



CLASS 10 · CBSE SCIENCE (086)

Science Solved Board Papers

Chapter-wise and year-wise CBSE board questions with complete step-by-step solutions

10 years · 2016–2026

- ✓ Part A: every question sorted chapter-wise, grouped by marks, with full solutions
- ✓ Part B: complete board papers, each followed by its solutions
- ✓ Board weightage table and most-asked topics for every chapter
- ✓ Answers written to the CBSE marking-scheme points
- ✓ Only the 2026-27 syllabus: questions on deleted topics are flagged

WHAT YOU GET

10 years of CBSE Science papers. Every question solved. Sorted chapter-wise.

17

board papers

608

solved questions

10

years · 2016–26

13

chapters

98

diagrams

X Questions scattered across years



✓ All in one place, chapter-wise

X Don't know what to study first



✓ Weightage + most-asked topics

X One-line answers online



✓ Full solutions, board-style

X Old books carry deleted topics



✓ Only the 2026-27 syllabus

PART A**Chapter-wise****A**

- ✓ Weightage table
- ✓ Most-asked topics
- ✓ Every question + solution

PART B**Full papers****B**

- ✓ Exactly as set by CBSE
- ✓ Solutions after each paper
- ✓ Timed 3-hour practice

2026 · 31/2/1

2026 · 31/3/1

2025 · 31/1/1

2025 · 31/2/1

2024 · 31/4/1

2024 · 31/5/1

2023 · 31/2/1

2023 · 31/4/1

2022 · 31/1/1 · T2

2022 · 31/3/1 · T2

2020 · 31/2/1

2020 · 31/4/1

2019 · 31/2/1

2019 · 31/4/1

2018 · 31/1

2017 · Set 3

2016 · 31/1


Complete Notes · Solved PYQs

CLASS 6–12 · ALL SUBJECTS

100%
 QUESTIONS
 SOLVED
Made for **board toppers**

How to use this book

Part A puts every board question of a chapter together, from 1-mark MCQs to 5-mark long answers. Finish a chapter in your notes, then solve its Part A questions without looking at the solutions. Check your answer, mark the ones you got wrong, and repeat them a week later.

Each question shows where it was asked, for example **CBSE 2026 · 31/2/1 · Q13**. Use the weightage table and the most-asked topics chart at the start of each chapter to decide what to revise first.

Part B gives full papers. In the last month before the exam, sit with a clock and write one paper in 3 hours, then check it with the solutions that follow the paper.

Solutions are written the way the board awards marks: key words, equations, units and labelled diagrams. Write your answers the same way.

Contents

Part A · Chapter-wise questions with solutions

- | | |
|---|---|
| 1. Chemical Reactions and Equations 42 Qs | 8. Heredity 31 Qs |
| 2. Acids, Bases and Salts 46 Qs | 9. Light – Reflection and Refraction 61 Qs |
| 3. Metals and Non-metals 45 Qs | 10. The Human Eye and the Colourful World 43 Qs |
| 4. Carbon and its Compounds 58 Qs | 11. Electricity 54 Qs |
| 5. Life Processes 60 Qs | 12. Magnetic Effects of Electric Current 31 Qs |
| 6. Control and Coordination 32 Qs | 13. Our Environment 42 Qs |
| 7. How do Organisms Reproduce? 63 Qs | |

Part B · Full board papers, each followed by its solutions

- | | |
|---------------------------------|---|
| 1. CBSE 2026 · 31/2/1 solutions | 9. CBSE 2022 · 31/1/1 · Term 2 solutions |
| 2. CBSE 2026 · 31/3/1 solutions | 10. CBSE 2022 · 31/3/1 · Term 2 solutions |
| 3. CBSE 2025 · 31/1/1 solutions | 11. CBSE 2020 · 31/2/1 solutions |
| 4. CBSE 2025 · 31/2/1 solutions | 12. CBSE 2020 · 31/4/1 solutions |
| 5. CBSE 2024 · 31/4/1 solutions | 13. CBSE 2019 · 31/2/1 solutions |
| 6. CBSE 2024 · 31/5/1 solutions | 14. CBSE 2019 · 31/4/1 solutions |
| 7. CBSE 2023 · 31/2/1 solutions | 15. CBSE 2018 · 31/1 solutions |
| 8. CBSE 2023 · 31/4/1 solutions | 16. CBSE 2017 · Set 3 solutions |
| | 17. CBSE 2016 · 31/1 solutions |

608 questions in all. Questions are taken from the CBSE Class 10 Science board papers and the solutions are our own. Questions on topics deleted from the 2026-27 syllabus are left out of Part A and marked in Part B.

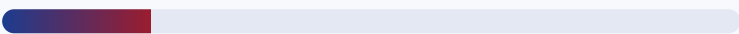
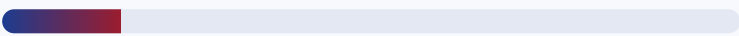
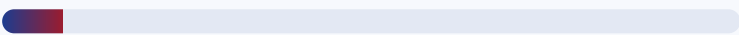
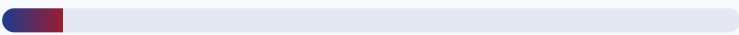
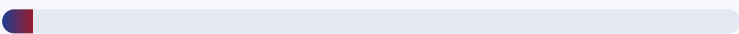
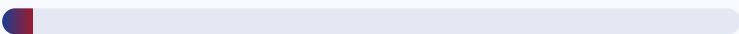
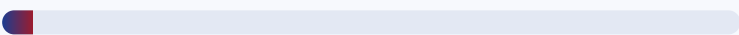
CHAPTER 1

Chemical Reactions and Equations

Board weightage 2016–2026

Year	2016	2017	2018	2019	2020	2022	2023	2024	2025	2026
Questions	–	–	2	5	5	–	9	8	6	7
Marks	–	–	5	13	11	–	15	20	11	11

Most asked topics

Types of reactions		25
Balancing equations		5
Oxidation and reduction		4
Corrosion and rancidity		2
Exothermic and endothermic		2
Chemical change		1
Chemical reactions		1
Chemical equations		1

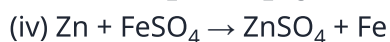
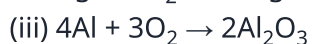
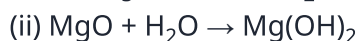
42 questions from 13 papers. Repeated questions are shown once with every year they were asked.

1 mark: MCQ and Assertion–Reason

CBSE 2026 · 31/2/1 · Q17

1 mark

Which of the following are combination reactions?



(A) (i) and (iii)

(B) (iii) and (iv)

(C) (ii) and (iv)

(D) (ii) and (iii)

Solution

Answer: (D) (ii) and (iii)

In a combination reaction two or more reactants form a single product: (ii) $\text{MgO} + \text{H}_2\text{O} \rightarrow \text{Mg(OH)}_2$ and (iii) $4\text{Al} + 3\text{O}_2 \rightarrow 2\text{Al}_2\text{O}_3$. (i) is decomposition and (iv) is displacement.

CBSE 2026 · 31/2/1 · Q19

1 mark

When ferrous sulphate crystals are heated in a test tube, we observe that:

(A) A colourless gas with no smell is evolved.

(B) A brown gas is evolved.

(C) The green colour of the salt fades and a gas with the smell of burning sulphur is evolved.

(D) The green colour of the salt fades and no gas is evolved.

Solution**Answer: (C)**

$2\text{FeSO}_4 \rightarrow \text{Fe}_2\text{O}_3 + \text{SO}_2 + \text{SO}_3$ (thermal decomposition). The green crystals lose water and change colour, and SO_2/SO_3 gases with the smell of burning sulphur are given off.

CBSE 2026 · 31/2/1 · Q23

1 mark

A student notices that her silver jewellery turned dull and had a grey-black coating over it after wearing for a few months. What results in the change in colour of the silver metal?

- (A) The polish over the jewellery was removed after wearing for a few months.
- (B) The jewellery comes in contact with air, moisture and acids and corrodes.
- (C) Dust particles over the jewellery change its colour.
- (D) Its colour changes due to rusting.

Solution**Answer: (B)**

Silver corrodes: it reacts with sulphur compounds in the air to form a black coating of silver sulphide. (Rusting is the corrosion of iron only.)

CBSE 2026 · 31/3/1 · Q17

1 mark

Which of the following is an example of a displacement reaction?

- (A) The combustion of natural gas
- (B) The reaction of a reactive metal with dilute acid
- (C) The electrolysis of water
- (D) The reaction of quick lime with water

Solution**Answer: (B)**

A reactive metal displaces hydrogen from the acid, e.g. $\text{Zn} + \text{H}_2\text{SO}_4 \rightarrow \text{ZnSO}_4 + \text{H}_2$. (A) is combustion, (C) is decomposition and (D) is combination.

CBSE 2026 · 31/3/1 · Q19

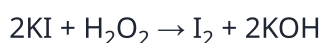
1 mark

In the following equation: $x \text{KI} + \text{H}_2\text{O}_2 \rightarrow \text{I}_2 + y \text{KOH}$, x and y respectively are:

- (A) 2, 2
- (B) 1, 2
- (C) 2, 1
- (D) 1, 1

Solution**Answer: (A) 2, 2**

I_2 on the right needs 2 iodine atoms, so $x = 2$. Then 2 K atoms need $y = 2$. Check O: 2 on each side; H: 2 on each side.



