CBSE Class 10 Science Formula Sheet

101 formulas across 13 chapters — 2025-26 CBSE board exams

Ch 9. Light — Reflection and Refraction

Mirror formula
$1/v + 1/u = 1/f$

v = image distance, u = object distance, f = focal length

Tip: Use Cartesian sign convention: distances measured from pole, +ve in direction of incident light

Focal length and radius
$f = R/2$

R = radius of curvature

Magnification (mirror)
$m = -v/u = h'/h$

h' = image height, h = object height

Tip: m negative → real inverted image; m positive → virtual erect image

Lens formula
$1/v - 1/u = 1/f$

Magnification (lens)
$m = v/u = h'/h$

Refractive index
$n = c/v = \sin i / \sin r$

c = speed in vacuum, v = speed in medium, i = angle of incidence, r = angle of refraction

Power of lens (D (dioptre))
$P = 1/f$

f in metres

Tip: Convex lens: +ve power; Concave lens: −ve power

Combined power
$P = P_1 + P_2 + P_3 + \ldots$

Ch 10. The Human Eye and the Colourful World

Near point (normal eye)
25 cm (least distance of distinct vision)

Tip: Closer than 25 cm and the eye cannot focus — ciliary muscles at maximum strain

Far point (normal eye)
Infinity (eye can see clearly)

Tip: Relaxed eye focuses parallel rays on retina

Myopia (short-sightedness)
Far point < ∞; image forms in front of retina | Corrected by: concave lens (diverging)

Tip: Power of corrective lens = negative; use P = 1/f (f in metres)

Hypermetropia (long-sightedness)
Near point > 25 cm; image forms behind retina | Corrected by: convex lens (converging)

Tip: Power of corrective lens = positive

Presbyopia
Both near and far vision affected (age-related) | Corrected by: bifocal lens

Tip: Ciliary muscles weaken with age; near point recedes and far point may also shift

Angle of deviation (prism)
$d = (i_1 + i_2) - A$

i_1 = angle of incidence, i_2 = angle of emergence, A = angle of prism

Tip: At minimum deviation: $i_1 = i_2$ and the ray passes symmetrically through the prism

Dispersion of white light
White light → VIBGYOR (Violet, Indigo, Blue, Green, Yellow, Orange, Red)

Tip: Violet deviates most (highest refractive index); Red deviates least (lowest refractive index)

Scattering of light (Tyndall effect)
Shorter wavelength (blue) scattered more than longer wavelength (red)

Tip: Blue colour of sky: sunlight scattered by atmosphere. Red colour of danger signals: least scattered, travels farthest

Ch 11. Electricity

Ohm's Law
$V = IR$

V = potential difference (V), I = current (A), R = resistance (Ω)

Resistance
$R = \rho L/A$

ρ = resistivity, L = length, A = cross-section area

Resistors in series
$R_{total} = R_1 + R_2 + R_3$

Resistors in parallel
$1/R_{total} = 1/R_1 + 1/R_2 + 1/R_3$

Electric power (W (watt))
$P = VI = I^2R = V^2/R$

Electrical energy (J or kWh)
$E = Pt = VIt$

Tip: 1 kWh = 3.6×10^6 J = 1 unit on electricity bill

Joule's law of heating (J)
$H = I^2Rt$

Ch 1. Chemical Reactions and Equations

Law of conservation of mass
Total mass of reactants = Total mass of products

Tip: Reason why chemical equations must be balanced

Combination reaction
$A + B \rightarrow AB$

Tip: e.g. $CaO + H_2O \rightarrow Ca(OH)_2$; always exothermic

Decomposition reaction
$AB \rightarrow A + B$

Tip: e.g. $2H_2O_2 \rightarrow 2H_2O + O_2$; requires heat, light, or electricity

Displacement reaction
$A + BC \rightarrow AC + B$

Tip: e.g. $Fe + CuSO_4 \rightarrow FeSO_4 + Cu$; more reactive metal displaces less reactive

Double displacement reaction
$AB + CD \rightarrow AD + CB$

Tip: e.g. $Na_2SO_4 + BaCl_2 \rightarrow BaSO_4\downarrow + 2NaCl$; one product usually precipitates

Precipitation reaction
Reactants (aq) → Insoluble precipitate (s) + Soluble product (aq)

Tip: ↓ symbol denotes precipitate; e.g. $AgNO_3 + NaCl \rightarrow AgCl\downarrow + NaNO_3$

Exothermic reaction
Reactants → Products + Heat (energy released)

Tip: e.g. Respiration, combustion, neutralisation; temperature of surroundings increases

Endothermic reaction
Reactants + Heat → Products (energy absorbed)

Tip: e.g. Photosynthesis, decomposition of $CaCO_3$; temperature of surroundings decreases

