



GCSE (9–1) Physics A (Gateway Science)

J249 01/02/03/04

Equation Sheet



- Do **not** send this Equation Sheet for marking. Keep it in the centre or recycle it.

- This Equation Sheet is for the June 2024 examination series only.
- This Equation Sheet has **4** pages.

Equations in physics

Key: HT = Higher Tier only

	P1 Matter	
	density = $\frac{\text{mass}}{\text{volume}}$	$\rho = \frac{m}{V}$
	change in thermal energy = mass $\times$ specific heat capacity $\times$ change in temperature	$\Delta E = m c \Delta \theta$
	thermal energy for a change in state = mass $\times$ specific latent heat	$E = m l$
	for a given mass of gas at a constant temperature: pressure $\times$ volume = constant	$p V = \text{constant}$
HT	pressure due to a column of liquid = height of column $\times$ density of liquid $\times$ gravitational field strength	$p = h \rho g$

	P2 Forces	
	distance travelled = speed $\times$ time	$s = v t$
	acceleration = $\frac{\text{change in velocity}}{\text{time}}$	$a = \frac{v - u}{t}$
	(final velocity) ² – (initial velocity) ² = 2 $\times$ acceleration $\times$ distance	$v^2 - u^2 = 2 a s$
	kinetic energy = $\frac{1}{2} \times \text{mass} \times (\text{speed})^2$	$E = \frac{1}{2} m v^2$
	force = mass $\times$ acceleration	$F = m a$
HT	momentum = mass $\times$ velocity	$p = m v$
	work done = force $\times$ distance (along the line of action of the force)	$W = F s$
	power = $\frac{\text{work done}}{\text{time}}$	$P = \frac{W}{t}$

	P2 Forces	
	force exerted by a spring = spring constant $\times$ extension	$F = kx$
	energy transferred in stretching = $\frac{1}{2} \times$ spring constant $\times$ (extension) ²	$E = \frac{1}{2} kx^2$
	gravitational force = mass $\times$ gravitational field strength	$W = mg$
	gravitational potential energy = mass $\times$ gravitational field strength $\times$ height	$E = mgh$
	pressure = $\frac{\text{force normal to a surface}}{\text{area of that surface}}$	$p = \frac{F}{A}$
	moment of a force = force $\times$ distance (normal to direction of the force)	$M = Fd$

	P3 Electricity	
	charge flow = current $\times$ time	$Q = It$
	potential difference = current $\times$ resistance	$V = IR$
	energy transferred = charge $\times$ potential difference	$E = QV$
	power = potential difference $\times$ current	$P = VI$
	power = (current) ² $\times$ resistance	$P = I^2R$
	energy transferred = power $\times$ time	$E = Pt$

	P4 Magnetism and magnetic fields	
HT	force on a conductor (at right angles to a magnetic field) carrying a current: force = magnetic flux density $\times$ current $\times$ length	$F = BIl$
HT	$\frac{\text{potential difference across primary coil}}{\text{potential difference across secondary coil}} = \frac{\text{number of turns in primary coil}}{\text{number of turns in secondary coil}}$	$\frac{V_p}{V_s} = \frac{N_p}{N_s}$

Turn over

	P5 Waves in matter	
	wave speed = frequency × wavelength	$v = f\lambda$
	P7 Energy	
	efficiency = $\frac{\text{useful output energy transfer}}{\text{input energy transfer}}$	
	P8 Global challenges	
	potential difference across primary coil × current in primary coil = potential difference across secondary coil × current in secondary coil	$V_p I_p = V_s I_s$