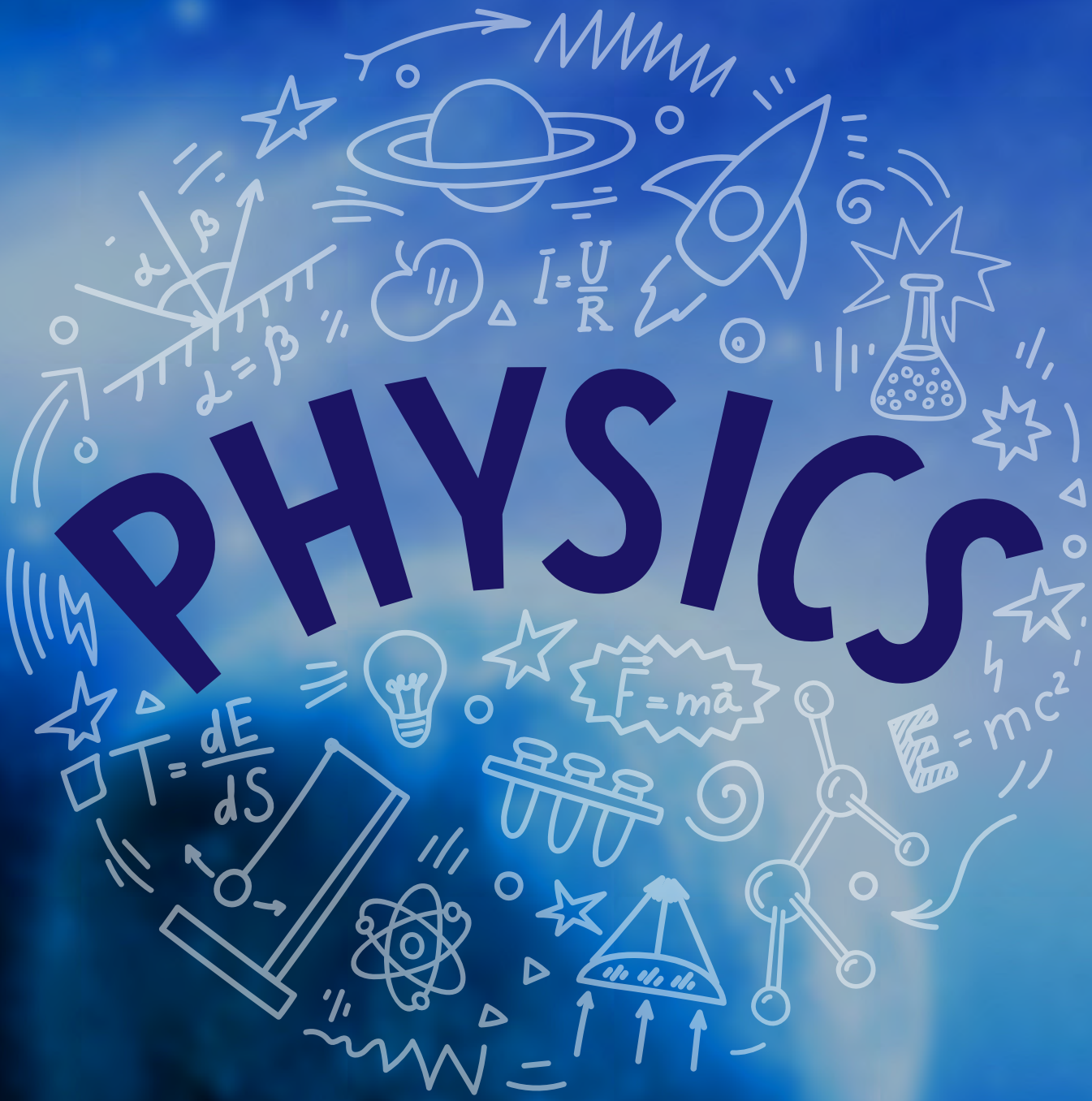


39 Cambridge IGCSE PHYSICS FORMULAS

How to use formulae effectively

- ❑ **Learn all the formulae** presented on the following pages. You must know them all for the supplementary level and the ones marked with a square for the core level.

- ❑ Read each examination question carefully and follow the steps below.

Step 1 List the values given in the examination question using **symbol**, **value** and **units** that represent each quantity, including the symbol for the answer you are being asked to find.

For example $v = 10\,\text{cm/s}$
$d = 5.0\,\text{m}$
$t = ?$

Step 2 Change all units to appropriate and consistent SI units if required.

For example $v = 0.1\,\text{m/s}$

Step 3 Write down the correct formula.

For example $d = vt$

Step 4 Rearrange the formula so that the subject of the formula you are trying to find is on its own on the left-hand side.

For example $t = \dfrac{d}{v}$

Step 5 Write down the figures in the formula and calculate the answer, **remembering to include units for calculated quantities**. (You may get marks for your working on the paper; remember this is the only way you can communicate with an examiner.)

For example $t = \dfrac{5.0}{0.1} = 50\,\text{s}$

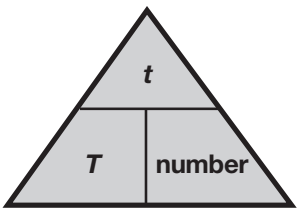
Formulae

General physics

The triangles provide a learning aid. They are not an alternative way of writing the formula.

