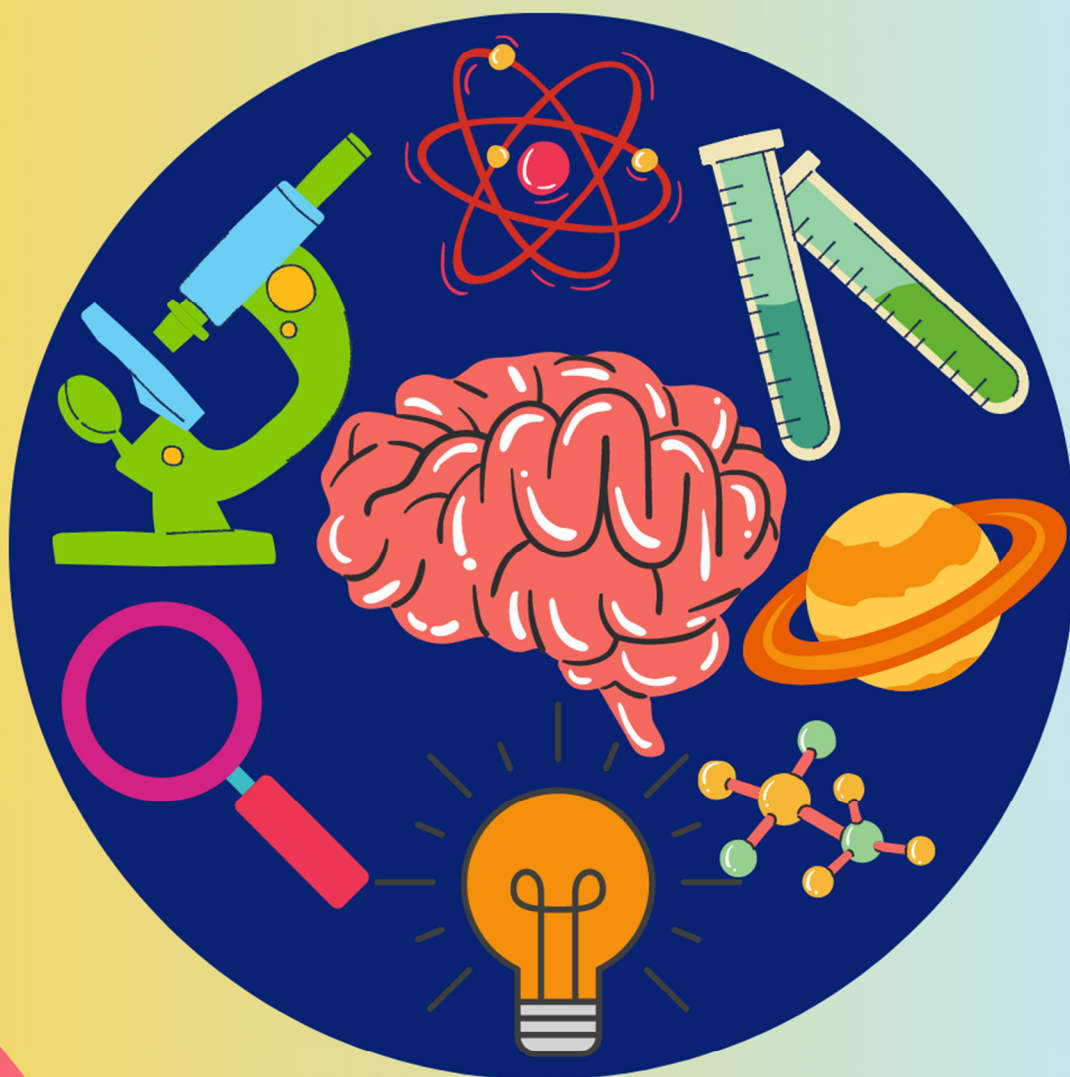


# SCIENCE WORKBOOK

10

For the preparation of National  
& International Olympiads



- Chapter-wise practice exercises
- Previous year paper

**CREST Science Olympiad (CSO)**

# Science Olympiad

## Exams Preparation Book

CSO | NSO | USO | iOS | NSTSE | HSO

**Grade 10**



#CRESTInnovator

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## CREST Science Olympiad Workbook for Grade 10

Fourth Edition

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**Disclaimer:** The information in the Workbook is to give you the path to success but it does not guarantee 100% success as the strategy is completely dependent on its execution. And it is based on previous year papers of CSO exam.

