

Exact page numbers vary across different printings/editions of the NCERT Class 10 Science textbook (2024-25). The references below indicate chapter numbers and approximate page ranges based on the standard NCERT structure. Students must consult their physical/digital copy of "Science Textbook for Class X" published by NCERT for precise pagination.

SECTION A – ANSWERS WITH REFERENCES

Q.1 Answer: (b) Exothermic reaction

Explanation: Heat is released during the reaction, making it exothermic.

Reference: Chapter 1: Chemical Reactions and Equations, Pages 6-9 (NCERT Class 10 Science) – Types of Chemical Reactions

Q.2 Answer: (b) NaOH

Explanation: Sodium hydroxide completely dissociates in water to produce OH^- ions.

Reference: Chapter 2: Acids, Bases and Salts, Pages 26-28 – Strength of Acids and Bases

Q.3 Answer: (b) $\text{CaSO}_4 \cdot \frac{1}{2}\text{H}_2\text{O}$

Explanation: Plaster of Paris contains half a molecule of water of crystallization per formula unit.

Reference: Chapter 2: Acids, Bases and Salts, Page 32 – Chemicals from Common Salt

Q.4 Answer: (c) Soluble in organic solvents

Explanation: Ionic compounds are soluble in polar solvents like water but insoluble in non-polar organic solvents.

Reference: Chapter 3: Metals and Non-metals, Pages 40-42 – Properties of Ionic Compounds

Q.5 Answer: (c) Amylase

Explanation: Salivary amylase (ptyalin) breaks down starch into maltose in the buccal cavity.

Reference: Chapter 6: Life Processes, Page 98 – Nutrition in Human Beings

Q.6 Answer: (b) Cerebellum

Explanation: Cerebellum coordinates voluntary movements and maintains body posture and equilibrium.

Reference: Chapter 7: Control and Coordination, Page 120 – Human Brain

Q.7 Answer: (c) Stamen

Explanation: Stamen consists of filament and anther; it is the male reproductive part producing pollen grains.

Reference: Chapter 8: How do Organisms Reproduce?, Page 138 – Sexual Reproduction in Flowering Plants

Q.8 Answer: (d) Between optical center and F

Explanation: When object is placed within focal length of convex lens, virtual, erect, and magnified image is formed on same side as object.

Reference: Chapter 10: Light – Reflection and Refraction, Pages 180-182 – Image Formation by Lenses

Q.9 Answer: (c) 1.24×10^8 m/s

Explanation: Speed of light in medium $v = \frac{c}{n} = \frac{3 \times 10^8}{2.42} = 1.24 \times 10^8$ m/s

Reference: Chapter 10: Light – Reflection and Refraction, Page 176 – Refractive Index

Q.10 Answer: (d) Length, area, and material

Explanation: Resistance $R = \rho \frac{L}{A}$, where ρ = resistivity (material property), L = length, A = area of cross-section.

Reference: Chapter 12: Electricity, Page 209 – Factors Affecting Resistance

Q.11 Answer: (c) 5Ω

Explanation: For parallel combination: $\frac{1}{R_p} = \frac{1}{10} + \frac{1}{10} = \frac{2}{10} = \frac{1}{5} \Rightarrow R_p = 5 \Omega$

Reference: Chapter 12: Electricity, Pages 213-214 – Resistors in Parallel

Q.12 Answer: (b) Right-hand thumb rule

Explanation: Grasp conductor with right hand; thumb points in direction of current, curled fingers show direction of magnetic field lines.

Reference: Chapter 13: Magnetic Effects of Electric Current, Page 229 – Magnetic Field due to Current through a Straight Conductor

Q.13 Answer: (d) Solar energy

Explanation: Solar energy is continuously replenished by the sun and will not exhaust in foreseeable future.

Reference: Chapter 14: Sources of Energy, Page 248 – Renewable vs Non-renewable Sources

Q.14 Answer: (c) Scattering of light

Explanation: Shorter blue wavelengths scatter more by atmospheric particles (Rayleigh scattering), making sky appear blue.