CBSE 2025 · 31/1/1 · Q1

1 mark

Electrolysis of water is a decomposition reaction. The mass ratio ($M_H : M_O$) of hydrogen and oxygen gases liberated at the electrodes during electrolysis of water is:

- (A) 8 : 1 (B) 2 : 1
(C) 1 : 2 (D) 1 : 8

Solution**Answer: (D) 1 : 8**

$2H_2O \rightarrow 2H_2 + O_2$. Mass of $2H_2 = 2 \times 2 = 4$ u; mass of $O_2 = 32$ u. Ratio $4 : 32 = 1 : 8$. (By *volume* the ratio is 2 : 1 — do not confuse the two.)

CBSE 2025 · 31/1/1 · Q17

1 mark

Assertion (A): Decomposition reactions are generally endothermic reactions.

Reason (R): Decomposition of organic matter into compost is an exothermic process.

(A) Both A and R are true and R is the correct explanation of A. (B) Both A and R are true but R is not the correct explanation of A. (C) A is true but R is false. (D) A is false but R is true.

Solution**Answer: (B)**

Both are true. Most decomposition reactions need energy (heat, light or electricity) to break the reactant, so they are endothermic. Composting releases heat. But R is an exception and does not explain A.

CBSE 2025 · 31/2/1 · Q1

1 mark

The correct balanced chemical equation showing exothermic reaction in which natural gas burns in air is:

- (A) $CH_4 + O_2 \rightarrow CO_2 + 2H_2O$
(B) $CH_4 + 2O_2 \rightarrow 2CO_2 + 2H_2O + \text{Energy}$
(C) $CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$
(D) $CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O + \text{Energy}$

Solution**Answer: (D)**

Methane (natural gas) burns: $CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O + \text{energy}$. Check: C 1 = 1; H 4 = 4; O 4 = 2 + 2. (A) and (B) are not balanced, and (C) does not show the energy released (exothermic).

CBSE 2024 · 31/4/1 · Q1

1 mark

$Zn + 2CH_3COOH \rightarrow (CH_3COO)_2Zn + H_2$. The above reaction is a:

- (A) Decomposition reaction (B) Displacement reaction
(C) Double displacement reaction (D) Combination reaction

Solution**Answer: (B) Displacement reaction**

Zinc, being more reactive, displaces hydrogen from ethanoic acid, forming zinc ethanoate and hydrogen gas.

CBSE 2024 · 31/5/1 · Q1

1 mark

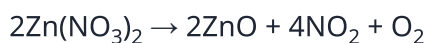
To balance the following chemical equation, the values of the coefficients x, y and z must be respectively: $x \text{Zn}(\text{NO}_3)_2 \rightarrow y \text{ZnO} + z \text{NO}_2 + \text{O}_2$

(A) 4, 2, 2

(B) 4, 4, 2

(C) 2, 2, 4

(D) 2, 4, 2

Solution**Answer: (C) 2, 2, 4**

Check: Zn 2 = 2; N 4 = 4; O 12 = 2 + 8 + 2.

CBSE 2024 · 31/5/1 · Q2

1 mark

Which of the following is a redox reaction, but **not** a combination reaction?

(A) $\text{C} + \text{O}_2 \rightarrow \text{CO}_2$ (B) $2\text{H}_2 + \text{O}_2 \rightarrow 2\text{H}_2\text{O}$ (C) $2\text{Mg} + \text{O}_2 \rightarrow 2\text{MgO}$ (D) $\text{Fe}_2\text{O}_3 + 3\text{CO} \rightarrow 2\text{Fe} + 3\text{CO}_2$ **Solution****Answer: (D)**

In (D) Fe_2O_3 loses oxygen (reduced) and CO gains oxygen (oxidised), so it is a redox reaction; it gives two products, so it is not a combination reaction. (A), (B) and (C) are redox reactions that are also combination reactions.

CBSE 2023 · 31/2/1 · Q1

1 mark

Which of the following is an example of endothermic process?

(a) Formation of slaked lime

(b) Decomposition of vegetable matter into compost

(c) Dissolution of ammonium chloride in water

(d) Digestion of food in our body

Solution**Answer: (c)**

When ammonium chloride dissolves in water, heat is absorbed and the solution becomes cold — an endothermic process. The other three release heat (exothermic).

CBSE 2023 · 31/2/1 · Q3

1 mark

In order to balance the following chemical equation, the values of the coefficients x and y respectively are: $x \text{ Pb(NO}_3)_2 \xrightarrow{\text{heat}} 2\text{PbO} + y \text{ NO}_2 + \text{O}_2$

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

Solution**Answer: (a) 2, 4**

Check: Pb 2 = 2; N 4 = 4; O 12 = 2 + 8 + 2.

CBSE 2023 · 31/4/1 · Q2

1 mark

When aqueous solutions of potassium iodide and lead nitrate are mixed, an insoluble substance separates out. The chemical equation for the reaction involved is:

- (a) $\text{KI} + \text{PbNO}_3 \rightarrow \text{PbI} + \text{KNO}_3$
(b) $2\text{KI} + \text{Pb(NO}_3)_2 \rightarrow \text{PbI}_2 + 2\text{KNO}_3$
(c) $\text{KI} + \text{Pb(NO}_3)_2 \rightarrow \text{PbI} + \text{KNO}_3$
(d) $\text{KI} + \text{PbNO}_3 \rightarrow \text{PbI}_2 + \text{KNO}_3$

Solution**Answer: (b)**

Lead is divalent (Pb^{2+}), so lead nitrate is $\text{Pb(NO}_3)_2$ and lead iodide is PbI_2 (the yellow precipitate). Only (b) has correct formulae and is balanced.

CBSE 2023 · 31/4/1 · Q3

1 mark

A metal ribbon 'X' burns in oxygen with a dazzling white flame forming a white ash 'Y'. The correct description of X, Y and the type of reaction is:

- (a) X = Ca; Y = CaO; Type of reaction = Decomposition
(b) X = Mg; Y = MgO; Type of reaction = Combination
(c) X = Al; Y = Al_2O_3 ; Type of reaction = Thermal decomposition
(d) X = Zn; Y = ZnO; Type of reaction = Endothermic

Solution**Answer: (b)**

A magnesium ribbon burns with a dazzling white flame forming white magnesium oxide: $2\text{Mg} + \text{O}_2 \rightarrow 2\text{MgO}$ — a combination reaction.

CBSE 2023 · 31/4/1 · Q17

1 mark

Assertion (A): Reaction of Quicklime with water is an exothermic reaction.

Reason (R): Quicklime reacts vigorously with water releasing a large amount of heat.

(A) Both A and R are true and R is the correct explanation of A. (B) Both A and R are true but R is not the correct explanation of A. (C) A is true but R is false. (D) A is false but R is true.

Solution**Answer: (a)**

Both are true and R explains A: $\text{CaO} + \text{H}_2\text{O} \rightarrow \text{Ca(OH)}_2 + \text{heat}$. A reaction that releases heat is exothermic.

CBSE 2020 · 31/2/1 · Q10

1 mark

Identify 'x', 'y' and 'z' in the following reaction: $2\text{KClO}_3(\text{x}) \xrightarrow{(\text{y})} 2\text{KCl}(\text{x}) + \text{O}_2(\text{z})$

- (a) x = gas; y = reaction condition, z = gas
- (b) x = solid; y = liquid; z = gas
- (c) x = number of moles of KClO_3 ; y = reaction condition; z = no. of molecules of oxygen.
- (d) x = physical state of KClO_3 and KCl ; y = reaction condition; z = physical state of O_2 .

Solution**Answer: (d)**

The symbols in brackets show the physical states — $2\text{KClO}_3(\text{s}) \rightarrow 2\text{KCl}(\text{s}) + 3\text{O}_2(\text{g})$ — and the condition (heat) is written above the arrow.

CBSE 2020 · 31/4/1 · Q13

1 mark

Assertion (A): Following is a balanced chemical equation for the action of steam on iron: $3\text{Fe} + 4\text{H}_2\text{O} \rightarrow \text{Fe}_3\text{O}_4 + 4\text{H}_2$

Reason (R): The law of conservation of mass holds good for a chemical equation.

(A) Both A and R are true and R is the correct explanation of A. (B) Both A and R are true but R is not the correct explanation of A. (C) A is true but R is false. (D) A is false but R is true.

Solution**Answer: (a)**

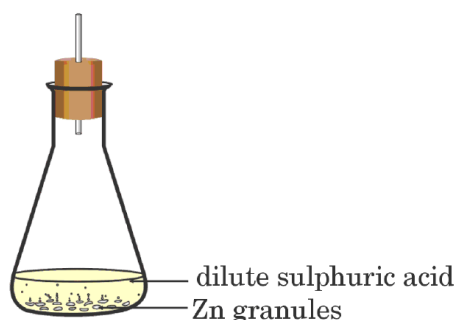
Check: Fe 3 = 3; H 8 = 8; O 4 = 4 — the equation is balanced, so A is true. R is true, and it is the reason a chemical equation must be balanced (mass is neither created nor destroyed, so the number of atoms of each element is the same on both sides).

2 marks: very short answer

CBSE 2025 · 31/1/1 · Q21

2 marks

A student performs the following experiment in his school laboratory.



List two observations to justify that in this experiment a chemical change has taken place.