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# Preface

We are pleased to launch a thoroughly revised edition of this workbook. We welcome feedback from students, teachers, educators and parents. For improvements in the next edition, please send your suggestions at [info@crestolympiads.com](mailto:info@crestolympiads.com). Our team will make an effort to work on those suggestions. The status of the improvements can be checked at <https://www.crestolympiads.com/corrections-class10-652>

CREST Olympiads is one of the largest Olympiad Exams with students from more than 60 countries. The objective of these exams is to build a competitive spirit while evaluating students on conceptual understanding of the concepts.

We strive to provide a superior learning experience, and this workbook is designed to complement the school studies and prepare the students for various competitive exams including the CREST Olympiads. This workbook provides a crisp summary of the topics followed by the practice questions. These questions encourage the students to think analytically, to be creative and to come up with solutions of their own. There is a previous year's paper given at the end of this workbook for the students to attempt after completing the syllabus. This paper should be attempted in 1 hour to get an assessment of the student's preparation for the final exam.

*Publishers*



## Chapter

## 1

# Chemical Reactions and Equations

## Chemical Reactions

A chemical reaction is the chemical change in which one or more substance(s) or reactant(s) react(s) to form new substance(s) with different properties.

## Indication of Chemical Reaction

A chemical reaction can be determined by either of the following changes:

- Change in state
- Change in colour
- Evolution of gas
- Change in temperature
- Formation of a precipitate

## Chemical Equations

A chemical equation shows a change of reactants to products.

A word equation is a chemical reaction expressed in words.

Sodium + Chlorine  $\rightarrow$  Sodium chloride

The word equation can be converted into a symbol equation by writing symbol and formula of the substance in place of their name.

$\text{Na} + \text{Cl} \rightarrow \text{NaCl}$

## Balanced Equations

A balanced chemical equation is that in which number of atoms of each element in the reactants side is equal to that of the product side.

$\text{Na} + \text{Cl}_2 \rightarrow \text{NaCl}$  (Unbalanced reaction)

Balancing of chemical equation is based on the law of conservation of mass. This means, the total mass of the products formed in a chemical reaction is equal to the total mass of the reactants participated in a chemical reaction.

$2\text{Na} + \text{Cl}_2 \rightarrow 2\text{NaCl}$  (Balanced reaction)

$\text{Fe} + \text{H}_2\text{O} \rightarrow \text{Fe}_3\text{O}_4 + \text{H}_2$  (Unbalanced equation)

$3\text{Fe} + 4\text{H}_2\text{O} \rightarrow \text{Fe}_3\text{O}_4 + 4\text{H}_2$  (Balanced equation)

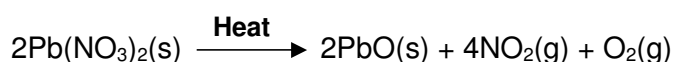
### Types of Chemical Reactions

**Combination Reaction:** In this reaction, two or more substances (reactants) combine to form a single substance (product).

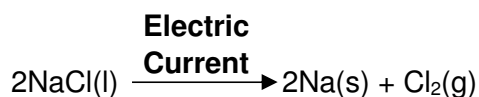
- Element + Element  $\rightarrow$  Compound  
 $2\text{Na} + \text{Cl}_2 \rightarrow 2\text{NaCl}$
- Element + Compound  $\rightarrow$  Compound  
 $2\text{NO} + \text{O}_2 \rightarrow 2\text{NO}_2$
- Compound + Compound  $\rightarrow$  Compound  
 $\text{CaO} + \text{SO}_3 \rightarrow \text{CaSO}_4$

**Decomposition Reaction:** In this reaction, a single substance (reactant) breaks down, on the application of heat or light or electricity, to form two or more simple substance (products).

- **Thermal Decomposition:** Decomposition of a substance on heating is called thermal decomposition.



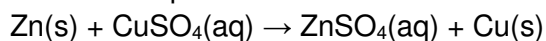
- **Electrolytic Decomposition:** Decomposition of a substance on passing of electricity is called electrolytic decomposition.



- **Photolysis or Photochemical Decomposition:** Decomposition of a substance on absorbing light energy is called photolysis.



**Displacement Reaction:** In this reaction, more reactive element displaces a less reactive element from its compound or solution.



As zinc is more reactive than copper, it displaces copper from copper sulphate solution, to form zinc sulphate and copper metal.

## Reactivity Series

### Reactivity Series of Metals

	Potassium	K	(Most reactive metal)
	Sodium	Na	
	Calcium	Ca	
	Magnesium	Mg	
These metal are more reactive than hydrogen	Aluminium	Al	
	Zinc	Zn	
	Iron	Fe	
	Tin	Sn	
	Lead	Pb	
	[Hydrogen]	[H]	
These metal are less reactive than hydrogen	Copper	Cu	
	Mercury	Hg	
	Silver	Ag	
	Gold	Au	(Least reactive metal)

## Double Displacement Reaction

In this reaction, two reactant exchange ions to form two new compounds.



