IGCSE Physics Formula Sheet

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The Association for Science Education
Promoting Excellence in Science Teaching and Learning

Introduction

As of January 2021, these are the formulas that students are expected to recall and use in the exam. There are other formulas which students may be expected to use but these are provided in the exam.

In formula lists, those which are shaded are required only for Supplemental.

Contents

Click to jump straight to the relevant section

General Physics

Variable	Symbol	Unit (abbreviation)
distance	*d*	metre (m)
time	*t*	second (s)
velocity	*v*	metres per second (m/s)
acceleration	*a*	metres per second squared (m/s^2)
gravitational field strength	*g*	newtons per kilogram (N/kg) (on Earth, g = 10 N/kg)
mass	*m* or *M*	kilogram (kg)
height	*h*	metre (m)
force	*F*	newton (N)
weight	*W*	newton (N)
volume	*V*	metres cubed (m^3)
density	ρ (rho)	kilograms per metre cubed (kg/m^3)
stiffness	*k*	newtons per metre (N/m)
extension	*x*	metre (m)
momentum	*p*	kilogram metres per second (kgm/s)
initial velocity	*u*	metres per second (m/s)
kinetic energy	*KE*	joule (J)
gravitational potential energy	*GPE*	joule (J)
work	*W*	joule (J)
energy	*E*	joule (J)
power	*P*	joules per second (J/s), or watt (W)
pressure	*p*	newtons per metre squared (N/m^2)

speed	speed (m/s) = $\frac{\text{distance (m)}}{\text{time (s)}}$	speed = d / t
acceleration	acceleration (m/s²) = $\frac{\text{change in velocity (m/s)}}{\text{time (s)}}$	$a = \Delta v / t$
weight	weight (N) = mass (kg) × grav. field strength (N/kg)	$W = mg$
density	density (kg/m³) = $\frac{\text{mass (kg)}}{\text{volume (m}^3\text{)}}$	$\rho = m / V$
Hooke's Law	force (N) = stiffness (N/m) × extension (m)	$F = kx$
Newton's 2nd Law	force (N) = mass (m) × acceleration (m/s²)	$F = ma$
moments	moment (Nm) = force (N) × distance (m)	moment = Fd
momentum	momentum (kgm/s) = mass (kg) × velocity (m/s)	$p = mv$
impulse		$Ft = mv - mu$
KE		$KE = ½ mv^2$
GPE		$GPE = mg\Delta h$
efficiency	efficiency = $\frac{\text{useful energy output (J)}}{\text{total energy input (J)}} \times 100\%$	
	efficiency = $\frac{\text{useful power output (W)}}{\text{total power input (W)}} \times 100\%$	
work	work done (J) = force (N) × distance (m)	$W = fd = \Delta E$
power	power (W) = $\frac{\text{change in energy (J)}}{\text{time (s)}}$	$P = \Delta E / t$
pressure	pressure (N/m²) = $\frac{\text{force (N)}}{\text{area (m}^2\text{)}}$	$p = F / A$
pressure due to a liquid	pressure (N/m²) = height (m) × density (kg/(m³) × grav.strength (N/kg)	$p = h\rho g$

Thermal Physics

Variable	Symbol	Unit (abbreviation)
mass	m	kilogram (kg)
volume	V	metres cubed (m^3)
temperature	T	degrees celsius (°C)
thermal capacity	C	Joules per degree celsius (J/°C)
specific heat capacity	c	Joules per kilogram per degree celsius (J/kg°C)
latent heat	L	joules (J)
specific latent heat	l	joules per kilogram (J/kg)
energy	E	joule (J)
pressure	p	newtons per metre squared (N/m^2)

in a gas	pressure (N/m^2) × volume (m^3) = constant	$pV = constant$
thermal capacity	thermal capacity = mass (kg) × specific heat capacity (J/(kg°C)	$C = mc$
thermal energy	energy (J) = mass (kg) × specific heat capacity (J/kg°C) × change in temperature (°C)	$E = mc\Delta T$
latent heat	energy (J) = mass (kg) × specific latent heat (J/kg)	$L = E = ml$

Waves

Variable	Symbol	Unit (abbreviation)
velocity	v	metres per second (m/s)
frequency	f	hertz (Hz)
wavelength	λ *[lambda]*	metre (m)
period	T	second (s)
incident angle	i	degrees (°)
refracted angle	r	degrees (°)
refractive index	n	no unit
critical angle	c	degrees (°)
speed of light	c	metres per second (m/s) (in a vacuum, $c = 3 \times 10^8$ m/s)

wave equation	velocity (m/s) = frequency (Hz) × wavelength (m)	$v = f\lambda$
refractive index	$\text{refractive index} = \dfrac{\text{speed of light in vacuum (m/s)}}{\text{speed of light in substance (m/s)}}$	$n = c / v$
behaviour of light	$\dfrac{\text{sin (incident angle)}}{\text{sin (refracted angle)}} = \text{refractive index}$	$\sin i / \sin r = n$
	$\text{refractive index} = \dfrac{1}{\text{sin (critical angle)}}$	$n = 1 / \sin c$

Electricity

Variable	Symbol	Unit (abbreviation)
charge	Q	coulomb (C)
time	t	second (s)
current	I	ampere (A)
potential difference (p.d.)	V	volt (V)
resistance	R	ohm (Ω)
power	P	joule per second (J/s) or watt (W)
energy	E	joule (J)
number of turns on coil	N	no unit
...on primary coil	N_P	
...on secondary coil	N_S	

current	$\text{current (A)} = \frac{\text{charge (C)}}{\text{time (s)}}$	$I = Q / t$
resistance	$\text{resistance }(\Omega) = \frac{\text{potential difference (V)}}{\text{current (A)}}$	$R = V / I$
electrical power	power (W) = current (A) × potential difference (V)	$P = IV$
energy transferred electrically	energy (J) = current (A) × potential difference (V) × time (s)	$E = IVt$
in a series circuit		$V_{TOTAL} = V_1 + V_2 + \ldots$
in a parallel circuit		$I_{TOTAL} = I_1 + I_2 + \ldots$

transformers	$\frac{\text{p.d. on primary (V)}}{\text{p.d. on secondary (V)}} = \frac{\text{turns on primary}}{\text{turns on secondary}}$	$V_P / V_S = N_P / N_S$
at 100% efficiency	$\frac{\text{current on primary (A)}}{\text{p.d. on primary (V)}} = \frac{\text{current on secondary (A)}}{\text{p.d. on secondary (V)}}$	$I_P V_P = I_S V_S$

Source: https://www.cambridgeinternational.org/Images/414447-2020-2021-syllabus.pdf