Solution

Zinc granules react with dilute sulphuric acid: $\text{Zn} + \text{H}_2\text{SO}_4 \rightarrow \text{ZnSO}_4 + \text{H}_2$.

1. **Evolution of a gas** — bubbles of hydrogen are seen around the zinc granules.

2. **Change (rise) in temperature** — the flask becomes warm.

(Also, the zinc granules slowly get smaller.)

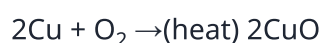
CBSE 2024 · 31/5/1 · Q21(a)

2 marks

Copper powder is taken in a china dish and heated over a burner. Name the product formed and state its colour. Write the chemical equation for the reaction involved.

Solution

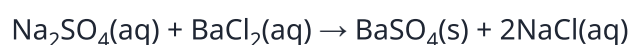
Product: **copper(II) oxide**, which is **black** (the surface of the brown copper powder turns black).



CBSE 2024 · 31/5/1 · Q21(b)

2 marks

Write chemical equation for the chemical reaction which occurs when the aqueous solutions of barium chloride and sodium sulphate react together. Write the symbols of the ions present in the compound precipitated in the reaction.

Solution

A white precipitate of **barium sulphate** forms (double displacement / precipitation reaction). Ions present in it: **Ba²⁺** and **SO₄²⁻**.

CBSE 2023 · 31/2/1 · Q21(a)

2 marks

What is observed when aqueous solutions of potassium iodide and lead nitrate are mixed together? Name the type of reaction and write the chemical equation for the reaction that occurs.

Solution

A **yellow precipitate** of lead iodide is formed.

Type: **double displacement (precipitation) reaction**.



CBSE 2023 · 31/2/1 · Q21(b)

2 marks

When copper powder is heated in a watch glass, a black substance is formed. (i) Why is this black substance formed? Name it. (ii) How can this black substance be reversed to its original form?

Solution

(i) Copper combines with oxygen of the air (oxidation), forming **copper(II) oxide** (black): $2\text{Cu} + \text{O}_2 \rightarrow 2\text{CuO}$.

(ii) Pass **hydrogen gas** over the heated black copper oxide; it is reduced back to brown copper:



CBSE 2019 · 31/2/1 · Q4(b)

2 marks

Silver articles become black when kept in open for some time, whereas copper vessels lose their shiny brown surfaces and gain a green coat when kept in open. Name the substances present in air with which these metals react and write the name of the products formed.

Solution

- **Silver** reacts with **sulphur (compounds such as H_2S)** in the air to form a black coating of **silver sulphide** (Ag_2S).
- **Copper** reacts with **moist carbon dioxide** (and oxygen, water) in the air to form a green coating of **basic copper carbonate** ($\text{CuCO}_3 \cdot \text{Cu}(\text{OH})_2$).

CBSE 2019 · 31/4/1 · Q22(a)

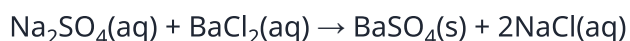
2 marks

A student mixes sodium sulphate powder in barium chloride powder. What change would the student observe on mixing the two powders? Justify your answer and explain how he can obtain the desired change.

Solution

No change is observed. In the solid state the ions are not free to move, so the reaction does not take place.

To obtain the change, he should prepare **aqueous solutions** of both and mix them: a **white precipitate** of barium sulphate forms (double displacement):



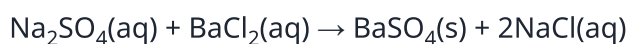
CBSE 2018 · 31/1 · Q23

2 marks

What is observed when a solution of sodium sulphate is added to a solution of barium chloride taken in a test tube? Write equation for the chemical reaction involved and name the type of reaction in this case.

Solution

A **white precipitate** of barium sulphate is formed.



Double displacement (precipitation) reaction.

3 marks: short answer

CBSE 2026 · 31/2/1 · Q27

3 marks

Seema took a small amount of copper powder in a china dish and heated it. What changes will she observe on heating? When H_2 gas is passed over this heated substance, what visible changes will be seen in it? Give the chemical equations of the reactions involved, along with the names and colours of the products in each case.

Solution

On heating: the brown copper powder becomes coated with a **black** substance, copper(II) oxide, because copper combines with oxygen of air (oxidation).



On passing hydrogen over the hot black substance: the black coating turns **brown** again as copper is formed, and drops of water appear (CuO is reduced).



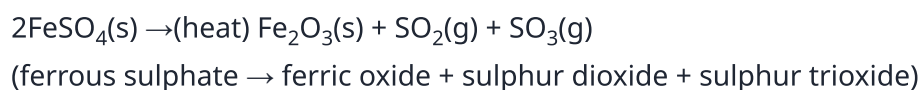
CBSE 2026 · 31/3/1 · Q26

3 marks

2 g of green coloured crystals of ferrous sulphate are heated in a dry boiling tube. Name the type of chemical reaction taking place. Write the balanced chemical equation for the reaction. Is this an exothermic or an endothermic reaction?

Solution

Type: thermal **decomposition** reaction (one reactant breaks down into simpler products on heating). The green crystals first lose their water of crystallisation, then decompose; a smell of burning sulphur is noticed.



It is an **endothermic** reaction, because heat has to be supplied continuously for the decomposition.

CBSE 2025 · 31/2/1 · Q27(a)

3 marks

- (i) Define the term decomposition reaction. Write one chemical equation each for decomposition reaction where energy is supplied in the form of heat, light or electricity.
- (ii) Decomposition of vegetable matter into compost is considered an exothermic reaction. Why?

Solution

- (i) A **decomposition reaction** is one in which a single reactant breaks down to give two or more simpler products.

Heat (thermal): $\text{CaCO}_3(\text{s}) \rightarrow (\text{heat}) \text{CaO}(\text{s}) + \text{CO}_2(\text{g})$

Light (photolytic): $2\text{AgCl}(\text{s}) \rightarrow (\text{sunlight}) 2\text{Ag}(\text{s}) + \text{Cl}_2(\text{g})$

Electricity (electrolytic): $2\text{H}_2\text{O}(\text{l}) \rightarrow (\text{electric current}) 2\text{H}_2(\text{g}) + \text{O}_2(\text{g})$

(ii) During the decomposition of vegetable matter into compost, **heat is released** (the compost pile becomes warm), so it is an exothermic process.

CBSE 2025 · 31/2/1 · Q27(b)

3 marks

Why are decomposition reactions called the opposite of combination reactions? Write one chemical equation each for these two types of reactions mentioning the name of the reactant(s) and the product(s) involved in the reactions.

Solution

In a **combination** reaction two or more reactants combine to form a **single product**; in a **decomposition** reaction a **single reactant** breaks down into two or more products. So one is the reverse of the other.

Combination: $\text{CaO}(\text{s}) + \text{H}_2\text{O}(\text{l}) \rightarrow \text{Ca}(\text{OH})_2(\text{aq})$

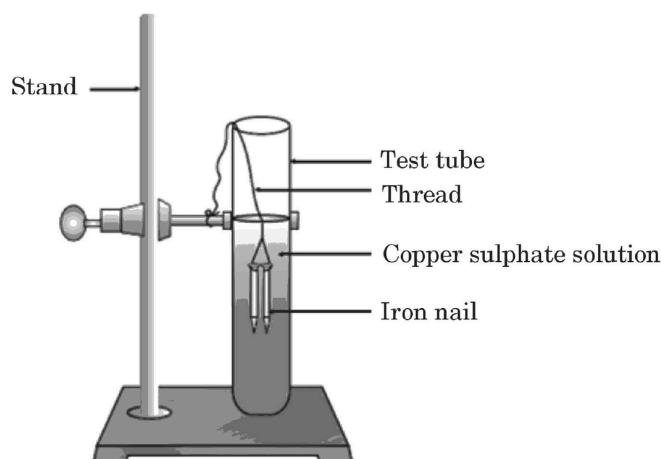
(calcium oxide / quick lime + water → calcium hydroxide / slaked lime)

Decomposition: $\text{CaCO}_3(\text{s}) \rightarrow (\text{heat}) \text{CaO}(\text{s}) + \text{CO}_2(\text{g})$

(calcium carbonate / limestone → calcium oxide + carbon dioxide)

CBSE 2024 · 31/5/1 · Q27

3 marks



Study the experimental set-up shown in the diagram and write chemical equation for the chemical reaction involved. Name and define the type of reaction. List two other metals which can be used in place of iron to show the same type of reaction with copper sulphate solution.

Solution

$\text{Fe}(\text{s}) + \text{CuSO}_4(\text{aq}) \rightarrow \text{FeSO}_4(\text{aq}) + \text{Cu}(\text{s})$

The iron nail gets a brownish coating of copper, and the blue solution fades to pale green.

Displacement reaction: a reaction in which a more reactive element displaces a less reactive

element from its compound (solution).

Other metals: **zinc** and **aluminium** (or magnesium) — all are more reactive than copper.

CBSE 2023 · 31/2/1 · Q27

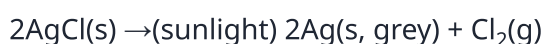
3 marks

Silver chloride kept in a china dish turns grey in sunlight. (a) Write the colour of silver chloride when it was kept in the china dish. (b) Name the type of chemical reaction taking place and write the chemical equation for the reaction. (c) State one use of the reaction. Name one more chemical which can be used for the same purpose.