- **Precipitation Reaction:** In this reaction, precipitate is formed by mixing of the aqueous solution of two salts.



- **Neutralisation Reaction:** In this reaction, an acid reacts with base to form salt and water by exchange of ions.



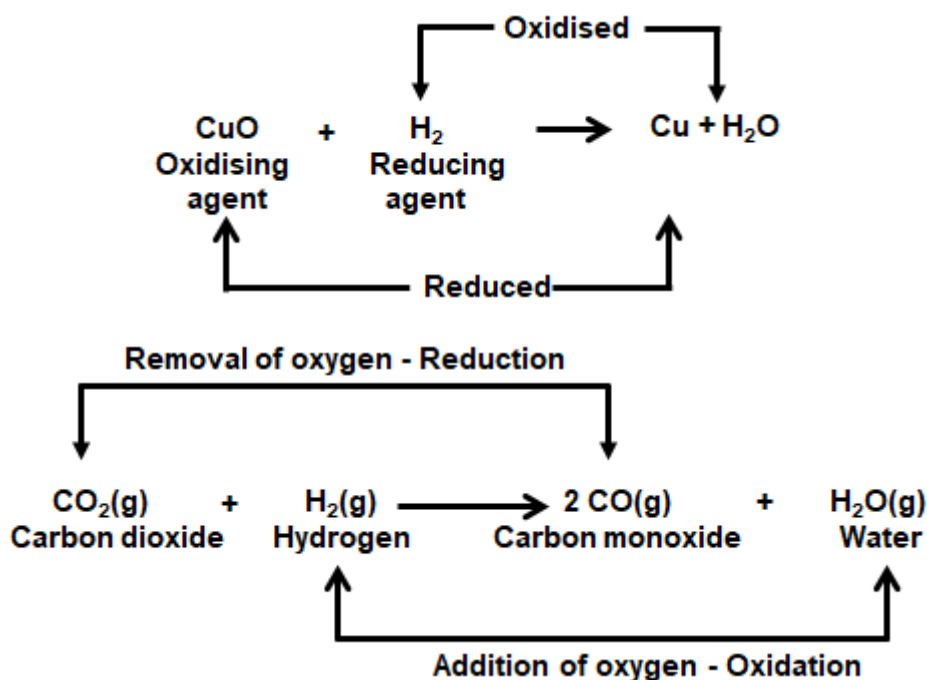
## Oxidation and Reduction Reaction

- **Oxidation:** In this reaction, substance loses electrons or gains oxygen or loses hydrogen. A substance which either gives oxygen or removes hydrogen in an oxidation reaction is called oxidising agent. A substance in which oxygen is added or hydrogen is removed is said to be oxidised.



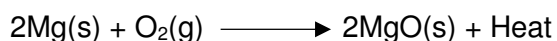
- Reduction:** In this reaction, substance gains electrons or loses oxygen or gains hydrogen. A substance which either gives hydrogen or removes oxygen for reduction is called reducing agent. A substance in which hydrogen is added or oxygen is removed is said to be reduced.

The reaction in which oxidation and reduction take place simultaneously is called redox reaction.



**Exothermic Reaction:** This reaction is accompanied by the evolution of heat. For example, Respiration

Burning of magnesium ribbon is an exothermic reaction

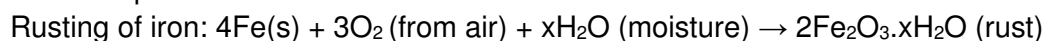


**Endothermic Reaction:** In this reaction, heat energy is absorbed. For example, Photosynthesis



## Effects of Oxidation Reactions in Our Daily Life

**Corrosion:** The process of slow conversion of metals into their undesirable compounds by the reaction of air, water, acids, gases, chemicals present in the atmosphere is called corrosion. For example:



Corrosion of copper:  $\text{Cu(s)} + \text{H}_2\text{O (moisture)} + \text{CO}_2 \text{ (from air)} \rightarrow \text{CuCO}_3 \cdot \text{Cu(OH)}_2 \text{ (green)}$

**Rancidity:** The process of slow oxidation of oil and fat present in the food material when they are left exposed in air for long time is called rancidity. It changes the taste and smell of the food material.

## Practice Questions

1. Consider the following equations and choose the correct option:

- I.  $2\text{HI} + \text{Cl}_2 \rightarrow \text{I}_2 + 2\text{HCl}$
- II.  $\text{Mg} + \text{Cl}_2 \rightarrow \text{MgCl}_2 + \text{H}_2$
- III.  $2\text{Na} + \text{Cl}_2 \rightarrow 2\text{NaCl}$

- a. Displacement reaction – I, II and Combination reaction – III
- b. Combination reaction – I, II and Precipitation reaction – III
- c. Neutralisation reaction – II and Combination reaction – I, II
- d. Displacement reaction – II and Combination reaction – I, III

2. Consider the following statements and choose the correct option:

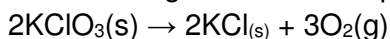
Statement 1: The burning of carbon-containing compounds uses oxygen, from air, and produces carbon dioxide, water. This is an example of exothermic reaction.