Oxidation
Gain of oxygen OR loss of hydrogen OR loss of electrons

Tip: OIL — Oxidation Is Loss (of electrons)

Reduction
Loss of oxygen OR gain of hydrogen OR gain of electrons

Tip: RIG — Reduction Is Gain (of electrons); oxidation and reduction always occur together (redox)

Ch 2. Acids, Bases and Salts

Acid definition (Arrhenius)
Acid furnishes H^+ ions in solution | e.g. $HCl \rightarrow H^+ + Cl^-$

Tip: Arrhenius definition — used in Class 10

Base definition (Arrhenius)
Base furnishes OH^- ions in solution | e.g. $NaOH \rightarrow Na^+ + OH^-$

pH scale
$pH < 7$ = acidic | $pH = 7$ = neutral | $pH > 7$ = basic

Tip: Gastric juice ~2; blood ~7.4; sea water ~8.4; strong acid pH ~0; strong base pH ~14

Neutralisation
Acid + Base → Salt + Water | $HCl + NaOH \rightarrow NaCl + H_2O$

Acid + Metal
$Zn + H_2SO_4 \rightarrow ZnSO_4 + H_2\uparrow$

Tip: H_2 gas produced — burns with pop sound. Cu, Ag, Au don't react.

Acid + Metal oxide
$CuO + H_2SO_4 \rightarrow CuSO_4 + H_2O$

Tip: Metal oxide is basic; reacts with acid to form salt + water

Acid + Metal carbonate
$Na_2CO_3 + 2HCl \rightarrow 2NaCl + H_2O + CO_2\uparrow$

Tip: CO_2 turns lime water milky — standard test for CO_2

Acid + Metal hydrogen carbonate
$NaHCO_3 + HCl \rightarrow NaCl + H_2O + CO_2\uparrow$

Action of base on non-metal oxide
$Ca(OH)_2 + CO_2 \rightarrow CaCO_3 + H_2O$

Tip: Non-metal oxides are acidic; react with base to form salt + water

Chlor-alkali process (NaOH)
$2NaCl(aq) + 2H_2O(l) \rightarrow 2NaOH(aq) + Cl_2(g) + H_2(g)$

Tip: Electrolysis of brine; Cl_2 at anode, H_2 at cathode, NaOH in solution

Bleaching powder
$Ca(OH)_2 + Cl_2 \rightarrow CaOCl_2 + H_2O$

Tip: Chemical name: Calcium oxychloride; used for disinfecting water and bleaching

Baking soda
$NaHCO_3$ (Sodium hydrogen carbonate) | On heating: $2NaHCO_3 \rightarrow Na_2CO_3 + H_2O + CO_2$

Tip: Used in baking (CO_2 makes dough rise), antacids, soda-acid fire extinguisher

Washing soda
$Na_2CO_3 \cdot 10H_2O$ (Sodium carbonate decahydrate)

Tip: Used as cleaning agent and for removing permanent hardness of water

Plaster of Paris
$CaSO_4 \cdot \frac{1}{2}H_2O$ | Setting: $CaSO_4 \cdot \frac{1}{2}H_2O + 1\frac{1}{2}H_2O \rightarrow CaSO_4 \cdot 2H_2O$ (gypsum)

Tip: Made from gypsum by heating at 100°C; expands on setting — used in casts

Ch 3. Metals and Non-Metals

Metal + Oxygen
$2Mg + O_2 \rightarrow 2MgO$

Tip: Most metals form basic oxides; non-metals form acidic oxides

Metal + Water (very reactive)
$2Na + 2H_2O \rightarrow 2NaOH + H_2\uparrow$

Tip: K, Na, Ca react vigorously with cold water

Metal + Steam
$3Fe + 4H_2O \rightarrow Fe_3O_4 + 4H_2\uparrow$

Tip: Iron reacts only with steam, not cold water

Metal + Acid
$Zn + H_2SO_4 \rightarrow ZnSO_4 + H_2\uparrow$

Tip: Cu, Ag, Au do not react with dilute acids — below H in reactivity series

Metal + Salt solution (displacement)
$Fe + CuSO_4 \rightarrow FeSO_4 + Cu$

Tip: More reactive metal displaces less reactive metal from its salt solution

Reactivity series (high → low)
K > Na > Ca > Mg > Al > Zn > Fe > Pb > H > Cu > Ag > Au

Tip: Metals above H displace hydrogen from dilute acids

Thermite reaction
$Fe_2O_3 + 2Al \rightarrow Al_2O_3 + 2Fe$

Tip: Used in welding railway tracks; Al acts as reducing agent

Corrosion of iron (rusting)
$4Fe + 3O_2 + xH_2O \rightarrow 2Fe_2O_3 \cdot xH_2O$

Tip: Both O_2 and moisture are required; prevented by painting, galvanising, alloying