Solution

(a) **White**.

(b) **Photolytic decomposition** (decomposition by light):



(c) Used in **black and white photography**. **Silver bromide (AgBr)** is also used: $2\text{AgBr} \rightarrow 2\text{Ag} + \text{Br}_2$.

CBSE 2023 · 31/4/1 · Q27

3 marks

(i) While electrolysis of water before passing the current some drops of an acid are added. Why? Name the gases liberated at cathode and anode. Write the relationship between the volume of gas collected at anode and the volume of gas collected at cathode.

(ii) What is observed when silver chloride is exposed to sunlight? Give the type of reaction involved.

Solution

(i) Pure water is a poor conductor; a few drops of dilute acid make it **conduct electricity**.

Cathode: **hydrogen**; anode: **oxygen**.

Volume of gas at anode : volume at cathode = **1 : 2** ($2\text{H}_2\text{O} \rightarrow 2\text{H}_2 + \text{O}_2$).

(ii) White silver chloride turns **grey** (silver is formed): $2\text{AgCl} \xrightarrow{\text{sunlight}} 2\text{Ag} + \text{Cl}_2$. It is a **photolytic decomposition** reaction.

CBSE 2020 · 31/2/1 · Q15

3 marks

A compound 'A' is used in the manufacture of cement. When dissolved in water, it evolves a large amount of heat and forms compound 'B'. (i) Identify A and B. (ii) Write chemical equation for the reaction of A with water. (iii) List two types of reaction in which this reaction may be classified.

Solution

(i) A = **calcium oxide (quick lime), CaO**; B = **calcium hydroxide (slaked lime), Ca(OH)₂**.

(ii)



(iii) **Combination reaction** (two reactants form one product) and **exothermic reaction** (heat is released).

CBSE 2020 · 31/4/1 · Q15(a)

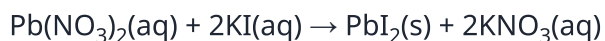
3 marks

Lead nitrate solution is added to a test tube containing potassium iodide solution. (a) Write the name and colour of the compound precipitated. (b) Write the balanced chemical equation for the reaction involved. (c) Name the type of this reaction justifying your answer.

Solution

(a) **Lead iodide, yellow.**

(b)



(c) **Double displacement (precipitation) reaction** — the two compounds exchange their ions (Pb^{2+} combines with I^- , K^+ with NO_3^-), and an insoluble product (precipitate) is formed.

CBSE 2020 · 31/4/1 · Q15(b)

3 marks

What happens when food materials containing fats and oils are left for a long time? List two observable changes and suggest three ways by which this phenomenon can be prevented.

Solution

The fats and oils get **oxidised** and become **rancid** (rancidity).

Observable changes: (1) the smell changes (bad, unpleasant smell); (2) the taste changes.

Prevention: (1) add **antioxidants** to food; (2) store food in **air-tight containers**; (3) **flush packets with nitrogen** (as in chips packets); also keep food in a refrigerator.

CBSE 2019 · 31/2/1 · Q6

3 marks

On heating blue coloured powder of copper (II) nitrate in a boiling tube, black copper oxide, O_2 and a brown gas X is formed. (a) Identify the type of reaction and the gas X. (b) Write balanced chemical equation of the reaction. (c) Write the pH range of aqueous solution of the gas X.

Solution

(a) **Thermal decomposition** reaction; X = **nitrogen dioxide (NO_2)**.

(b)



(c) NO_2 is the oxide of a non-metal; its solution in water is **acidic — pH less than 7**.

CBSE 2019 · 31/4/1 · Q8(a)

3 marks

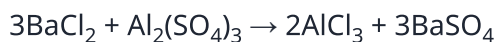
(a) Classify the following reactions into different types: (i) $\text{AgNO}_3(\text{aq}) + \text{NaCl}(\text{aq}) \rightarrow \text{AgCl}(\text{s}) + \text{NaNO}_3(\text{aq})$ (ii) $\text{CaO}(\text{s}) + \text{H}_2\text{O}(\text{l}) \rightarrow \text{Ca}(\text{OH})_2(\text{aq})$ (iii) $2\text{KClO}_3(\text{s}) \rightarrow 2\text{KCl}(\text{s}) + 3\text{O}_2(\text{g})$ (iv) $\text{Zn} + \text{CuSO}_4 \rightarrow \text{ZnSO}_4 + \text{Cu}$

(b) Translate the following statement into a balanced chemical equation: "Barium chloride reacts with aluminium sulphate to give aluminium chloride and barium sulphate."

Solution

(a) (i) **Double displacement** (precipitation) (ii) **Combination** (exothermic) (iii) **Decomposition** (thermal) (iv) **Displacement**

(b)



Check: Ba 3 = 3; Cl 6 = 6; Al 2 = 2; SO₄ 3 = 3.

CBSE 2019 · 31/4/1 · Q8(b)

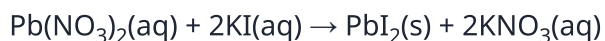
3 marks

When potassium iodide solution is added to a solution of lead (II) nitrate in a test tube, a precipitate is formed. (a) What is the colour of this precipitate? Name the compound precipitated. (b) Write the balanced chemical equation for this reaction. (c) List two types of reactions in which this reaction can be placed.

Solution

(a) **Yellow; lead iodide** (PbI₂).

(b)



(c) **Double displacement** reaction and **precipitation** reaction.

CBSE 2018 · 31/1 · Q6

3 marks

Decomposition reactions require energy either in the form of heat or light or electricity for breaking down the reactants. Write one equation each for decomposition reactions where energy is supplied in the form of heat, light and electricity.

Solution



5 marks: long answer

CBSE 2024 · 31/4/1 · Q34(a)

5 marks

What is a chemical reaction? Describe one activity each to show that a chemical change has occurred in which (i) change of colour, and (ii) change in temperature has taken place.

Solution

A **chemical reaction** is a process in which one or more substances (reactants) change into new substances (products) with different properties. It is indicated by a change in state, colour, temperature, evolution of gas, or formation of a precipitate.

(i) **Change of colour:** put an iron nail into copper sulphate solution in a test tube. After about 20 minutes the blue colour of the solution fades to pale green, and a brownish coating appears on the nail.



(ii) **Change in temperature:** take a small amount of quick lime in a beaker and slowly add water. The beaker becomes **hot** (the reaction is exothermic).



(Also: zinc granules with dilute sulphuric acid — the flask becomes warm.)

CBSE 2024 · 31/4/1 · Q34(b)

5 marks

- (i) Define a decomposition reaction. How can we say that (I) electrolysis of water, and (II) blackening of silver bromide when exposed to sunlight, are decomposition reactions? Mention the type of energy involved in each case.
- (ii) The type of reactions in which (I) calcium oxide is formed, and (II) calcium hydroxide is formed are opposite reactions to each other. Justify this statement with the help of chemical equations.

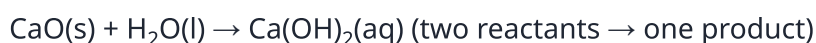
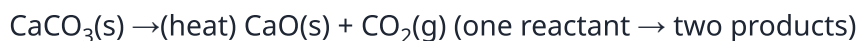
Solution

(i) A **decomposition reaction** is one in which a single reactant breaks down to give two or more simpler products.

(I) Water (single reactant) breaks into hydrogen and oxygen — **electrical energy**: $2\text{H}_2\text{O(l)} \rightarrow 2\text{H}_2(\text{g}) + \text{O}_2(\text{g})$.

(II) Silver bromide (single reactant) breaks into silver (grey/black) and bromine — **light energy**: $2\text{AgBr(s)} \xrightarrow{\text{sunlight}} 2\text{Ag(s)} + \text{Br}_2(\text{g})$.

(ii) Calcium oxide is formed by **decomposition**, and calcium hydroxide by **combination**:



In decomposition one substance breaks into simpler ones; in combination substances join to form one — so they are opposite types of reactions.

CBSE BOARD PAPER

2026 · Q.P. Code 31/2/1

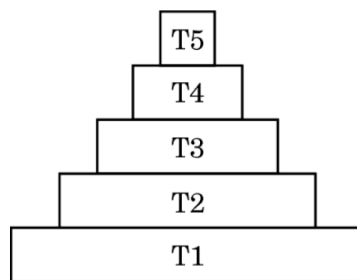
Time: 3 hours

Maximum marks: 80

Section A · Biology

1. The genotype of green stemmed tomato plant is denoted by 'GG' and that of purple stemmed tomato plant as 'gg'. Hybrid of a cross between these two were self-pollinated to obtain F_2 progeny. What will be the ratio of GG, Gg and gg in this F_2 progeny? 1
- (A) 2 : 1 : 1 (B) 3 : 1 : 0
(C) 1 : 1 : 2 (D) 1 : 2 : 1
2. Identify the type of tropic movement that is responsible for the movement of the pollen tube towards an ovule from the following options. 1
- (A) Hydrotropism (B) Geotropism
(C) Chemotropism (D) Phototropism
3. *Spirogyra*, despite being a multi-cellular organism, still shows a simple reproductive method. Select the correct option with regard to reproduction in *Spirogyra*: 1
- (A) Asexual reproduction by division of cells into two cells
(B) Sexual reproduction by division of cells into many cells
(C) Asexual reproduction by breaking up of *Spirogyra* filaments into smaller parts
(D) Sexual reproduction by the formation of gametes after meiosis of cells of filaments followed by fusion of male and female gametes
4. The carbohydrates, which are not used immediately in plants, are stored in the form of 'a', which serves as an internal energy reserve. What does 'a' stand for? 1
- (A) Starch (B) Sugar
(C) Fat (D) Protein
5. The following events occur during the process of photosynthesis. Choose the option that indicates the correct events. 1
- (i) Oxidation of carbon dioxide to carbohydrates
(ii) Conversion of light energy into chemical energy
(iii) Absorption of light energy by chlorophyll
(iv) Conversion of hydrogen and oxygen into water
- (A) (i) and (ii) (B) (ii) and (iii)
(C) (iii) and (iv) (D) (i) and (iv)

6.



