



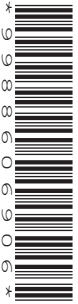
Oxford Cambridge and RSA

**June 2023 only**

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

**J249 01/02/03/04**

**Equation Sheet**



**INSTRUCTIONS**

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

**INFORMATION**

- This Equation Sheet is for the June 2023 examination series only.
- This Equation Sheet has **4** pages.

# Equations in physics

Key: HT = Higher Tier only

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

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

	<b>P2 Forces</b>	
	force exerted by a spring = spring constant $\times$ extension	$F = kx$
	energy transferred in stretching = $\frac{1}{2} \times$ spring constant $\times$ (extension) <sup>2</sup>	$E = \frac{1}{2} kx^2$
	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)	$M = Fd$

	<b>P3 Electricity</b>	
	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) <sup>2</sup> $\times$ resistance	$P = I^2R$
	energy transferred = power $\times$ time	$E = Pt$

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

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