Reference: Chapter 11: Human Eye and the Colourful World, Page 194 – Atmospheric Refraction

Q.15 Answer: (b) Stratosphere

Explanation: Ozone layer (15-50 km altitude) absorbs harmful UV radiation from sun.

Reference: Chapter 15: Our Environment, Page 265 – Ozone Layer Depletion

Q.16 Answer: (c) Quicklime

Explanation: Calcium oxide (CaO) is commonly known as quicklime or burnt lime.

Reference: Chapter 2: Acids, Bases and Salts, Page 31 – Chemicals from Common Salt

Q.17 Answer: (c) Thyroxine

Explanation: Thyroxine (produced by thyroid gland) regulates metabolism of carbohydrates, proteins, and fats.

Reference: Chapter 7: Control and Coordination, Page 124 – Hormones in Animals

Q.18 Answer: (b) -4 D

Explanation: Power $P = \frac{1}{f} = \frac{1}{-0.25 \text{ m}} = -4$ D (negative sign for concave lens)

Reference: Chapter 10: Light – Reflection and Refraction, Page 186 – Power of a Lens

Q.19 Answer: (c) Kilowatt-hour

Explanation: 1 kWh = energy consumed by 1 kW device running for 1 hour = 3.6×10^6 J

Reference: Chapter 12: Electricity, Page 222 – Heating Effect of Electric Current

Q.20 Answer: (b) Grass, goat, human

Explanation: Represents producer (grass) → primary consumer (goat) → secondary consumer (human).

Reference: Chapter 15: Our Environment, Page 259 – Food Chains and Webs

SECTION B – DETAILED SOLUTIONS

Q.21

Solution:

Oxidation state analysis:

- In MnO_2 : Mn = +4; in MnCl_2 : Mn = +2 $\Rightarrow$ Mn reduced (gains electrons)
- In HCl : Cl = -1; in Cl_2 : Cl = 0 $\Rightarrow$ Cl oxidized (loses electrons)

Oxidizing agent: MnO_2 (causes oxidation of Cl^- and itself gets reduced)

Reducing agent: HCl (causes reduction of Mn^{4+} and itself gets oxidized)

Reference: Chapter 1: Chemical Reactions and Equations, Pages 11-13 – Oxidation and Reduction

Q.22

Solution:

Acids produce H^+ ions only in aqueous solution. Dry HCl gas does not dissociate into ions without water molecules. Similarly, dry litmus paper lacks moisture required for ionization. Both substance and indicator must be in aqueous medium for acidic property to manifest.

Reference: Chapter 2: Acids, Bases and Salts, Pages 18-19 – What Happens to an Acid or a Base in Water Solution?

Q.23

Solution:

(Diagram description for students to draw)

- Bowman's capsule: Cup-shaped structure at beginning of nephron
- Glomerulus: Tuft of capillaries enclosed within Bowman's capsule
- Proximal convoluted tubule extending from capsule
- Loop of Henle (U-shaped)
- Distal convoluted tubule leading to collecting duct

Reference: Chapter 6: Life Processes, Page 110 – Excretion in Human Beings

Q.24

Solution:

Given: Object distance $u = -20$ cm (negative by sign convention), Focal length $f = -10$ cm (concave mirror)

Using mirror formula:

$$\frac{1}{v} + \frac{1}{u} = \frac{1}{f}$$
$$\frac{1}{v} = \frac{1}{f} - \frac{1}{u} = \frac{1}{-10} - \frac{1}{-20} = -\frac{1}{10} + \frac{1}{20} = -\frac{2}{20} + \frac{1}{20} = -\frac{1}{20}$$
$$v = -20 \text{ cm}$$

Image position: 20 cm in front of mirror (same side as object)

Nature of image: Real, inverted, same size as object (since $|u| = |v|$)

Reference: Chapter 10: Light – Reflection and Refraction, Pages 168-170 – Mirror Formula and Magnification

Q.25

Solution:

Function of earth wire: Provides low-resistance conducting path for leakage/fault current to flow directly into the ground.