1

In the given figure, identify the trophic level having maximum concentration of harmful chemicals.

- (A) T1 (B) T5
(C) T4 (D) T3

7. Which of the following limits the number of trophic levels in a food chain?

1

- (A) Availability of water (B) Deficient food supply
(C) Decrease in energy at higher levels (D) Pollution in air

8. Assertion (A): Blood plasma transports carbon dioxide in dissolved form, while oxygen is transported by respiratory pigments.

1

Reason (R): Carbon dioxide is more soluble in water than in oxygen.

(A) Both A and R are true and R is the correct explanation of A. (B) Both A and R are true but R is not the correct explanation of A. (C) A is true but R is false. (D) A is false but R is true.

9. Assertion (A): There are generally a greater number of individuals at the lower trophic levels of an ecosystem.

1

Reason (R): The greatest number is of the producers.

(A) Both A and R are true and R is the correct explanation of A. (B) Both A and R are true but R is not the correct explanation of A. (C) A is true but R is false. (D) A is false but R is true.

10. (a) "The timing and the amount of hormone secreted by a gland are regulated in the human body." Justify this statement with the help of an example.

2

OR

(b) Electrical impulse is an excellent means to transmit information in the animal body, but there are some limitations to the use of electrical impulses. State any two limitations.

2

11. "Variation is useful for the survival of species over time." Explain this statement with the help of an example.

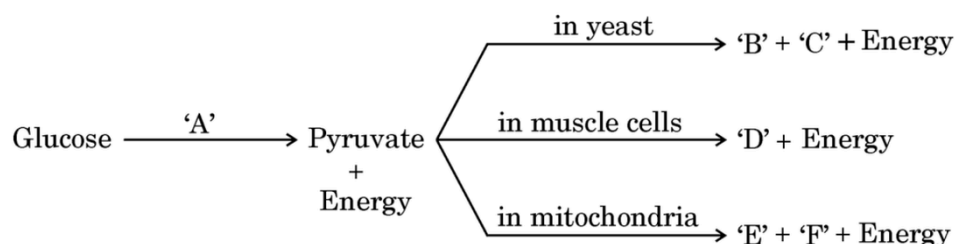
2

12. Suggest one best way to dispose of the following wastes:

2

(i) Kitchen waste (ii) Metallic waste (iii) Plastic bottles (iv) Sanitary waste

13. Complete the pathways given below, showing the breakdown of glucose. 3



Identify 'A', 'B', 'C', 'D', 'E' and 'F'.

14. (a) Giving two examples, justify the statement that the sex of the offspring in all animals is not always genetically determined. 3
 (b) Differentiate between the sex chromosomes of male and female human beings.
15. Read the following passage and answer the questions that follow: 4

A middle-aged person is facing some cognitive changes in himself. His early symptoms included mild forgetfulness. For example, forgetting where he left his mobile or failing to find words to complete his sentences. He was facing problems in driving a car, climbing up and down the stairs, inserting a plug into an outlet. He slowly developed a sad mood and anxiety.

- (a) What are voluntary actions? 1
 (b) Which part of the brain is responsible for precision of voluntary actions? 1
 (c) (i) Explain the role of the medulla. 2
- OR**
- (c) (ii) How do the animal muscles move? 2
16. (a) (i) Name an organ that helps in the formation of male germ cells in humans and also mention the condition that favours the formation of male germ cells. 5
 (ii) In male reproductive system, write the pathway followed to deliver male germ cells to the site of fertilisation.
 (iii) Mention the main physical feature of the male germ cell that helps it move towards the female germ cell. 2+2+1

OR

- (b) Radha has three children. She does not want to have more children. Radha visits a nearby hospital, to know the methods to prevent pregnancy. 5
 (i) Mention the name of any two ways other than the surgical methods, following which Radha can avoid unwanted pregnancies.
 (ii) Name the surgical methods to prevent pregnancy.
 (iii) Give one example each of sexually transmitted diseases caused by bacteria and virus. 2+2+1

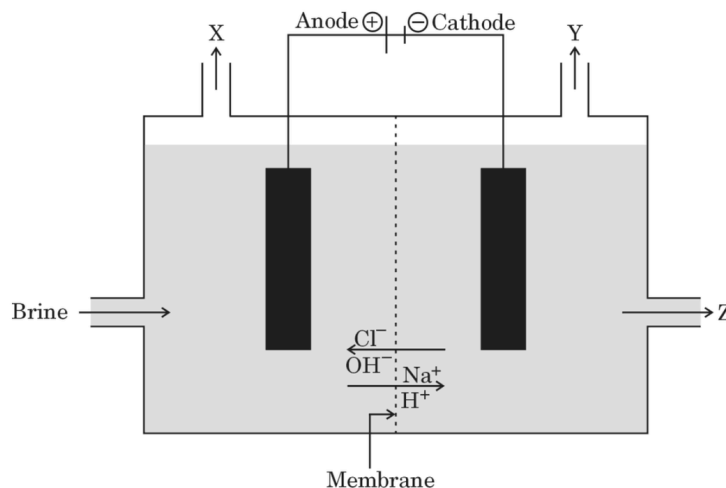
Section B · Chemistry

17. Which of the following are combination reactions? 1
- (i) $2\text{KClO}_3 \rightarrow 2\text{KCl} + 3\text{O}_2$
(ii) $\text{MgO} + \text{H}_2\text{O} \rightarrow \text{Mg(OH)}_2$
(iii) $4\text{Al} + 3\text{O}_2 \rightarrow 2\text{Al}_2\text{O}_3$
(iv) $\text{Zn} + \text{FeSO}_4 \rightarrow \text{ZnSO}_4 + \text{Fe}$
- (A) (i) and (iii) (B) (iii) and (iv)
(C) (ii) and (iv) (D) (ii) and (iii)
18. A metal carbonate reacts with a solution X which forms a salt, water and a gas Y. What are X and Y? 1
- (A) X – Sodium hydroxide, Y – Carbon dioxide
(B) X – Sodium hydroxide, Y – Hydrogen
(C) X – Hydrochloric acid, Y – Carbon dioxide
(D) X – Hydrochloric acid, Y – Hydrogen
19. When ferrous sulphate crystals are heated in a test tube, we observe that: 1
- (A) A colourless gas with no smell is evolved.
(B) A brown gas is evolved.
(C) The green colour of the salt fades and a gas with the smell of burning sulphur is evolved.
(D) The green colour of the salt fades and no gas is evolved.
20. When Mg metal is treated with hot water, it starts floating on the surface of the water. The reason for its different behaviour is: 1
- (A) Mg is a lighter element than water.
(B) Mg reacts with water to produce H_2 gas which helps in floating.
(C) Mg reacts with water to produce N_2 gas which helps in floating.
(D) Mg reacts with water to form CO_2 gas which helps in floating.
21. The pH of the gastric juices released during digestion is: 1
- (A) Less than 7 (B) More than 7
(C) Equal to 7 (D) Equal to 0
22. Baking powder is a mixture of: 1
- (A) Sodium carbonate + Acetic acid
(B) Sodium carbonate + Tartaric acid
(C) Sodium hydrogen carbonate + Tartaric acid
(D) Sodium hydrogen carbonate + Acetic acid
23. A student notices that her silver jewellery turned dull and had a grey-black coating over it after wearing for a few months. What results in the change in colour of the silver metal? 1
- (A) The polish over the jewellery was removed after wearing for a few months.
(B) The jewellery comes in contact with air, moisture and acids and corrodes.
(C) Dust particles over the jewellery change its colour.
(D) Its colour changes due to rusting.