Ionic compound formation
$Na \rightarrow Na^+ + e^-$ | $Cl + e^- \rightarrow Cl^- \rightarrow NaCl$

Tip: Metals lose electrons (oxidation); non-metals gain electrons (reduction)

Non-metal + Oxygen (acidic oxide)
$S + O_2 \rightarrow SO_2$ | $C + O_2 \rightarrow CO_2$ | $4P + 5O_2 \rightarrow 2P_2O_5$

Tip: Non-metal oxides dissolve in water to form acids; opposite of metal oxides (basic)

Amphoteric oxide
$Al_2O_3 + 2NaOH \rightarrow 2NaAlO_2 + H_2O$ (with base) | $Al_2O_3 + 6HCl \rightarrow 2AlCl_3 + 3H_2O$ (with acid)

Tip: Reacts with both acids and bases; Al_2O_3 and ZnO are amphoteric

Basic metallurgical processes
Ore → (Concentration) → (Roasting/Calcination) → (Reduction/Smelting) → Crude metal → (Refining)

Tip: Calcination: heating without air (carbonates). Roasting: heating in air (sulphides). Reduction: using C, CO, or electrolysis

Ch 4. Carbon and its Compounds

Alkane general formula
C_nH_{2n+2}

Tip: Saturated hydrocarbons; e.g. methane CH_4, ethane C_2H_6

Alkene general formula
C_nH_{2n}

Tip: One C=C double bond; unsaturated; e.g. ethene C_2H_4

Alkyne general formula
C_nH_{2n-2}

Tip: One C≡C triple bond; unsaturated; e.g. ethyne C_2H_2

Combustion (complete)
$CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$ + heat

Tip: Complete combustion gives blue flame; incomplete gives sooty yellow flame

Combustion of ethanol
$C_2H_5OH + 3O_2 \rightarrow 2CO_2 + 3H_2O$

Tip: Ethanol burns with a clean blue flame

Esterification
$CH_3COOH + C_2H_5OH \rightleftharpoons CH_3COOC_2H_5 + H_2O$

conc. H_2SO_4, heat

Tip: Acid + Alcohol → Ester + Water; sweet smell; reversible reaction

Saponification
Ester + NaOH → RCOONa (soap) + Alcohol

Tip: Soap molecules have hydrophilic head ($-COO^-Na^+$) and hydrophobic tail (carbon chain)

Addition reaction (alkene + Cl_2)
$CH_2=CH_2 + Cl_2 \rightarrow CH_2Cl-CH_2Cl$

Tip: Unsaturated compounds undergo addition; Br_2 water turns colourless — test for unsaturation

Substitution reaction (alkane + Cl_2)
$CH_4 + Cl_2 \rightarrow CH_3Cl + HCl$

sunlight

Tip: Saturated compounds undergo substitution in presence of sunlight

Oxidation of ethanol
$C_2H_5OH \rightarrow CH_3COOH$ (alkaline $KMnO_4$ or acidic $K_2Cr_2O_7$)

Tip: Ethanol oxidised to ethanoic acid; oxidising agents act as oxygen suppliers

Dehydration of ethanol
$C_2H_5OH \rightarrow C_2H_4 + H_2O$

conc. H_2SO_4, 170°C

Tip: Produces ethene (unsaturated); H_2SO_4 acts as dehydrating agent

Ethanoic acid + Na_2CO_3
$2CH_3COOH + Na_2CO_3 \rightarrow 2CH_3COONa + H_2O + CO_2\uparrow$

Tip: Ethanoic acid reacts with carbonates/bicarbonates to give CO_2 — used to identify carboxylic acids

Ethanoic acid properties
Boiling point 118°C | Glacial acetic acid: pure CH_3COOH (freezes at 16.6°C) | Vinegar: 5–8% solution

Tip: Glacial = no water; called acetic acid in older nomenclature

Ch 5. Life Processes

Photosynthesis
$6CO_2 + 6H_2O \rightarrow C_6H_{12}O_6 + 6O_2$

sunlight, chlorophyll

Tip: CO_2 enters through stomata; water absorbed by roots; O_2 is byproduct

Aerobic respiration
$C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O$ + Energy (ATP)

Tip: Occurs in mitochondria; releases ~38 ATP molecules per glucose

Anaerobic respiration (yeast)
$C_6H_{12}O_6 \rightarrow 2C_2H_5OH + 2CO_2$ + Energy

Tip: Used in fermentation; occurs without oxygen

Anaerobic respiration (muscles)
Glucose → Lactic acid + Energy

Tip: Causes muscle cramps; lactic acid removed by increased blood supply after exercise

Excretion (kidney filtration)
Blood → Glomerulus filtration → Tubular reabsorption → Urine

Tip: Nephron is the structural and functional unit of kidney; urea is the main nitrogenous waste

