# IGCSE Physics

**Formula Sheet · 公式表**

*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 考卷不附公式表: 以下公式必须全部背下来。*

## Motion, forces and energy

**Average speed** 平均速度 – $v = s/t$. Distance is the whole path travelled; displacement is the straight line from start to finish.

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

**Weight and mass** 重力与质量 – $W = mg$, with $g = 9.8$ N kg$^{-1}$ on Earth. Mass is in kilograms and never changes; weight is a force in newtons and does.

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

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

**Moment** 力矩 – moment = force × perpendicular distance from the pivot. At balance, total clockwise moment equals total anticlockwise moment.

**Pressure** 压强 – $p = F/A$, and in a liquid $p = \rho g h$ where $h$ is depth below the surface.

**Work and power** 功与功率 – $W = Fd$ and $P = W/t$. One watt is one joule per second.

**Kinetic and gravitational energy** 动能与重力势能 – $E_k = \frac{1}{2}mv^2$ and $\Delta E_p = mg\Delta h$. Doubling the speed quadruples the kinetic energy.

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

**Hooke"s law** 胡克定律 – $F = kx$, where $x$ is the extension, not the total length.

## Thermal physics

**Specific heat capacity** 比热容 – $E = mc\Delta\theta$, used when the temperature changes

**Specific latent heat** 比潜热 – $E = mL$, used when the state changes and the temperature stays constant

**Gas laws** 气体定律 – For a fixed mass at constant temperature, $p_1V_1 = p_2V_2$.

## Waves and light

**Wave equation** 波速公式 – $v = f\lambda$, and $T = 1/f$

**Refractive index** 折射率 – $n = \sin i / \sin r$, angles always measured from the normal, never the surface

**Critical angle** 临界角 – $\sin c = 1/n$. Beyond this angle you get total internal reflection.

## Electricity and magnetism

**Charge** 电荷 – $Q = It$

**Potential difference** 电势差 – $V = W/Q$, that is, energy transferred per unit charge

**Ohm"s law** 欧姆定律 – $V = IR$

**Electrical power and energy** 电功率与电能 – $P = IV$ and $E = IVt$

**Resistors in series and parallel** 电阻串并联 – series $R = R_1 + R_2$; parallel $1/R = 1/R_1 + 1/R_2$, which always gives less than the smallest resistor

**Transformer** 变压器 – $V_p/V_s = N_p/N_s$; for 100 per cent efficiency, $V_pI_p = V_sI_s$

## Nuclear and space

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

**Orbital speed** 轨道速度 – $v = 2\pi r/T$, 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.