the reaction $\text{ZnO} + \text{C} \rightarrow \text{Zn} + \text{CO}$, identify the substance oxidised and the substance reduced. [3 marks]

7. What is rancidity? State two ways to prevent it. [2 marks]

8. A shiny brown coloured element X on heating in air becomes black. Name X and the black compound, and write the reaction. How can the black compound be turned back to X? [3 marks]

SECTION C - Practice Problems

1. Balance: $\text{HNO}_3 + \text{Ca}(\text{OH})_2 \rightarrow \text{Ca}(\text{NO}_3)_2 + \text{H}_2\text{O}$

Hint: Count nitrate groups first - the product needs 2 NO_3 .

2. Balance: $\text{NaCl} + \text{AgNO}_3 \rightarrow \text{AgCl} + \text{NaNO}_3$

Hint: Count every element carefully before changing anything.

3. Balance: $\text{BaCl}_2 + \text{Al}_2(\text{SO}_4)_3 \rightarrow \text{AlCl}_3 + \text{BaSO}_4$

Hint: Start with the sulphate groups (3 of them), then chlorine.

4. Zinc is dipped in silver nitrate solution. Write the balanced equation and name the reaction type.

Hint: Zinc is more reactive than silver; silver nitrate is AgNO_3 .

5. In the reaction $\text{MnO}_2 + 4\text{HCl} \rightarrow \text{MnCl}_2 + \text{Cl}_2 + 2\text{H}_2\text{O}$, identify the substance oxidised and the substance reduced.

Hint: Track who loses oxygen and who loses hydrogen.

6. Your grandmother's silver bangle has turned blackish, and an old iron gate at home shows brown flakes. Name both phenomena and suggest one prevention for the gate.

Hint: Both metals are being slowly attacked by substances in the air - think of the chapter's last section on damaged metal surfaces.

ANSWER KEY

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Section A - MCQ answers

1. (d) Change in the container's shape

The four signs are change of state, colour, gas evolution and temperature change - the container is not part of the reaction.

2. (b) To remove the magnesium oxide layer so the fresh metal burns readily

Magnesium reacts with air forming an MgO coating; removing it exposes fresh metal for easy burning.

3. (b) Conservation of mass

Atoms are neither created nor destroyed, so both sides must have equal atoms of each element.

4. (c) Combination reaction (and exothermic)

Two reactants combine into a single product, releasing heat - combination and exothermic.

5. (b) Burning sulphur

SO₂ and SO₃ gases are released, giving the characteristic burning-sulphur smell.

6. (c) 2:1

Water is 2H₂O → 2H₂ + O₂ - double the volume of hydrogen compared to oxygen.

7. (b) Photolytic decomposition into silver and chlorine

Light decomposes AgCl into grey metallic silver and chlorine gas - used in black & white photography.

8. (b) Solution turns green and a brown coating forms on the nail

Iron displaces copper: FeSO₄ makes the solution green while displaced copper coats the nail brown.

9. (c) BaSO₄

Barium sulphate is insoluble in water and settles as a white precipitate.

10. (b) H₂

H₂ gains oxygen (becoming H₂O) - gaining oxygen is oxidation. CuO loses oxygen, so it is reduced.

11. (b) Exothermic reaction

Glucose combines with oxygen releasing energy - energy released means exothermic.

12. (b) Prevent oxidation of the oils (rancidity)

Nitrogen is unreactive; it keeps oxygen away from the fats and oils, preventing rancidity.

13. (c) Galvanisation

Galvanisation is the protective zinc coating on iron or steel.

14. (b) 3 and 4

3Fe + 4H₂O → Fe₃O₄ + 4H₂ balances iron (3), oxygen (4) and hydrogen (8 atoms each side).

15. (c) Both air (oxygen) and moisture

Rust forms only when iron is exposed to both oxygen and water - remove either and rusting stops.

16. (c) Displacement reaction

Aluminium, being more reactive, displaces iron from its oxide - a displacement reaction (the thermite reaction). Many students wrongly pick double displacement because two compounds appear, but no ions are exchanged.

Section B - Model answers

1. Why should a magnesium ribbon be cleaned before burning in air?

Magnesium reacts with air to form a layer of magnesium oxide on its surface. This layer prevents the metal from burning. Cleaning with sandpaper removes the MgO layer, exposing fresh magnesium so that it burns readily with a dazzling white flame.

2. Balance the following chemical equations: (i) Fe + H₂O → Fe₃O₄ + H₂ (ii) NaOH + H₂SO₄ → Na₂SO₄ + H₂O (iii) BaCl₂ + H₂SO₄ → BaSO₄ + HCl

(i) 3Fe + 4H₂O → Fe₃O₄ + 4H₂. (ii) 2NaOH + H₂SO₄ → Na₂SO₄ + 2H₂O. (iii) BaCl₂ + H₂SO₄ → BaSO₄ + 2HCl.