- 24.** Assertion (A): Carbon compounds can form chains, branched and ring structures. Reason (R): Carbon exhibits the property of catenation. 1
- (A) Both A and R are true and R is the correct explanation of A. (B) Both A and R are true but R is not the correct explanation of A. (C) A is true but R is false. (D) A is false but R is true.
- 25.** Read the following passage and answer the questions that follow: 2
- One student was comparing the reactivity of different metals for his science project. He added iron filings in four test tubes A, B, C and D containing aqueous solutions of ZnSO_4 , CuSO_4 , FeSO_4 and $\text{Al}_2(\text{SO}_4)_3$.*
- (i) In which of the test tubes will he observe the reaction to be the most vigorous and why? 1+1
- (ii) Write a balanced equation for the reaction involved. 1+1
- 26.** (a) (i) Write one example each of one metal that is so soft that it can be cut with a knife, and one non-metal that is a good conductor of electricity. 3
- (ii) Using the electronic configuration, explain how Mg atom combines with oxygen to form magnesium oxide by transfer of electrons. [Atomic number: Mg = 12, O = 8] 1+2
- OR**
- (b) Give reasons: 3
- (i) Metal sulphides and carbonates should be converted to their metal oxides in the process of extraction of metals.
- (ii) Aluminium oxide is considered as an amphoteric oxide.
- (iii) Metals like Na, K, Ca and Mg are never found in their free state in nature. 3×1
- 27.** Seema took a small amount of copper powder in a china dish and heated it. What changes will she observe on heating? When H_2 gas is passed over this heated substance, what visible changes will be seen in it? Give the chemical equations of the reactions involved, along with the names and colours of the products in each case. 3

28. Read the following passage and answer the questions that follow:

In the given diagram, when electricity is passed through an aqueous solution of a common salt, a substance 'Z' is produced, along with the evolution of gases 'X' and 'Y'. When a burning matchstick is brought near the gas 'Y', it burns with a pop sound, whereas 'X' is used for disinfecting drinking water. When 'X' is passed through slaked lime, an insoluble substance 'A' is produced.



- (a) Write the names of the gases 'X' and 'Y'. 1
 (b) Write the balanced chemical equation for the formation of substance 'Z'. 1
 (c) (i) What happens: (I) If a drop of red litmus solution is added to the aqueous solution of substance 'Z'? (II) If CO_2 gas is passed through ammoniacal solution of aqueous NaCl ? 2
OR
 (c) (ii) Identify the substance 'A' and write the balanced chemical equation of the reaction which takes place in its preparation. 2

29. (a) A carbon compound 'P' of molecular formula $\text{C}_2\text{H}_6\text{O}$ is found to be neutral when tested with red and blue litmus. A gas that burns with a pop sound is produced when sodium metal reacts with compound 'P'. 5
 (i) Identify the compound 'P'.
 (ii) The carbon compound 'P' is heated with conc. H_2SO_4 at 443 K to produce compound 'Q'. (I) Write the chemical equation for the reaction. (II) What is the role of conc. H_2SO_4 in this reaction?
 (iii) What is likely to be observed on heating compound 'P' with ethanoic acid with an acid as a catalyst? Write the chemical equation for the reaction. 1+2+2

OR

- (b) (i) Write the structural formula of benzene. 5
 (ii) State the reason why carbon can neither form C^{4+} cation nor C^{4-} anion.
 (iii) What type of bond is formed between carbon and hydrogen?
 (iv) How is ethanol converted to ethanoic acid?
 (v) Complete the following chemical equation: $\text{CH}_3\text{COOC}_2\text{H}_5 + \text{NaOH} \rightarrow$ 5×1

Section C · Physics

30. From the following options choose the one which gives negative magnification greater than one:
- Concave mirror; Nature of image – real
 - Concave mirror; Nature of image – virtual
 - Convex mirror; Nature of image – real
 - Convex mirror; Nature of image – virtual

1

31. A thin beam of white light falls on a face of a glass prism and a spectrum is obtained on a screen. Which of the following options is the correct sequence of colours from top to bottom on the screen?
- Red, Green, Yellow, Violet, Blue
 - Red, Yellow, Green, Blue, Violet
 - Violet, Blue, Green, Yellow, Red
 - Violet, Red, Green, Yellow, Blue

1

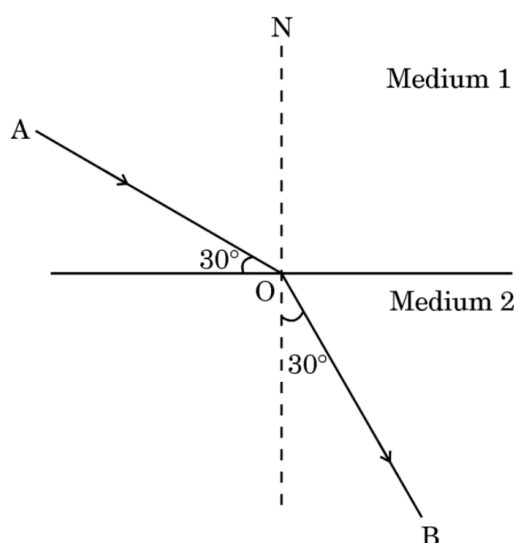
32. Assertion (A): Direction of force exerted on a current-carrying conductor placed in a magnetic field remains same if the directions of both magnetic field and current flowing through the conductor are reversed.
- Reason (R): The direction of force exerted on a current-carrying conductor placed in an external magnetic field can be determined by using magnetic compass.

1

(A) Both A and R are true and R is the correct explanation of A. (B) Both A and R are true but R is not the correct explanation of A. (C) A is true but R is false. (D) A is false but R is true.

33.

2



With the help of the given ray diagram, calculate the refractive index of Medium 2 with respect to Medium 1. (Given that $\sqrt{3} = 1.732$)

34. (a) How does the focal length of eye lens change as the distance of the object from the eyes is altered? Explain.

2

OR

- (b) Why is the concave lens used as a corrective lens for a myopic eye?

2

35. (a) Write the expression for the magnification produced by a lens in terms of object distance and image distance. 3
 (b) A 4 cm tall object is placed perpendicular to the principal axis of a convex lens of focal length 20 cm. Calculate the size of the image formed, if the distance of the object from the lens is 10 cm.

36. What is scattering of light? How is scattering of light different from reflection of light? Explain. 3

37. The values of current I flowing in a given resistor for the corresponding values of potential difference V applied across the ends of resistor are given below in the table: 3

I (amperes)	0.4	0.8	1.2	1.6	2.0
V (volts)	1.2	2.4	3.6	4.8	6.0

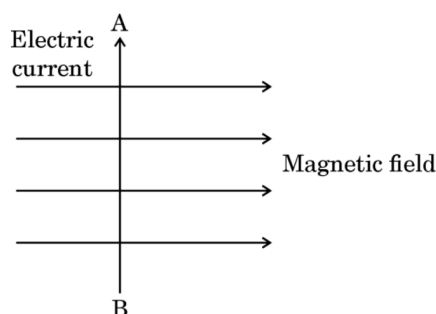
Plot a graph between V and I and calculate the resistance of that resistor.

38. Read the following passage and answer the questions that follow: 4

Swati, a class 10 student, observes that when she passes close to the refrigerator in her kitchen, she feels the heat, although the things kept inside the refrigerator are cool.

- (a) Describe the cause of heating in the above-mentioned case. 1
 (b) A current I flows through a resistor of resistance R when the potential difference across it is V . Applying Ohm's law, write the formula for amount of heat produced by the resistor in time t . 1
 (c) (i) Write any two practical applications of heating effect of electric current. 2
OR
 (c) (ii) Define the commercial unit of electric energy and express it in Joules (J). 2

39. (a) (i) State the rule which gives the direction of force acting on a current-carrying conductor placed in a magnetic field. 5
 (ii) What is a fuse? Why is it called a safety device?
 (iii) Why are electrical appliances with metallic bodies connected to the mains through a three-pin plug, whereas an electric bulb is connected with a two-pin plug?
 (iv)



What will be the direction of force experienced by the conductor AB due to the magnetic field, when current flows in the direction shown? Name the law you applied to find the direction.

OR

- (b) (i) Draw the pattern of magnetic field lines through and around a current-carrying circular loop.
- (ii) State the rule to find out the direction of the magnetic field inside and around the circular loop.
- (iii) Give reasons: (I) Why should a burnt-out fuse be replaced by another fuse of identical rating only, in an electric circuit? (II) Why is soft iron-core used in making an electromagnet?

Solutions · CBSE 2026 · 31/2/

Q1 **Answer: (D) 1 : 2 : 1**

$GG \times gg \rightarrow F_1$ all **Gg**. Selfing $Gg \times Gg$ gives gametes G and g from each parent:

	G	g
G	GG	Gg
g	Gg	gg

$GG : Gg : gg = 1 : 2 : 1$ (genotypic ratio). The phenotypic ratio is 3 green : 1 purple.

Q2 **Answer: (C) Chemotropism**

The pollen tube grows towards the ovule in response to chemicals released by the ovule; growth in response to a chemical stimulus is chemotropism.

Q3 **Answer: (C)**

Spirogyra reproduces by **fragmentation**: the filament simply breaks into smaller pieces and each piece grows into a new individual. This is asexual reproduction.

Q4 **Answer: (A) Starch**

Plants store unused carbohydrate (glucose made in photosynthesis) as starch, which serves as the internal energy reserve. (Animals store it as glycogen.)

Q5 **Answer: (B) (ii) and (iii)**

The three events of photosynthesis are: absorption of light energy by chlorophyll; conversion of light energy to chemical energy and splitting of water into hydrogen and oxygen; and **reduction** (not oxidation) of carbon dioxide to carbohydrates. Water is split, not formed. So only (ii) and (iii) are correct.

Q6 **Answer: (B) T5**

Harmful non-biodegradable chemicals (like pesticides) accumulate at every step of the food chain. This is **biological magnification**, so their concentration is maximum at the top trophic level, T5.

Q7 **Answer: (C) Decrease in energy at higher levels**

Only about 10% of the energy is passed on from one trophic level to the next (10 per cent law). After 3–4 levels too little energy is left to support another level, so food chains are short.

