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OCR GCSE (9-1) PHYSICS B J259

TWENTY FIRST CENTURY SCIENCE | FOUNDATION + HIGHER

EQUATIONS, METHODS & PRACTICAL-MATHS HANDBOOK

Current equation-sheet regime + Physics B formula selection + PAG calculation toolkit

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Current equation-sheet regime

Equation sheet is permanent under the current specification

OCR confirms J259 students receive a revised equation sheet containing all Physics equations in 2027. Following Ofqual's 2026 decision, equation sheets continue from 2028 for the lifetime of the current specification. Students still need to select, rearrange and interpret equations and units correctly.

The J259 specification identifies recall/apply and select/apply relationships, with Higher-only equations shown in bold. Several equations are also separate-Physics-only relative to Combined Science B.

Wave speed - P1.3.6

Scope	Relationship / equation	Typical unit
Both	$v = f \lambda$	m/s

Selection/check: Use frequency in Hz and wavelength in m; frequency stays fixed across a boundary when source unchanged.

Original worked example: A wave has frequency 250 Hz and wavelength 1.36 m: v = 250 × 1.36 = 340 m/s.

Energy transferred - P2.1.3

Scope	Relationship / equation	Typical unit
Both	$E = P t$	J

Selection/check: Power is rate of energy transfer; use seconds with watts unless working deliberately in kWh.

Original worked example: A 1.5 kW heater operates for 20 min. In SI: P=1500 W, t=1200 s, so E=1.8×10^6 J.

Efficiency - P2.1.8

Scope	Relationship / equation	Typical unit
Both	efficiency = useful energy transferred / total energy transferred	ratio or %

Selection/check: Useful output divided by total input.

Charge flow - P3.2.2

Scope	Relationship / equation	Typical unit
Both	$Q = I t$	C

Selection/check: Convert mA to A and minutes to seconds when using SI.

Original worked example: 0.40 A flows for 150 s: Q = 0.40 × 150 = 60 C.

Ohm relationship - P3.2.4a

Scope	Relationship / equation	Typical unit
Both	$V = I R$	V

Selection/check: Use p.d. and current for the same component.

Original worked example: A resistor has 6.0 V across it and 0.30 A through it: R = 6.0/0.30 = 20 Ω.

Potential difference and work - P3.3.1

Scope	Relationship / equation	Typical unit
Both	$V = W / Q$	V

Selection/check: Work/energy per coulomb.

Power - P3.4.2 / P4.4.9

Scope	Relationship / equation	Typical unit
Both	P = E / t	W

Selection/check: Do not confuse energy with power.

Electrical energy - P3.4.3

Scope	Relationship / equation	Typical unit
Both	E = Q V	J

Selection/check: Energy transferred by charge moving through a p.d.

Electrical power - P3.4.4a

Scope	Relationship / equation	Typical unit
Both	P = V I	W

Selection/check: Choose known p.d. and current.

Electrical power via resistance - P3.4.4b

Scope	Relationship / equation	Typical unit
Both	$P = I^2 R$	W

Selection/check: Square current, not resistance.

Weight - P4.1.7

Scope	Relationship / equation	Typical unit
Both	W = m g	N

Selection/check: Mass in kg; gravitational field strength in N/kg.

Average speed - P4.2.1

Scope	Relationship / equation	Typical unit
Both	v = s / t	m/s

Selection/check: Use distance, not displacement, for average speed.

Acceleration - P4.2.6a

Scope	Relationship / equation	Typical unit
Both	a = (v-u)/t	m/s^2

Selection/check: Signed velocities matter.

Original worked example: Velocity changes from 4 to 16 m/s in 3 s: a=(16-4)/3=4.0 m/s^2.

Momentum - P4.3.4 / P4.3.13

Scope	Relationship / equation	Typical unit
Higher	p = m v	kg m/s

Selection/check: Choose a positive direction for collision calculations.

Original worked example: A 0.20 kg ball moving at -12 m/s has p = -2.4 kg m/s for the chosen positive direction.

Moment - P4.3.9

Scope	Relationship / equation	Typical unit

Both	M = F d	N m

Selection/check: d is perpendicular distance to the line of action.

Newton II - P4.3.12 / P4.3.13

Scope	Relationship / equation	Typical unit
Both	F = m a	N

Selection/check: Use resultant force.

Work done - P4.4.2

Scope	Relationship / equation	Typical unit
Both	W = F s	J

Selection/check: Distance is along the force direction.

Kinetic energy - P4.4.3

Scope	Relationship / equation	Typical unit
Both	$E = 1/2\ m\ v^2$	J

Selection/check: Square speed.

Original worked example: m=1.5 kg, v=8 m/s: $E=0.5\times1.5\times8^2=48$ J.

Gravitational potential energy - P4.4.4

Scope	Relationship / equation	Typical unit
Both	E = m g h	J

Selection/check: Use change in vertical height.

Density - P6.1.2

Scope	Relationship / equation	Typical unit
Both	ρ = m / V	kg/m^3

Selection/check: Convert volume units correctly; cubic conversions matter.

Original worked example: m=0.72 kg, V=3.0×10^-4 m^3: ρ=2400 kg/m^3.

Hooke law - P6.3.5

Scope	Relationship / equation	Typical unit
Both	F = k x	N

Selection/check: x is extension, not total length.

