

Class 9 Science: Chapter-wise Key Points and Formulas

Physics, chemistry and biology of Class 9 NCERT, in one revision file.

Matter in our surroundings

- Matter is made of tiny particles with spaces between them; particles attract each other and are always moving.
- Solid: fixed shape and volume. Liquid: fixed volume, no fixed shape. Gas: no fixed shape or volume.
- Melting point of ice 0°C (273 K). Boiling point of water 100°C (373 K). $K = ^\circ C + 273$.
- Evaporation happens at any temperature from the surface and causes cooling. Latent heat of fusion is the heat needed to change 1 kg solid to liquid at its melting point.
- Sublimation: solid straight to gas (camphor, naphthalene, dry ice).

Is matter around us pure?

- Pure substance: element or compound. Mixture: homogeneous (solution) or heterogeneous (suspension, colloid).
- Tyndall effect: scattering of light by colloid particles. Suspensions settle; solutions and colloids do not.
 $\text{Concentration} = (\text{mass of solute} \div \text{mass of solution}) \times 100$
- Separation: evaporation, centrifugation, separating funnel (immiscible liquids), sublimation, chromatography, distillation, fractional distillation, crystallisation.
- Physical change vs chemical change. Elements: metals, non-metals, metalloids.

Atoms and molecules

- Laws: conservation of mass (mass is neither created nor destroyed in a reaction) and constant proportions (a compound always has the same elements in the same ratio by mass).
- Atomic mass unit: 1/12 of the mass of a carbon-12 atom.
 $\text{Mole} = \text{given mass} \div \text{molar mass} = \text{number of particles} \div 6.022 \times 10^{23}$
- Molecular mass is the sum of atomic masses. Formula unit mass is used for ionic compounds.
- Valency is the combining capacity. Write formulas by crossing over valencies (Al^{3+} and O^{2-} give Al_2O_3).

Structure of the atom

- Electron (–), proton (+), neutron (no charge). Thomson: plum pudding model. Rutherford: nucleus at the centre (α -particle scattering). Bohr: electrons in fixed orbits.
- Maximum electrons in a shell = $2n^2$ (K: 2, L: 8, M: 18). The outermost shell can hold at most 8.
 $\text{Atomic number } Z = \text{number of protons} \mid \text{Mass number } A = \text{protons} + \text{neutrons}$
- **Isotopes:** same Z, different A (carbon-12, carbon-14). **Isobars:** same A, different Z (calcium-40 and argon-40).

The fundamental unit of life

- Cell wall (plants only), cell membrane (selectively permeable), nucleus (control, DNA), cytoplasm.
- Mitochondria: power houses. Ribosomes: protein factories. ER: transport. Golgi: packing and secretion. Lysosomes: waste disposal. Plastids (chloroplast): photosynthesis (plants). Vacuoles: storage.
- Diffusion and osmosis move substances in and out of cells. Prokaryotes have no true nucleus; eukaryotes do.

Tissues

- Plant tissues: meristematic (growth) and permanent (simple: parenchyma, collenchyma, sclerenchyma; complex: xylem carries water, phloem carries food).
- Animal tissues: epithelial, connective (blood, bone, cartilage), muscular (striated, smooth, cardiac), nervous.

Motion

$$v = u + at \mid s = ut + \frac{1}{2}at^2 \mid v^2 = u^2 + 2as$$

- Distance is a scalar; displacement is a vector. Speed = distance/time; velocity = displacement/time; acceleration = change in velocity/time.
- Uniform circular motion has constant speed but changing velocity. The slope of a distance-time graph is speed; the area under a speed-time graph is the distance.

Force and laws of motion

- First law: a body stays at rest or in uniform motion unless a net force acts (inertia). Second law: force = rate of change of momentum. Third law: every action has an equal and opposite reaction.

$$\text{Momentum } p = m \times v \mid \text{Force } F = m \times a \mid \text{Unit of force: newton (N) = kg}\cdot\text{m/s}^2$$

- Conservation of momentum: total momentum before collision = total momentum after.

Gravitation

$$F = G \frac{m_1 m_2}{r^2} \mid G = 6.67 \times 10^{-11} \text{ N m}^2/\text{kg}^2 \mid g = 9.8 \text{ m/s}^2 \text{ near Earth}$$

Weight $W = m \times g$ | Weight on the Moon is about one-sixth of that on Earth.

- Free fall: all objects fall with the same acceleration in a vacuum. Pressure = force/area. Buoyant force acts upward; Archimedes' principle: the upthrust equals the weight of the fluid displaced.

Work and energy

$$\text{Work } W = F \times s \text{ (force along the displacement) } \mid \text{unit joule (J)}$$

$$\text{Kinetic energy} = \frac{1}{2} m v^2 \mid \text{Potential energy} = m g h \mid \text{Power} = \text{Work} \div \text{Time (watt)}$$

- The law of conservation of energy: energy can change form but the total stays constant. 1 kWh = 3.6×10^6 J.

Sound

- Sound is a longitudinal wave of compressions and rarefactions; it needs a medium. Speed is highest in solids, then liquids, then gases.

$$v = f \times \lambda \mid \text{Speed of sound in air about } 344 \text{ m/s at } 22^\circ\text{C}$$

- Echo: needs a minimum distance of about 17 m between the source and the reflector. Reverberation: repeated echoes in a hall. SONAR uses ultrasonic waves.
- Human hearing range: about 20 Hz to 20,000 Hz.

Improvement in food resources

- Crop seasons: kharif (monsoon: rice, maize, soyabean) and rabi (winter: wheat, gram, mustard).
- Manure and fertilisers improve soil. Mixed cropping, intercropping and crop rotation raise yield. Organic farming avoids chemicals.
- Animal husbandry: cattle (milk, draught), poultry (eggs, meat), fish production, bee keeping (honey).

Tip: Numericals: write given, formula, substitution with units, answer with units. Chemistry: learn symbols and valencies of the first 20 elements. Biology: practise labelled diagrams.