Ch 6. Control and Coordination

Reflex arc path
Stimulus → Receptor → Sensory nerve → Spinal cord → Motor nerve → Effector → Response

Tip: Reflex actions are controlled by spinal cord, not brain — faster response

Synapse
Electrical signal → Chemical neurotransmitter → Electrical signal (next neuron)

Tip: Neurotransmitters released at synapse bridge the gap between two neurons

Plant hormones
Auxin (growth/phototropism) | Gibberellin (stem elongation) | Cytokinin (cell division) | Abscisic acid

Tip: Auxin accumulates on shaded side → cell elongation → bending towards light

Tropic movements
Phototropism (light) | Geotropism (gravity) | Hydrotropism (water) | Thigmotropism (touch)

Tip: Positive tropism = towards stimulus; negative = away from stimulus

Ch 7. How do Organisms Reproduce?

Asexual reproduction types
Binary fission (Amoeba) | Budding (Hydra, Yeast) | Fragmentation (Spirogyra) | Spore formation (Rh

Tip: Asexual reproduction produces genetically identical offspring (clones)

Vegetative propagation
Stem cutting (Rose) | Tuber (Potato) | Leaf (Bryophyllum) | Layering (Jasmine)

Tip: Useful for propagating plants that do not produce seeds or produce sterile seeds

Pollination types
Self-pollination (same flower) | Cross-pollination (different flower/plant)

Tip: Cross-pollination introduces genetic variation; aided by wind, insects, water

Double fertilisation (plants)
1 sperm + egg → zygote (embryo) | 1 sperm + 2 polar nuclei → endosperm

Tip: Unique to angiosperms; endosperm provides nutrition to developing embryo

Gestation period (humans)
~9 months (38–40 weeks) from fertilisation to birth

Tip: Placenta provides nutrients and O_2 to foetus; removes CO_2 and waste

Ch 8. Heredity

Monohybrid cross F_2 ratio
3 : 1 (dominant : recessive) phenotype | 1 : 2 : 1 (TT : Tt : tt) genotype

Tip: Law of Segregation: alleles separate during gamete formation

Dihybrid cross F_2 ratio
9 : 3 : 3 : 1 (four phenotype classes)

Tip: Law of Independent Assortment: genes for different traits assort independently

Sex determination (humans)
XX = Female | XY = Male

Tip: Father determines sex of child — Y chromosome from sperm decides male; X from sperm gives female

Inherited vs acquired traits
Inherited: controlled by genes, passed to offspring | Acquired: caused by environment, NOT passed

Tip: Acquired traits (e.g. muscle built by exercise) do not change DNA and cannot be inherited

Ch 12. Magnetic Effects of Electric Current

Force on current-carrying conductor
$F = BIL \sin\theta$

B = magnetic field (T), I = current (A), L = length (m), θ = angle between B and L

Tip: Maximum force when conductor is perpendicular to field (θ = 90°)

Right-hand thumb rule
Thumb → direction of current; curled fingers → direction of magnetic field lines around wire

Tip: Used to find direction of B around a straight current-carrying conductor

Fleming's Left-Hand Rule (motor)
Forefinger → B field | Middle finger → Current | Thumb → Force (motion)

Tip: Used for electric motors (converts electrical energy to mechanical energy)

Fleming's Right-Hand Rule (generator)
Forefinger → B field | Middle finger → Induced current | Thumb → Motion

Tip: Used for electric generators (converts mechanical energy to electrical energy)

AC frequency (India)
$f = 50$ Hz | $T = 1/f = 0.02$ s

Tip: AC reverses direction 50 times per second in India; USA uses 60 Hz

Advantage of AC over DC
AC voltage can be stepped up/down using transformer; DC cannot

Tip: High voltage AC used for long-distance transmission to reduce energy loss ($P = I^2R$)

Domestic circuit
Live (red/brown, 220V) | Neutral (black/blue, 0V) | Earth (green, safety)

Tip: Fuse and switch always connected in live wire; earth wire prevents electric shock

Ch 13. Our Environment

10% energy law (Lindemann)
Only 10% of energy transfers from one trophic level to the next

Tip: 90% lost as heat; reason food chains are short (usually 3–4 levels)

Trophic levels

T1: Producers (plants) → T2: Primary consumers (herbivores) → T3: Secondary consumers → T4: Ter

Tip: Energy and biomass decrease at each level; toxins (DDT) accumulate — biological magnification

Ozone layer reaction (depletion)

$CFC \rightarrow Cl \mid Cl + O_3 \rightarrow ClO + O_2$ (chain reaction depletes ozone)

Tip: CFCs from refrigerants and aerosols cause ozone depletion; UV-B radiation increases

Biodegradable vs non-biodegradable

Biodegradable: broken down by microbes (paper, food) | Non-biodegradable: persist in environmen

Tip: Non-biodegradable substances accumulate in food chains (biological magnification)