Necessity of earthing:

1. Prevents electric shock – if live wire touches metallic body of appliance, current flows through earth wire instead of through person touching it
2. Causes fuse to melt or MCB to trip instantly, disconnecting faulty appliance from supply
3. Protects appliance from damage due to voltage surges

Reference: Chapter 12: Electricity, Page 232 – Domestic Electric Circuits

Q.26

Solution:

Biomagnification: Progressive increase in concentration of non-biodegradable toxic substances (e.g., pesticides, heavy metals) at successive trophic levels in a food chain.

Example of heavy metal: Mercury (Hg) – accumulates in fish and causes Minamata disease in humans consuming contaminated fish.

Reference: Chapter 15: Our Environment, Pages 262-263 – Biological Magnification

SECTION C – DETAILED SOLUTIONS

Q.27

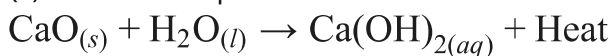
Solution:

(a) Combination reaction: Two or more substances combine to form a single product.

Example: $2\text{Mg} + \text{O}_2 \rightarrow 2\text{MgO}$ (Magnesium burns in air to form magnesium oxide)

(b) The reaction releases large amount of heat energy (temperature rises significantly), making surroundings hot. Such heat-releasing reactions are exothermic.

(c) Chemical equation:



Reference: Chapter 1: Chemical Reactions and Equations, Pages 6-8 – Types of Chemical Reactions

Q.28

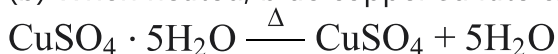
Solution:

(a) Water of crystallization: Fixed number of water molecules chemically bound to one formula unit of a salt in crystalline state.

Examples:

- Copper sulfate pentahydrate: $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$ (blue crystals)
- Washing soda: $\text{Na}_2\text{CO}_3 \cdot 10\text{H}_2\text{O}$

(b) When heated, blue copper sulfate crystals lose water of crystallization and turn white:



The white anhydrous copper sulfate regains blue color when water is added back.

Reference: Chapter 2: Acids, Bases and Salts, Pages 29-30 – Are the Crystals of Salts Really Dry?

Q.29

Solution:

(a) *(Diagram description for students to draw)*

- Nostrils → Nasal cavity (with mucous membrane) → Pharynx → Larynx (voice box) → Trachea (windpipe with C-shaped cartilaginous rings) → Bronchi (two branches) → Bronchioles → Lungs (spongy, elastic organs with alveoli)

(b) Aquatic organisms extract dissolved oxygen from water. Since concentration of dissolved oxygen in water (~1%) is much lower than oxygen in air (21%), aquatic organisms need to breathe faster to obtain sufficient oxygen for metabolic processes.

Reference: Chapter 6: Life Processes, Pages 100-102 – Respiration

Q.30

Solution:

(a) Laws of refraction:

First law: Incident ray, refracted ray, and normal at point of incidence all lie in same plane.

Second law (Snell's law): Ratio of sine of angle of incidence to sine of angle of refraction is constant for given pair of media.

$$\frac{\sin i}{\sin r} = \text{constant} = \text{refractive index } (n)$$

(b) Given: Angle of incidence $i = 45^\circ$, Refractive index of water $n = \frac{4}{3}$

Using Snell's law:

$$n = \frac{\sin i}{\sin r}$$

$$\sin r = \frac{\sin i}{n} = \frac{\sin 45^\circ}{4/3} = \frac{0.7071 \times 3}{4} = \frac{2.1213}{4} = 0.5303$$

$$r = \sin^{-1}(0.5303) \approx 32^\circ$$

Reference: Chapter 10: Light – Reflection and Refraction, Pages 173-175 – Refraction of Light

Q.31

Solution:

(a) Derivation for parallel combination:

Let two resistors R_1 and R_2 be connected in parallel across potential difference V .

