CLASS 11 PHYSICS — FORMULA SHEET

Chapter 1 : Units and Measurements (NCERT)

1.1 SI Base (Fundamental) Units

Physical Quantity	SI Unit	Symbol
Length	metre	m
Mass	kilogram	kg
Time	second	s
Electric current	ampere	A
Temperature	kelvin	K
Amount of substance	mole	mol
Luminous intensity	candela	cd
Supplementary: plane angle	radian	rad
Supplementary: solid angle	steradian	sr

1.2 Measurement of Length, Mass & Time

Concept	Detail / Value
Parallax method	Distance D = b ÷ θ (b = basis/baseline, θ = parallax angle in radian)
Angular size relation	d = D × α (α = angular diameter in radian)
1 light year	= 9.46×10^{15} m (distance light travels in 1 year)
1 astronomical unit (AU)	= 1.496×10^{11} m (mean Earth–Sun distance)
1 parsec	= 3.08×10^{16} m = 3.26 light years
1 angstrom (Å)	= 10^{-10} m
1 fermi	= 10^{-15} m
1 atomic mass unit (u)	= 1.66×10^{-27} kg

1.3 Significant Figures — Rules

Rule	Example
All non-zero digits are significant	23.45 → 4 s.f.
Zeros between non-zero digits are significant	1005 → 4 s.f.
Leading zeros are NOT significant	0.0023 → 2 s.f.
Trailing zeros after decimal ARE significant	2.300 → 4 s.f.
Trailing zeros (no decimal) ambiguous	use scientific notation to be clear
Addition / Subtraction	Answer keeps least DECIMAL PLACES
Multiplication / Division	Answer keeps least SIGNIFICANT FIGURES
Rounding off	If digit > 5 round up; < 5 round down; = 5 → make preceding digit even

1.4 Errors in Measurement

Type of Error	Formula
Mean / true value	$a_{mean} = (a_1 + a_2 + \ldots + a_n) \div n$
Absolute error	$\Delta a_i = \lvert a_{mean} - a_i \rvert$
Mean absolute error	$\Delta a_{mean} = (\lvert \Delta a_1 \rvert + \ldots + \lvert \Delta a_n \rvert) \div n$
Relative (fractional) error	$= \Delta a_{mean} \div a_{mean}$
Percentage error	$= (\Delta a_{mean} \div a_{mean}) \times 100\%$

1.5 Combination (Propagation) of Errors

Operation	Resultant Error
Sum: Z = A + B	$\Delta Z = \Delta A + \Delta B$ (absolute errors ADD)
Difference: Z = A − B	$\Delta Z = \Delta A + \Delta B$ (absolute errors still ADD)
Product: Z = A × B	$\Delta Z/Z = \Delta A/A + \Delta B/B$ (relative errors add)
Quotient: Z = A ÷ B	$\Delta Z/Z = \Delta A/A + \Delta B/B$ (relative errors add)
Power: Z = A^pB^q/C^r	$\Delta Z/Z = p(\Delta A/A) + q(\Delta B/B) + r(\Delta C/C)$
Key idea	In ±, absolute errors add; in ×÷ and powers, relative/percentage errors add

1.6 Dimensional Analysis

Quantity	Dimensional Formula
Area	$[L^2]$
Volume	$[L^3]$
Velocity / Speed	$[M^0L^1T^{-1}]$
Acceleration	$[M^0L^1T^{-2}]$
Force	$[M^1L^1T^{-2}]$
Work / Energy / Torque	$[M^1L^2T^{-2}]$
Power	$[M^1L^2T^{-3}]$
Pressure / Stress	$[M^1L^{-1}T^{-2}]$
Momentum / Impulse	$[M^1L^1T^{-1}]$
Density	$[M^1L^{-3}T^0]$
Frequency	$[M^0L^0T^{-1}]$
Gravitational constant G	$[M^{-1}L^3T^{-2}]$
Planck's constant h	$[M^1L^2T^{-1}]$

1.7 Uses & Limitations of Dimensional Analysis

Point	Detail
Principle of homogeneity	Every term in a valid physical equation has the SAME dimensions
Use 1: Check correctness	An equation is dimensionally correct if LHS dimensions = RHS dimensions
Use 2: Convert units	$n_1u_1 = n_2u_2$ (numeric value × unit size is constant)
Use 3: Derive relations	Deduce form of a formula by equating dimensions
Limitation 1	Cannot find dimensionless constants (like ½, 2π)
Limitation 2	Cannot derive equations with +, −, trig, exp, or log terms
Limitation 3	Fails if a quantity depends on more than 3 quantities

★ QUICK MEMORY AIDS & TRICKS

7 SI base units	'metre, kg, second, ampere, kelvin, mole, candela' — Length, Mass, Time, Current, Temp, Amount, Light.
Error rule	± → absolute errors ADD ; ×÷ and powers → relative (%) errors ADD.
Power error	For $Z = A^pB^q/C^r$, multiply each relative error by its power (p, q, r).
Homogeneity	Both sides of any real equation must have identical dimensions.
Sig-fig zeros	Leading zeros never count; trailing zeros count only after a decimal.
Length ladder	fermi 10^{-15} < Å 10^{-10} < AU 10^{11} < light-year 10^{15} < parsec 10^{16} (in metres).
Energy = Work = Torque	All share dimension $[ML^2T^{-2}]$ — handy for quick checks.
Unit conversion	$n_1u_1 = n_2u_2$: bigger unit → smaller number.