Q8 **Answer: (A)** (the board also accepted (C) because of the wording of R)

Both statements are true. Carbon dioxide is more soluble in water than oxygen is, so it is mostly carried dissolved in plasma, whereas oxygen, being less soluble, needs the respiratory pigment haemoglobin. R explains A.

Q9 Answer: (B)

Both statements are true. The reason for A is the loss of energy at each level (less energy can support fewer individuals higher up); R only states that producers are most numerous and does not explain why. So R is not the correct explanation of A.

Q10(a) The timing and amount of hormone secreted are regulated by a **feedback mechanism**.

Example (insulin): when the blood sugar level rises (after a meal), cells of the pancreas detect it and secrete more insulin. Insulin lowers blood sugar. As the sugar level falls, insulin secretion is reduced. Too much or too little hormone is harmful, so the body keeps adjusting the amount.

- Q10(b)**
1. Electrical impulses reach only those cells that are connected by nervous tissue, not every cell of the body.
 2. Once a cell generates and transmits an impulse, it needs some time to reset its mechanism before it can send a new impulse, so cells cannot continually create and transmit impulses. (This is why animals also use chemical communication — hormones.)

Q11 Variations give some individuals of a population a better chance of surviving if the environment changes.

Example: consider a population of bacteria living in temperate water. If the water temperature rises because of global warming, most bacteria would die, but a few variants that can tolerate heat would survive and multiply. Without variation, the whole species could be wiped out. So variation helps the species survive over time.

- Q12**
- (i) Kitchen waste — **composting** (it is biodegradable; turns into manure).
 - (ii) Metallic waste — **recycling** (melt and reuse the metal).
 - (iii) Plastic bottles — **recycling / reuse**.
 - (iv) Sanitary waste — **incineration** (burning at high temperature in an incinerator).

- Q13**
- A** – Cytoplasm (glucose, a 6-carbon molecule, breaks into pyruvate, a 3-carbon molecule)
B – Ethanol and **C** – Carbon dioxide (anaerobic respiration / fermentation in yeast)
D – Lactic acid (in muscle cells when oxygen is in short supply)
E – Carbon dioxide and **F** – Water (aerobic respiration in mitochondria; most energy released)

Glucose → (cytoplasm) Pyruvate + energy
 Pyruvate → (yeast, no O₂) Ethanol + CO₂ + energy
 Pyruvate → (muscle, lack of O₂) Lactic acid + energy
 Pyruvate → (mitochondria, O₂) CO₂ + H₂O + energy

- Q14**
- (a) In some animals sex is decided by non-genetic factors:
- In some reptiles, the **temperature** at which fertilised eggs are kept decides whether the young will be male or female.

- Some animals such as **snails** can change sex during their life.

So sex is not always genetically determined.

(b)

Female	Male
Has a perfect pair of sex chromosomes, both called X (XX)	Has a mismatched pair: one normal-sized X and one short Y (XY)
All eggs carry an X chromosome	Half the sperms carry X and half carry Y; so the father's sperm decides the sex of the child

Q15

(a) Voluntary actions are actions done consciously, according to our will, e.g. writing, talking, picking up a pen. They are controlled by the fore-brain (cerebrum).

(b) The **cerebellum** (part of the hind-brain) is responsible for precision of voluntary actions and maintaining posture and balance.

(c) (i) The medulla (in the hind-brain) controls many **involuntary actions** such as blood pressure, salivation and vomiting. It connects the brain to the spinal cord.

OR (c) (ii) Muscle cells contain special proteins. When a nerve impulse reaches a muscle, these proteins change their shape and arrangement in the cell. This makes the muscle cells shorter (contraction), and the muscle moves the part of the body; when they return to their original form the muscle relaxes.

Q16(a)

(i) **Testes** form the male germ cells (sperms). They lie outside the abdominal cavity in the **scrotum** because sperm formation needs a **temperature lower than the normal body temperature**.

(ii) Testes → **vas deferens** → (joins a tube from the urinary bladder) → **urethra** → out of the body (through the penis) into the vagina. On the way, the seminal vesicles and prostate gland add their secretions so that the sperms are in a fluid, which makes their transport easier and provides nutrition.

(iii) The sperm has a **long tail** that helps it swim towards the female germ cell (egg).

Q16(b)

(i) Any two non-surgical methods:

- **Mechanical barrier** — condom, so that sperm does not reach the egg.
- **Oral pills** (hormonal) — change the hormonal balance so that eggs are not released.
- **Copper-T / loop** placed in the uterus.

(ii) Surgical methods: **vasectomy** in males (vas deferens is blocked so sperm transfer is prevented) and **tubectomy** in females (fallopian tube is blocked so the egg cannot reach the uterus).

(iii) Bacterial STD: **gonorrhoea** or syphilis. Viral STD: **HIV-AIDS** or warts.

Q17

Answer: (D) (ii) and (iii)

In a combination reaction two or more reactants form a single product: (ii) $\text{MgO} + \text{H}_2\text{O} \rightarrow \text{Mg}(\text{OH})_2$ and (iii) $4\text{Al} + 3\text{O}_2 \rightarrow 2\text{Al}_2\text{O}_3$. (i) is decomposition and (iv) is displacement.

Q18

Answer: (C)

Metal carbonate + acid → salt + water + carbon dioxide. E.g. $\text{Na}_2\text{CO}_3 + 2\text{HCl} \rightarrow 2\text{NaCl} + \text{H}_2\text{O} + \text{CO}_2$. So X is hydrochloric acid and Y is carbon dioxide.

Q19 Answer: (C)

$2\text{FeSO}_4 \rightarrow \text{Fe}_2\text{O}_3 + \text{SO}_2 + \text{SO}_3$ (thermal decomposition). The green crystals lose water and change colour, and SO_2/SO_3 gases with the smell of burning sulphur are given off.

Q20 Answer: (B)

$\text{Mg} + 2\text{H}_2\text{O} \rightarrow \text{Mg}(\text{OH})_2 + \text{H}_2$. Bubbles of hydrogen stick to the surface of the metal and make it float.

Q21 Answer: (A) Less than 7

The stomach produces hydrochloric acid, so gastric juice is acidic (pH about 1.5–2).

Q22 Answer: (C)

Baking powder = baking soda (sodium hydrogencarbonate, NaHCO_3) + a mild edible acid such as tartaric acid. On heating or wetting, CO_2 is released and makes the dough rise; the acid removes the bitter taste of sodium carbonate.

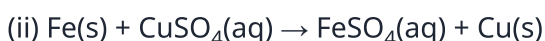
Q23 Answer: (B)

Silver corrodes: it reacts with sulphur compounds in the air to form a black coating of silver sulphide. (Rusting is the corrosion of iron only.)

Q24 Answer: (A)

Both are true. Catenation — the ability of carbon to form bonds with other carbon atoms — gives long chains, branched chains and rings. R explains A.

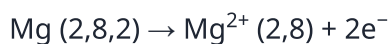
Q25 (i) Test tube B (CuSO_4). Iron is more reactive than copper, so it displaces copper from copper sulphate solution. Iron is less reactive than zinc and aluminium, so nothing happens in A and D; in C the metal and the salt are the same (iron), so there is no reaction. The blue solution turns pale green and a reddish-brown copper coating appears.



Q26(a) (i) Soft metal: **sodium** (or potassium). Non-metal conductor: **graphite** (a form of carbon).

(ii) Mg (12): 2, 8, 2 — it loses its 2 valence electrons to get the stable configuration 2, 8 and becomes Mg^{2+} .

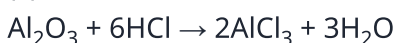
O (8): 2, 6 — it gains these 2 electrons to get 2, 8 and becomes O^{2-} .



The oppositely charged ions are held by strong electrostatic attraction, forming the ionic compound magnesium oxide.

Q26(b) (i) It is easier to obtain a metal from its oxide (by reduction, e.g. with carbon) than from its sulphide or carbonate. So sulphide ores are roasted and carbonate ores are calcined to convert them into oxides first.

(ii) Aluminium oxide reacts with both acids and bases to give salt and water:





So it shows both acidic and basic behaviour — it is amphoteric.

(iii) These metals are very reactive (high in the reactivity series). They react readily with oxygen, water and other elements, so they are always found combined as compounds, never free.

Q27 **On heating:** the brown copper powder becomes coated with a **black** substance, copper(II) oxide, because copper combines with oxygen of air (oxidation).



On passing hydrogen over the hot black substance: the black coating turns **brown** again as copper is formed, and drops of water appear (CuO is reduced).



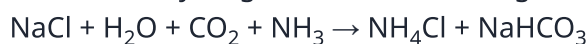
Q28 (a) X = **chlorine** (given off at the anode; used to disinfect water). Y = **hydrogen** (given off at the cathode; burns with a pop sound).

(b) Z is sodium hydroxide:

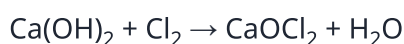


(c) (i) (I) NaOH is a base, so **red litmus turns blue**.

