Oxford Cambridge and RSA

June 2023 only

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

J249 01/02/03/04

Equation Sheet

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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

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

	P2 Forces	
	distance travelled = speed × time	$s = v t$
	acceleration = $\frac{\text{change in velocity}}{\text{time}}$	$a = \frac{v - u}{t}$
	(final velocity)^2 – (initial velocity)^2 = 2 × acceleration × distance	$v^2 - u^2 = 2 a s$
	kinetic energy = $\frac{1}{2}$ × mass × (speed)^2	$E = \frac{1}{2} m v^2$
	force = mass × acceleration	$F = m a$
HT	momentum = mass × velocity	$p = m v$
	work done = force × 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 × extension	$F = kx$
	energy transferred in stretching = $\frac{1}{2}$ × spring constant × (extension)^2	$E = \frac{1}{2}kx^2$
	gravitational force = mass × gravitational field strength	$W = mg$
	gravitational potential energy = mass × gravitational field strength × 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 × distance (normal to direction of the force)	$M = Fd$

	P3 Electricity	
	charge flow = current × time	$Q = It$
	potential difference = current × resistance	$V = IR$
	energy transferred = charge × potential difference	$E = QV$
	power = potential difference × current	$P = VI$
	power = (current)^2 × resistance	$P = I^2R$
	energy transferred = power × 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 × current × 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	$V_p I_p = V_s I_s$