Pressure - P6.4.2

Scope	Relationship / equation	Typical unit
Separate Physics	p = F / A	Pa

Selection/check: Use normal force and area in m^2.

Motor effect - P3.6.3

Scope	Relationship / equation	Typical unit
Higher	F = B I l	N

Selection/check: For conductor at right angles to magnetic field.

Original worked example: B=0.25 T, I=3.0 A, l=0.40 m at right angles: F=0.30 N.

Ideal transformer power - P3.4.5 / P3.7.8a

Scope	Relationship / equation	Typical unit
Both	Vp Ip = Vs Is	W

Selection/check: Ideal model: input power = output power.

Transformer turns ratio - P3.7.8b

Scope	Relationship / equation	Typical unit
Higher Separate Physics	Vp/Vs = Np/Ns	ratio

Selection/check: Label primary/secondary first.

SUVAT - P4.2.7

Scope	Relationship / equation	Typical unit
Both	$v^2 - u^2 = 2\ a\ s$	SI

Selection/check: Keep signs consistent.

Impulse / momentum change - P4.3.5

Scope	Relationship / equation	Typical unit
Higher	$\Delta p = F\ t$	kg m/s

Selection/check: Resultant force times interaction time.

Specific heat capacity - P6.1.5a

Scope	Relationship / equation	Typical unit
Both	$\Delta E = m\ c\ \Delta\theta$	J

Selection/check: Use temperature change.

Original worked example: m=2.0 kg, c=900 J/kg°C, Δθ=15°C: ΔE=27 000 J.

Specific latent heat - P6.1.6

Scope	Relationship / equation	Typical unit
Both	$E = m\ L$	J

Selection/check: State change at constant temperature in ideal model.

Elastic energy - P6.3.7

Scope	Relationship / equation	Typical unit
Both	$E = 1/2\ k\ x^2$	J

Selection/check: Extension in metres, squared.

Gas pressure-volume - P6.4.5

Scope	Relationship / equation	Typical unit
Separate Physics	pV = constant	Pa m^3

Selection/check: Fixed mass of gas at constant temperature.

Liquid pressure - P6.4.8

Scope	Relationship / equation	Typical unit
Higher Separate Physics	$p = \rho\ g\ h$	Pa

Selection/check: Use vertical depth and density.

Unit, graph and data control

- Length: mm/cm -> m before SI substitution; area/volume conversion factors are squared/cubed.
- Mass: g -> kg. Time: min/h -> s when equations use SI.
- Prefixes: milli 10^-3, micro 10^-6, kilo 10^3, mega 10^6.
- Use axis units to identify gradient/area meaning; do not call a trend proportional unless it is linear through the origin.
- Carry extra digits through intermediate steps and round only the final answer unless the question specifies otherwise.

PAG calculation toolkit

PAG1 Materials

Measure mass and appropriate dimensions/volume; use displacement for irregular solids; calculate density and consider measurement resolution.

PAG2 Forces

Measure original and loaded lengths; calculate extension; vary force systematically; graph force against extension; identify linear region/limit behaviour.

PAG3 Motion

Measure distance/time or use suitable sensors; calculate speed/acceleration; vary force or mass as designed; control relevant variables.

PAG4 Measuring Waves

Use ripple tank/sound apparatus as appropriate; repeat distance over several wavelengths where useful; apply $v=f\lambda$ and evaluate uncertainty.

PAG5 Energy

Measure mass, temperature change and energy input; minimise/consider losses; calculate c and explain systematic limitations.

PAG6 Circuit components

Construct circuit correctly; ammeter in series, voltmeter in parallel; vary p.d.; record paired I/V values; plot and interpret characteristics.

PAG7 Series and Parallel Circuits

Build circuits from diagrams; compare current/p.d./brightness or equivalent quantities; identify how changes in arrangement affect behaviour.

PAG8 Interactions of waves

Use ray box/mirror/prism or equivalent; draw normal; measure angles; repeat and evaluate alignment/thickness/parallax limitations.

Breadth/Depth equation strategy

Context	Best control
Breadth	Recognise the quantity fast; select the correct equation from the sheet; convert units before substitution; keep concise visible working.
Depth	Expect multi-step calculations or equations embedded in practical/novel contexts; explain why the relationship/model applies and connect the numerical result to the physics.
Higher	Be ready for momentum, motor effect, transformer turns and liquid-pressure relationships where the specification marks them Higher-only.

References and evidence base

Accessed 12 November 2026. Specification mappings, boundaries, results statistics, equation-sheet policy and examiner-evidence labels were checked against the sources below. Diagnostic entries do not claim frequency percentages unless OCR has published them.

[SPEC] OCR GCSE (9-1) Twenty First Century Science Physics B J259 Specification, Version 4.2 (February 2024)
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https://www.ocr.org.uk/administration/support-and-tools/subject-updates/formulae-equation-sheets-763224/

[EQ28] OCR formulae and equation sheets confirmed for 2028 onwards
https://www.ocr.org.uk/administration/support-and-tools/subject-updates/maths-science-ofqual-update-758751/

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https://www.ocr.org.uk/administration/support-and-tools/subject-updates/gcse-sciences-maths-handbook-750981/