$$\text{Current through } R_1: I_1 = \frac{V}{R_1}$$

$$\text{Current through } R_2: I_2 = \frac{V}{R_2}$$

$$\text{Total current: } I = I_1 + I_2 = \frac{V}{R_1} + \frac{V}{R_2} = V \left(\frac{1}{R_1} + \frac{1}{R_2} \right)$$

$$\text{If } R_p \text{ is equivalent resistance: } I = \frac{V}{R_p}$$

$$\frac{V}{R_p} = V \left(\frac{1}{R_1} + \frac{1}{R_2} \right)$$

$$\frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2}$$

(b) Calculation:

$$\frac{1}{R_p} = \frac{1}{6} + \frac{1}{3} = \frac{1}{6} + \frac{2}{6} = \frac{3}{6} = \frac{1}{2}$$

$$R_p = 2 \, \Omega$$

Reference: Chapter 12: Electricity, Pages 213-214 – Resistors in Parallel

Q.32

Solution:

(a) Solenoid: Long coil of insulated copper wire wound closely in helical shape (like a cylinder). When current flows, it produces magnetic field similar to bar magnet.

(b) *(Diagram description for students to draw)*

- Parallel, equally spaced straight lines inside solenoid (uniform magnetic field)
- Curved field lines outside solenoid emerging from North pole and entering South pole
- Field lines form closed continuous loops

(c) Strength of magnetic field can be increased by:

1. Increasing magnitude of current flowing through solenoid
2. Increasing number of turns per unit length of solenoid
3. Inserting soft iron core inside solenoid (core gets magnetized, adding to field strength)

Reference: Chapter 13: Magnetic Effects of Electric Current, Pages 234-236 – Magnetic Field due to a Current through a Solenoid

Q.33

Solution:

(a) Trophic levels: Sequential steps in a food chain representing feeding positions – producers (first level), primary consumers/herbivores (second level), secondary consumers/carnivores (third level), tertiary consumers (fourth level).

(b) Secondary consumer: Frog (eats insects which are primary consumers)

(c) Energy flow is unidirectional because:

- Energy enters ecosystem as sunlight → captured by producers via photosynthesis
- Transferred to consumers in one direction (producer → primary → secondary → tertiary)
- At each transfer, large portion (~90%) lost as heat (respiration, metabolism) which cannot be reused by organisms
- Heat dissipates into environment and cannot flow back to sun or previous trophic levels

Reference: Chapter 15: Our Environment, Pages 260-261 – Energy Flow in Ecosystem

SECTION D – DETAILED SOLUTIONS

Q.34

Solution:

(a) Rancidity: Oxidation of fats and oils present in food items resulting in unpleasant smell and taste.

Prevention methods:

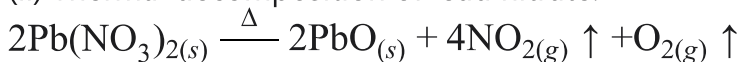
1. Adding antioxidants (e.g., BHA, BHT) that prevent oxidation
2. Storing food in airtight containers to limit oxygen exposure
3. Refrigeration to slow down oxidation rate
4. Flushing food packets with nitrogen gas (inert atmosphere)

(b) Balanced chemical equations:

(i) Reaction of sodium with water:

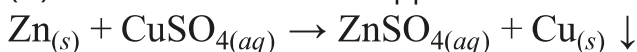


(ii) Thermal decomposition of lead nitrate:



(Brown fumes of nitrogen dioxide observed)

(iii) Reaction of zinc with copper sulfate solution (displacement):



(Blue solution turns colorless; reddish-brown copper deposits)

(c) Nitrogen gas is inert and prevents oxidation of food items by displacing oxygen from packaging. This inhibits rancidity in fatty/oily foods and microbial growth, extending shelf life.

