

CLASS 9

Physics & Chemistry — Complete Formula Handbook

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PHYSICS

Motion

Speed	$v = s / t$
Average speed	$v_{avg} = \text{Total distance} / \text{Total time}$
Velocity	$v = \text{Displacement} / \text{Time}$
Acceleration	$a = (v - u) / t$
1st equation of motion	$v = u + at$
2nd equation of motion	$s = ut + \frac{1}{2}at^2$
3rd equation of motion	$v^2 = u^2 + 2as$
Distance (uniform circular motion)	$v = 2\pi r / t$

Force and Laws of Motion

Newton's 2nd law	$F = ma$
Momentum	$p = mv$
Impulse	$J = F \times t = \Delta p$
Law of conservation of momentum	$m_1u_1 + m_2u_2 = m_1v_1 + m_2v_2$

Gravitation

Universal law of gravitation	$F = G \cdot m_1 \cdot m_2 / r^2$
Universal gravitational constant	$G = 6.674 \times 10^{-11} \text{ N} \cdot \text{m}^2 / \text{kg}^2$
Acceleration due to gravity	$g = GM / R^2 (\approx 9.8 \text{ m/s}^2)$
Weight	$W = mg$
Mass vs Weight	Mass is constant; Weight = mg varies with g
Thrust and Pressure	Pressure = Thrust / Area
Pressure in fluids	$P = h \cdot \rho \cdot g$
Archimedes' principle	Buoyant force = Weight of fluid displaced
Relative density	RD = Density of substance / Density of water
Free fall equations	$v = gt, h = \frac{1}{2}gt^2, v^2 = 2gh$

Work and Energy

Work done	$W = F \times s \times \cos \theta$
Kinetic energy	$KE = \frac{1}{2}mv^2$
Potential energy	$PE = mgh$
Power	$P = W / t$
Power (alt. form)	$P = F \times v$
Law of conservation of energy	Total energy before = Total energy after (energy is never created or destroyed)
Commercial unit of energy	1 kWh = 3.6×10^6 J

Sound

Wave speed	$v = f \times \lambda$
Speed of sound (air, 25°C)	≈ 346 m/s
Time period	$T = 1 / f$
Echo (minimum distance)	$d = v \times t / 2$
Range of hearing (human)	20 Hz – 20,000 Hz

CHEMISTRY

Matter in Our Surroundings

States of matter	Solid, Liquid, Gas — interconvertible by changing temperature/pressure
Latent heat of fusion	Heat needed to convert 1 kg solid to liquid at constant temperature (ice → water: 334 J/g)
Latent heat of vaporization	Heat needed to convert 1 kg liquid to vapour at constant temperature (water → steam: 2260 J/g)
Temperature conversion	$K = ^\circ C + 273$

Is Matter Around Us Pure

Concentration of solution	Concentration = Mass of solute / Mass of solution $\times 100$
Mass by mass %	% = (Mass of solute / Mass of solution) $\times 100$
Mass by volume %	% = (Mass of solute / Volume of solution) $\times 100$
Separation techniques	Evaporation, Distillation, Chromatography, Centrifugation, Sublimation, Separating funnel

Atoms and Molecules

Law of conservation of mass	Mass of reactants = Mass of products
Law of constant proportions	Elements in a compound are always in a fixed ratio by mass
Atomic mass unit (amu)	1 amu = 1/12 mass of a Carbon-12 atom
Mole concept	1 mole = 6.022×10^{23} particles (Avogadro's number)
Number of moles	$n = \text{Given mass} / \text{Molar mass}$
Molar volume (STP)	1 mole of gas = 22.4 L at STP
Molecular mass	Sum of atomic masses of all atoms in a molecule

Structure of the Atom

Atomic number (Z)	Z = Number of protons
Mass number (A)	A = Number of protons + Number of neutrons
Number of neutrons	$n = A - Z$
Valency	Combining capacity of an atom, related to valence electrons
Bohr-Bury rule (max electrons in shell)	$2n^2$ (n = shell number)
Isotopes	Same atomic number, different mass number

Isobars	Same mass number, different atomic number
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