3. Why is respiration considered an exothermic reaction? Explain.

During respiration, glucose (from digested food) combines with oxygen in our cells to form carbon dioxide and water, releasing energy: C₆H₁₂O₆ + 6O₂ → 6CO₂ + 6H₂O + energy. Since energy is released, respiration is exothermic.

4. Why does the colour of copper sulphate solution change when an iron nail is dipped in it? Write the equation and name the reaction type.

Iron is more reactive than copper, so it displaces copper from copper sulphate: $\text{Fe(s)} + \text{CuSO}_4(\text{aq}) \rightarrow \text{FeSO}_4(\text{aq}) + \text{Cu(s)}$. The blue colour fades to green because ferrous sulphate forms, and reddish-brown copper deposits on the nail. This is a displacement reaction.

5. What is a precipitation reaction? Explain with an example.

A reaction in which an insoluble solid (precipitate) is formed when two solutions are mixed. Example: $\text{Na}_2\text{SO}_4(\text{aq}) + \text{BaCl}_2(\text{aq}) \rightarrow \text{BaSO}_4(\text{s}) (\text{ppt}) + 2\text{NaCl}(\text{aq})$ - white insoluble barium sulphate precipitates out. It is also a double displacement reaction.

6. Define oxidation and reduction. In the reaction $\text{ZnO} + \text{C} \rightarrow \text{Zn} + \text{CO}$, identify the substance oxidised and the substance reduced.

Oxidation is the gain of oxygen or loss of hydrogen; reduction is the loss of oxygen or gain of hydrogen. In $\text{ZnO} + \text{C} \rightarrow \text{Zn} + \text{CO}$: carbon gains oxygen, so C is oxidised; zinc oxide loses oxygen, so ZnO is reduced.

7. What is rancidity? State two ways to prevent it.

Rancidity is the oxidation of fats and oils in food, which spoils their smell and taste. Prevention: (i) adding antioxidants, (ii) storing food in airtight containers / flushing packets with nitrogen / refrigeration (any two).

8. A shiny brown coloured element X on heating in air becomes black. Name X and the black compound, and write the reaction. How can the black compound be turned back to X?

X is copper (Cu); the black compound is copper(II) oxide (CuO): $2\text{Cu} + \text{O}_2 \xrightarrow{\text{heat}} 2\text{CuO}$. Passing hydrogen gas over heated CuO reduces it back to copper: $\text{CuO} + \text{H}_2 \xrightarrow{\text{heat}} \text{Cu} + \text{H}_2\text{O}$.

Section C - Solutions

1. Balance: $\text{HNO}_3 + \text{Ca(OH)}_2 \rightarrow \text{Ca(NO}_3)_2 + \text{H}_2\text{O}$

$2\text{HNO}_3 + \text{Ca(OH)}_2 \rightarrow \text{Ca(NO}_3)_2 + 2\text{H}_2\text{O}$. Check: H 4|4, N 2|2, O 8|8, Ca 1|1.

2. Balance: $\text{NaCl} + \text{AgNO}_3 \rightarrow \text{AgCl} + \text{NaNO}_3$

It is already balanced! Na 1|1, Cl 1|1, Ag 1|1, N 1|1, O 3|3. (Also a double displacement - white AgCl precipitates.)

3. Balance: $\text{BaCl}_2 + \text{Al}_2(\text{SO}_4)_3 \rightarrow \text{AlCl}_3 + \text{BaSO}_4$

$3\text{BaCl}_2 + \text{Al}_2(\text{SO}_4)_3 \rightarrow 2\text{AlCl}_3 + 3\text{BaSO}_4$. Check: Ba 3|3, Cl 6|6, Al 2|2, SO₄ 3|3.

4. Zinc is dipped in silver nitrate solution. Write the balanced equation and name the reaction type.

$\text{Zn} + 2\text{AgNO}_3 \rightarrow \text{Zn(NO}_3)_2 + 2\text{Ag}$ - a displacement reaction; shiny silver deposits form.

5. In the reaction $\text{MnO}_2 + 4\text{HCl} \rightarrow \text{MnCl}_2 + \text{Cl}_2 + 2\text{H}_2\text{O}$, identify the substance oxidised and the substance reduced.

HCl is oxidised (loses hydrogen, forming Cl₂), and MnO₂ is reduced (loses oxygen, forming MnCl₂).

6. Your grandmother's silver bangle has turned blackish, and an old iron gate at home shows brown flakes. Name both phenomena and suggest one prevention for the gate.

Both are corrosion: silver reacts (with sulphur compounds in air) forming black silver sulphide; iron rusts to brown Fe₂O₃.xH₂O in moist air. The gate can be protected by painting (or oiling/galvanisation).

