

Unlike A-Level, the IGCSE paper gives you no formula sheet. Every relationship below has to come out of memory, and a question that begins “calculate” is unanswerable without it. They are grouped the way the syllabus groups them, and the note after each says what the examiner is really testing. IGCSE :

Motion, forces and energy

Average speed — $v = s/t$. Distance is the whole path travelled; displacement is the straight line from start to finish.

Acceleration — $a = \Delta v/t$. A negative value means slowing down only if the object is moving forwards.

Weight and mass — $W = mg$, with $g = 9.8 \text{ N kg}^{-1}$ on Earth. Mass is in kilograms and never changes; weight is a force in newtons and does.

Resultant force — $F = ma$. Use the resultant, after adding the forces with their directions, never a single one of them.

Density — $\rho = m/V$. If it floats, its density is less than the liquid's.

Moment — moment = force $\times$ perpendicular distance from the pivot. At balance, total clockwise moment equals total anticlockwise moment.

Pressure — $p = F/A$, and in a liquid $p = \rho gh$ where h is depth below the surface.

Work and power — $W = Fd$ and $P = W/t$. One watt is one joule per second.

Kinetic and gravitational energy — $E_k = \frac{1}{2}mv^2$ and $\Delta E_p = mg\Delta h$. Doubling the speed quadruples the kinetic energy.

Efficiency — useful energy output divided by total energy input, times 100 per cent. It can never exceed 100.

Hooke's law — $F = kx$, where x is the extension, not the total length.

Thermal physics

Specific heat capacity — $E = mc\Delta\theta$, used when the temperature changes

Specific latent heat — $E = mL$, used when the state changes and the temperature stays constant

Gas laws — For a fixed mass at constant temperature, $p_1V_1 = p_2V_2$.

Waves and light

Wave equation — $v = f\lambda$, and $T = 1/f$

Refractive index — $n = \sin i / \sin r$, angles always measured from the normal, never the surface

Critical angle — $\sin c = 1/n$. Beyond this angle you get total internal reflection.

Electricity and magnetism

Charge — $Q = It$

Potential difference — $V = W/Q$, that is, energy transferred per unit charge

Ohm's law — $V = IR$

Electrical power and energy — $P = IV$ and $E = IVt$

Resistors in series and parallel — series $R = R_1 + R_2$; parallel $1/R = 1/R_1 + 1/R_2$, which always gives less than the smallest resistor

Transformer — $V_p/V_s = N_p/N_s$; for 100 per cent efficiency, $V_p I_p = V_s I_s$

Nuclear and space

Half-life — the time for half the undecayed nuclei to decay. After n half-lives, a fraction $1/2^n$ remains.

Orbital speed — $v = 2\pi r/T$, where r is the orbital radius and T the period

How to lose marks with the right equation

Write the equation first, in symbols, before substituting. A correct equation with an arithmetic slip usually keeps a mark; a bare wrong number keeps none.

Convert units before substituting, not after: centimetres to metres, grams to kilograms, minutes to seconds, kilowatts to watts.

Every answer needs a unit, and the unit tells you whether the equation was rearranged correctly. If the numbers give newtons where the question asked for joules, look again.