Statement 2:  $\text{Zn} + \text{CuSO}_4 \rightarrow \text{ZnSO}_4 + \text{Cu}$  is a double displacement reaction.

- a. Statement 1 is correct but statement 2 is incorrect.
- b. Statement 1 is incorrect but statement 2 is correct.
- c. Both the statements are correct.
- d. Both the statements are incorrect.

3. Oxygen is prepared by catalytic decomposition of potassium chlorate ( $\text{KClO}_3$ ). Decomposition of potassium chlorate gives potassium chloride ( $\text{KCl}$ ) and oxygen ( $\text{O}_2$ ).

The following reaction takes place:



How many grams of  $\text{KClO}_3$  are required to produce 192 grams of  $\text{O}_2$ ?

- a. 490 g
- b. 320 g
- c. 249 g
- d. 467 g

4. Peter was provided with two containers made up of copper and aluminium. He was also provided with solutions of dil.  $\text{HCl}$ , dil.  $\text{HNO}_3$ ,  $\text{ZnCl}_2$  and  $\text{H}_2\text{O}$ . Choose the correct option regarding the storage of the given solutions:

- a. Dil.  $\text{HCl}$ ,  $\text{ZnCl}_2$  and  $\text{H}_2\text{O}$  can be kept in aluminium container.
- b. Dil.  $\text{HCl}$ , dil.  $\text{HNO}_3$ ,  $\text{ZnCl}_2$  and  $\text{H}_2\text{O}$  can be kept in copper container.
- c. Dil.  $\text{HCl}$  and  $\text{ZnCl}_2$  cannot be kept in aluminium container
- d. Dil.  $\text{HNO}_3$ ,  $\text{ZnCl}_2$  and  $\text{H}_2\text{O}$  cannot be kept in copper container.

- Which one of the following salt solutions on reaction with excess sodium hydroxide solution gives a clear solution finally?
  - $(\text{PbNO}_3)_2$  (aq)
  - $\text{CuSO}_4$  (aq)
  - $\text{FeCl}_3$  (aq)
  - $\text{ZnSO}_4$  (aq)
- Which of the following is a displacement reaction?
  - $\text{NaBr} + \text{Ca}(\text{OH})_2 \rightarrow \text{CaBr}_2 + \text{NaOH}$
  - $\text{NH}_3 + \text{H}_2\text{SO}_4 \rightarrow (\text{NH}_4)_2 \text{SO}_4$
  - $\text{C}_5\text{H}_9\text{O} + \text{O}_2 \rightarrow \text{CO}_2 + \text{H}_2\text{O}$
  - Only I
  - Only II
  - I and III
  - II and III
- Identify the substance oxidised, reduced, oxidising agent and reducing agent in the following reaction:
$$2\text{Al} + \text{HCl} \rightarrow 2\text{AlCl}_3 + 3\text{H}_2$$
  - Substance oxidised – Al, Substance reduced – HCl, Oxidising agent – HCl, Reducing agent – Al
  - Substance oxidised – Cl, Substance reduced – HCl, Oxidising agent – HCl, Reducing agent – Al
  - Substance oxidised – HCl, Substance reduced – Cl, Oxidising agent – HCl, Reducing agent – Al
  - Substance oxidised – Al, Substance reduced – Cl, Oxidising agent – HCl, Reducing agent – Cl
- Balance the following chemical reaction and choose the correct value of sum of co-efficient of the products:
$$\text{H}_3\text{PO}_4 + \text{Mg}(\text{OH})_2 \rightarrow \text{Mg}_3(\text{PO}_4)_2 + \text{H}_2\text{O}$$
  - 6
  - 8
  - 3
  - 4
- Why does the blue colour of  $\text{CuSO}_4$  solution fades away when Mg wire is kept in this solution?
  - Due to the formation of  $\text{ZnSO}_4$
  - Due to the formation of  $\text{MgSO}_4$
  - Due to the formation of  $\text{CuSO}_4$
  - None of the above
- If the formula of metal nitride is MN, the formula of the metal sulphate is \_\_\_\_\_.
  - $\text{M}_2(\text{SO}_4)_3$
  - $\text{M}(\text{SO}_4)_3$
  - $\text{M}_2(\text{SO}_4)$
  - $\text{M}(\text{SO}_4)$