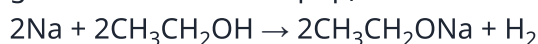
(II) Sodium hydrogencarbonate (baking soda) is formed:



OR (c) (ii) A = **bleaching powder** (calcium oxychloride, CaOCl_2):



Q29(a) (i) P is **ethanol**, $\text{C}_2\text{H}_5\text{OH}$. It is neutral to litmus and reacts with sodium to give hydrogen (the gas that burns with a pop):

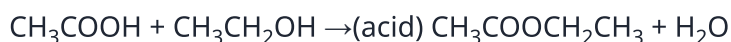


(ii) (I)

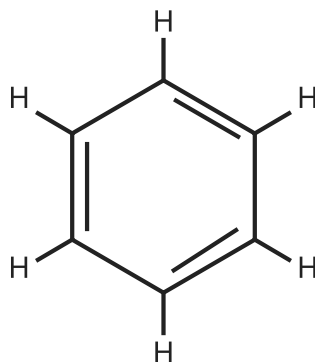


(II) Conc. H_2SO_4 acts as a **dehydrating agent** — it removes water from ethanol.

(iii) A **sweet-smelling** substance, the ester ethyl ethanoate, is formed (esterification):



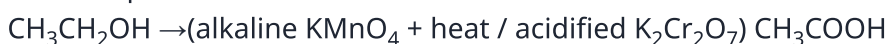
Q29(b) (i) Benzene, C_6H_6 : a ring of six carbon atoms with alternate single and double bonds, each carbon carrying one hydrogen.



(ii) Carbon has 4 valence electrons. To form C^{4+} it would have to lose 4 electrons, which needs a very large amount of energy. To form C^{4-} it would have to gain 4 electrons, and a nucleus of 6 protons cannot hold 10 electrons. So carbon **shares** its electrons and forms covalent bonds.

(iii) A **covalent bond** (single covalent bond, formed by sharing a pair of electrons).

(iv) By **oxidation** using an oxidising agent such as alkaline potassium permanganate or acidified potassium dichromate:



(v)



(saponification: sodium ethanoate and ethanol are formed)

Q30 Answer: (A)

Negative magnification means the image is real and inverted; magnitude greater than 1 means it is enlarged. Only a concave mirror gives a real, inverted, enlarged image (object between F and C, or at F). A convex mirror always gives a virtual, erect, diminished image (m positive, less than 1).

Q31 Answer: (B)

Red bends the least and violet bends the most, so on the screen (prism with base downward) red is at the top and violet at the bottom: VIBGYOR read from bottom — red, orange, yellow, green, blue, indigo, violet from the top.

Q32 Answer: (C)

A is true: reversing either the current or the field reverses the force, so reversing both leaves it unchanged. R is false: the direction of the force is found using **Fleming's left-hand rule**, not a compass.

Q33 The angles are measured from the normal ON.

Ray AO makes 30° with the surface, so the angle of incidence $i = 90^\circ - 30^\circ = 60^\circ$.

The refracted ray OB makes 30° with the normal, so $r = 30^\circ$.

$$n_{21} = \sin i / \sin r = \sin 60^\circ / \sin 30^\circ = (\sqrt{3}/2) \div (1/2) = \sqrt{3} = 1.732$$

Medium 2 is optically denser than medium 1 (the ray bends towards the normal).

Q34(a) The ciliary muscles change the curvature of the eye lens (power of accommodation):

- When the object is **far**, the ciliary muscles **relax**, the lens becomes **thin** and its focal length **increases**.

- When the object is **near**, the ciliary muscles **contract**, the lens becomes **thick** and its focal length **decreases**.

In both cases the image is formed on the retina.

Q34(b) In myopia (near-sightedness) the image of a distant object is formed **in front of the retina** (eyeball too long or lens too curved). A **concave (diverging) lens** of suitable power spreads the rays out a little before they enter the eye, so the eye lens now brings them to focus on the retina. In effect, the lens makes rays from far away appear to come from the far point of the myopic eye.

Q35 (a) $m = v / u$ (image distance ÷ object distance); also $m = h'/h$.

(b) Given $h = +4$ cm, $f = +20$ cm, $u = -10$ cm.

$$1/v - 1/u = 1/f \Rightarrow 1/v = 1/f + 1/u = 1/20 + 1/(-10) = (1 - 2)/20 = -1/20$$

$$v = -20 \text{ cm}$$

$$m = v/u = (-20)/(-10) = +2$$

$$h' = m \times h = 2 \times 4 = \mathbf{8 \text{ cm}}$$

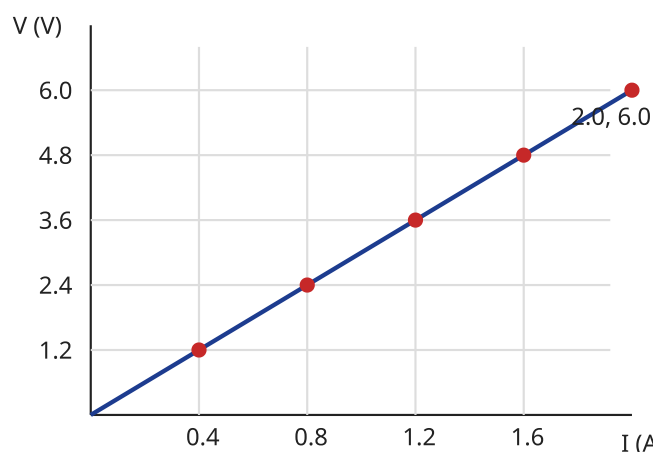
The image is 8 cm tall, virtual and erect, 20 cm from the lens on the same side as the object (the object is within the focal length).

Q36 **Scattering:** when light falls on very small particles of a medium (dust, smoke, air molecules), it is thrown off (spread) in different directions. This is scattering of light. Example: the path of a beam of light becomes visible in a dusty room (Tyndall effect).

Difference from reflection:

- In reflection, light bounces back from a surface in a **fixed direction** obeying the laws of reflection; in scattering it spreads in **all directions**.
- Reflection does not depend on the size of particles; the colour of scattered light **depends on the size of the particles** — very fine particles scatter mainly blue light (blue sky), larger particles scatter all colours (white clouds).

Q37 Plot I on the x-axis and V on the y-axis. The points lie on a **straight line through the origin** ($V \propto I$, Ohm's law).



Resistance = slope of the V-I graph:

$$R = \Delta V / \Delta I = (6.0 - 1.2) / (2.0 - 0.4) = 4.8 / 1.6 = \mathbf{3 \Omega}$$

(Each pair also gives $V/I = 3 \Omega$.)

Q38

(a) Only a part of the electrical energy supplied to the refrigerator is used for useful work (cooling); the rest is unavoidably converted into **heat** (heating effect of current in its coils and motor), which raises the temperature of the appliance and its surroundings. The heat removed from inside is also released outside.

(b) Work done = VIt ; using $V = IR$:

$$H = VIt = I^2Rt = (V^2/R) t$$

(c) (i) Any two: electric iron, electric heater, toaster, oven, kettle, electric bulb (filament glows), electric fuse.

OR (c) (ii) The commercial unit of electric energy is the **kilowatt hour (kWh)**: the energy used when 1 kW of power is used for 1 hour.

$$1 \text{ kWh} = 1000 \text{ W} \times 3600 \text{ s} = 3.6 \times 10^6 \text{ J}$$

Q39(a)

(i) **Fleming's left-hand rule**: stretch the thumb, forefinger and middle finger of the left hand so that they are mutually perpendicular. If the forefinger points in the direction of the magnetic field and the middle finger in the direction of current, the thumb points in the direction of the force (motion) on the conductor.

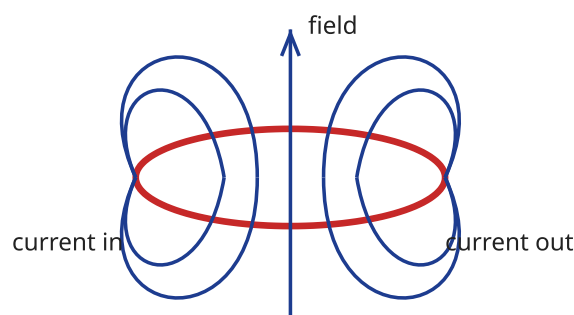
(ii) A fuse is a short piece of wire of low melting point connected in series with the circuit. When too much current flows (overloading or short-circuit), the wire heats up and melts, breaking the circuit. It protects the circuit and appliances from damage, so it is called a safety device.

(iii) In a three-pin plug the third pin connects the metal body of the appliance to the **earth wire**. If the live wire touches the metal body, current flows to the earth through this low-resistance path and the user does not get a severe shock. A bulb has no metal body that a person touches, so it does not need earthing and a two-pin plug is enough.

(iv) Current flows from B to A (upwards) and the field is from left to right. By **Fleming's left-hand rule** the force on AB is **perpendicular to the plane of the paper, directed into the page**.

Q39(b)

(i) The field lines are concentric circles near each point of the wire; near the centre of the loop they become almost straight and parallel, all in the same direction.



(ii) **Right-hand thumb rule**: imagine holding the current-carrying wire in the right hand with the thumb pointing in the direction of current; the curled fingers give the direction of the

magnetic field lines around it. (Applied to each part of the loop, it shows that inside the loop all the lines point in the same direction.)

(iii) (I) A fuse of the same rating melts at the safe current limit. A fuse of higher rating would not melt during overloading and would not protect the circuit; a fuse of lower rating would melt even with normal current and the appliance would not work.

(II) Soft iron gets strongly magnetised when current flows in the coil and loses its magnetism as soon as the current is switched off. So the electromagnet can be switched on and off.



All the best for your boards!

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