Reference: Chapter 1: Chemical Reactions and Equations, Pages 14-15 – Effects of Oxidation Reactions in Everyday Life

Q.35

Solution:

(a) *(Diagram description for students to draw)*

Female reproductive system components:

- Ovaries (two almond-shaped structures producing ova and hormones)
- Fallopian tubes/oviducts (funnel-shaped, site of fertilization)
- Uterus/womb (pear-shaped, muscular organ for embryo development)
- Cervix (narrow lower part of uterus)
- Vagina (birth canal)

(b) Menstruation: Monthly shedding of thickened uterine lining (endometrium) along with blood through vagina.

Cause: If fertilization does not occur, corpus luteum degenerates → progesterone level drops → endometrium breaks down and is expelled. Occurs approximately every 28 days in sexually mature females.

(c) Fertilization process:

1. During copulation, sperms deposited in vagina travel upward through cervix and uterus to reach fallopian tube
2. If ovum present in fallopian tube, one sperm penetrates and fuses with ovum
3. Fusion of male and female gametes forms single-celled zygote (fertilization)
4. Zygote undergoes mitotic divisions while moving toward uterus
5. Blastocyst implants into uterine wall (implantation)

(d) Role of placenta:

1. Nutritive function: Transfers glucose, amino acids, oxygen from mother's blood to embryo
2. Excretory function: Removes carbon dioxide and nitrogenous wastes from embryo to mother's blood
3. Endocrine function: Secretes hormones (hCG, progesterone, estrogen) to maintain pregnancy
4. Protective barrier: Prevents mixing of maternal and fetal blood while allowing selective exchange

Reference: Chapter 8: How do Organisms Reproduce?, Pages 146-149 – Reproduction in Human Beings

Q.36

Solution:

(a) Ohm's law: At constant temperature, the current flowing through a conductor is directly proportional to the potential difference across its ends.

$$V \propto I \quad \text{or} \quad V = IR$$

where R is constant resistance of conductor.

(Circuit diagram description for students to draw)

Components:

- Battery (power source)
- Key/rheostat (to vary current)

- Ammeter (connected in series with resistor)
- Resistor (unknown resistance R)
- Voltmeter (connected in parallel across resistor)
- Connecting wires

(b) Graph plotting and calculation:

Plot V on y-axis and I on x-axis. Points: (0.2, 1.0), (0.4, 2.0), (0.6, 3.0), (0.8, 4.0), (1.0, 5.0)

The graph is a straight line passing through origin, confirming Ohm's law.

Slope of V-I graph = Resistance R

$$R = \frac{\Delta V}{\Delta I} = \frac{5.0-1.0}{1.0-0.2} = \frac{4.0}{0.8} = 5 \, \Omega$$

(Alternatively, using any pair: $R = \frac{V}{I} = \frac{5.0}{1.0} = 5 \, \Omega$)

Reference: Chapter 12: Electricity, Pages 206-208 – Ohm's Law

SECTION E – DETAILED SOLUTIONS

Q.37

Solution:

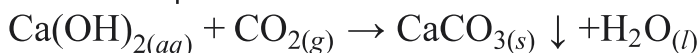
(a) Gas evolved: Carbon dioxide (CO_2)

Balanced chemical equation:



(b) Change in lime water: Turns milky/cloudy white due to formation of insoluble calcium carbonate.

Chemical equation:



(With excess CO_2 , milkiness disappears due to formation of soluble calcium bicarbonate)

(c) Common name of sodium hydrogen carbonate: Baking soda

(d) Acetic acid is weak acid because it partially dissociates in water, producing low concentration of H^+ ions:



(Only small fraction of molecules ionize at equilibrium)

Reference: Chapter 2: Acids, Bases and Salts, Pages 24-25 – Reaction of Acids with Metal Carbonates and Hydrogen Carbonates

Q.38

Solution:

Given: $V = 12 \, \text{V}$, $R_1 = 4 \, \Omega$, $R_2 = 6 \, \Omega$ (in parallel), $R_3 = 5 \, \Omega$ (in series with parallel combination)

(a) Equivalent resistance:

Parallel combination resistance R_p :

$$\frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2} = \frac{1}{4} + \frac{1}{6} = \frac{3+2}{12} = \frac{5}{12}$$

$$R_p = \frac{12}{5} = 2.4 \, \Omega$$

Total equivalent resistance R_{eq} :

$$R_{eq} = R_p + R_3 = 2.4 + 5 = 7.4 \, \Omega$$

(b) Total current drawn (using Ohm's law):

$$I = \frac{V}{R_{eq}} = \frac{12}{7.4} = 1.62 \, \text{A}$$

(c) Potential difference across $5 \, \Omega$ resistor:

Since R_3 is in series with parallel combination, same current $I = 1.62 \, \text{A}$ flows through it.

$$V_3 = I \times R_3 = 1.62 \times 5 = 8.1 \, \text{V}$$

(d) Power dissipation comparison:

Power $P = I^2 R$ (for series elements with same current)

- Power in $R_3 = 5 \, \Omega$: $P_3 = (1.62)^2 \times 5 = 13.12 \, \text{W}$
- Power in parallel combination ($R_p = 2.4 \, \Omega$): $P_p = (1.62)^2 \times 2.4 = 6.29 \, \text{W}$

Since $R_3 > R_p$ and same current flows, $5 \, \Omega$ resistor dissipates maximum power.

Reference: Chapter 12: Electricity, Pages 212-216 – Combination of Resistors and Power Calculation

Q.39

Solution:

(a) Iris controls amount of light entering eye by adjusting size of pupil (contracts in bright light, expands in dim light).

(b) Image is formed on retina (light-sensitive layer containing photoreceptors – rods and cones).

(c) Defect: Myopia (nearsightedness)

Cause:

- Excessive curvature of cornea, OR
- Elongation of eyeball

Result: Light rays from distant objects converge before reaching retina, forming blurred image.

(d) Correction: Using concave (diverging) lens of appropriate power.

(Ray diagram description for students to draw)

- Rays from distant object (parallel rays)
- Concave lens diverges rays before they enter eye
- Eye lens then converges diverged rays onto retina
- Clear image formed on retina

Lens power calculation (if required):

For far point at 2 m: $u = \infty$, $v = -2$ m (image at far point)

$$\frac{1}{f} = \frac{1}{v} - \frac{1}{u} = \frac{1}{-2} - \frac{1}{\infty} = -0.5 \text{ D}$$

Concave lens of power -0.5 D required.

Reference: Chapter 11: Human Eye and the Colourful World, Pages 188-190 – Defects of Vision and Their Correction

COMPLETE NCERT TEXTBOOK REFERENCE GUIDE (2024-25 EDITION)

Chapter No.	Chapter Title	Approximate Pages	Unit
1	Chemical Reactions and Equations	1-17	Chemical Substances
2	Acids, Bases and Salts	18-35	Chemical Substances
3	Metals and Non-metals	36-55	Chemical Substances
4	Carbon and its Compounds	56-79	Chemical Substances
5	Periodic Classification of Elements	80-93	Chemical Substances
6	Life Processes	94-118	World of Living
7	Control and Coordination	119-137	World of Living
8	How do Organisms Reproduce?	138-157	World of Living
9	Heredity and Evolution	158-181	World of Living
10	Light – Reflection and Refraction	162-185	Natural Phenomena
11	Human Eye and the Colourful World	186-200	Natural Phenomena

Chapter No.	Chapter Title	Approximate Pages	Unit
12	Electricity	201-223	Effects of Current
13	Magnetic Effects of Electric Current	224-240	Effects of Current
14	Sources of Energy	241-254	Natural Resources
15	Our Environment	255-270	Natural Resources
16	Sustainable Management of Natural Resources	(Deleted for 2024-25)	Natural Resources

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3. **For Reference:** Consult NCERT textbook chapters mentioned for conceptual clarity
4. **PDF Conversion:** Copy entire content → Paste in Google Docs/Microsoft Word → Format equations using built-in equation editor → Export as PDF

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