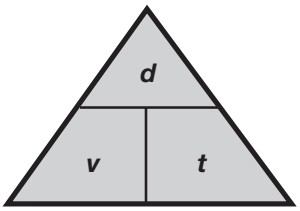
❑ period of pendulum $= \dfrac{\text{total time}}{\text{number of swings}}$

$$\boldsymbol{T = \dfrac{t}{\text{number}}}$$



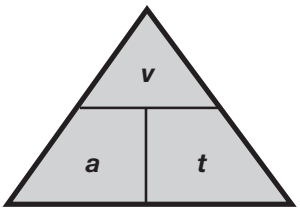
❑ distance = speed × time

$$\boldsymbol{d = vt}$$



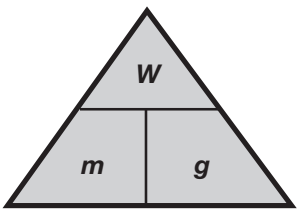
❍ acceleration $= \dfrac{\text{final velocity} - \text{initial velocity}}{\text{time}}$

$$\boldsymbol{a = \dfrac{v - u}{t} = \dfrac{v}{t}} \text{ if } \boldsymbol{u} \text{ is 0}$$



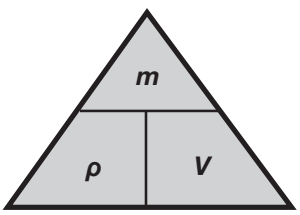
❑ weight = mass × gravitational field strength

$$\boldsymbol{W = mg}$$



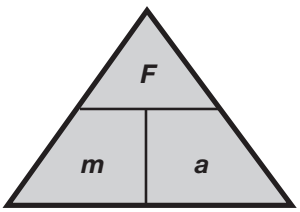
❑ density $= \dfrac{\text{mass}}{\text{volume}}$

$$\boldsymbol{\rho = \dfrac{m}{V}}$$



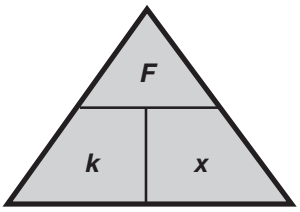
❍ force = mass × acceleration

$$\boldsymbol{F = ma}$$



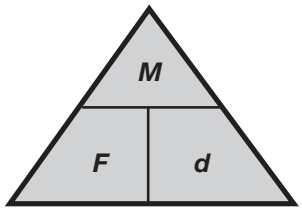
❍ force = spring constant × extension

$$\boldsymbol{F = kx}$$



❑ moment = force × perpendicular distance

$M = Fd$

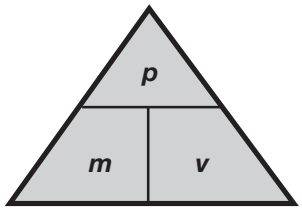


❑ sum of clockwise moments = sum of anti-clockwise moments

$F_1 d_1 = F_2 d_2$

❍ momentum = mass × velocity

$p = mv$

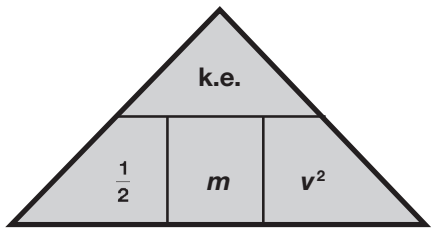


❍ impulse = change in momentum

$Ft = mv - mu$

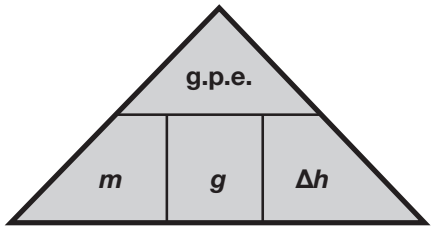
❍ kinetic energy = $\frac{1}{2}$ × mass × velocity^2

$\text{k.e.} = \frac{1}{2} mv^2$



❍ change in gravitational potential energy = mass × gravitational field strength × change in height

$\text{g.p.e.} = mg\Delta h$



❍ efficiency = $\frac{\text{useful energy out}}{\text{energy in}} \times 100\%$

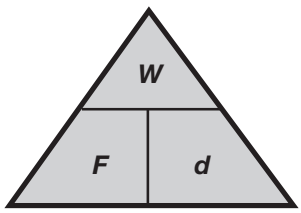
$\text{efficiency} = \frac{E_{out}}{E_{in}} \times 100\%$

❍ $\text{efficiency} = \dfrac{\text{useful power output}}{\text{power input}} \times 100\%$

$$\textbf{efficiency} = \frac{\boldsymbol{P_{out}}}{\boldsymbol{P_{in}}} \times \mathbf{100\%}$$

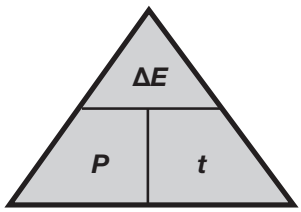
❍ work done = force × distance

$$\boldsymbol{W = Fd}$$



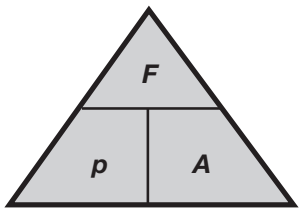
❍ energy transferred = power × time

$$\boldsymbol{\Delta E = Pt}$$



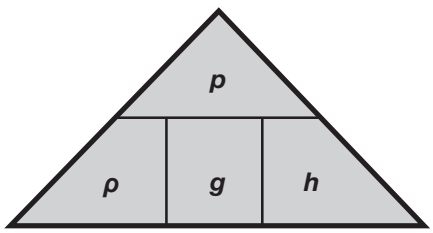
❑ $\text{pressure} = \dfrac{\text{force}}{\text{area}}$

$$\boldsymbol{p = \frac{F}{A}}$$



❍ fluid pressure = density × gravitational field strength × height

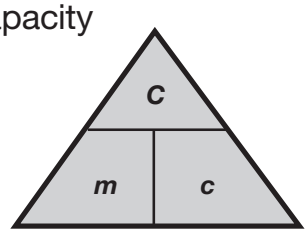
$$\boldsymbol{p = \rho g h}$$



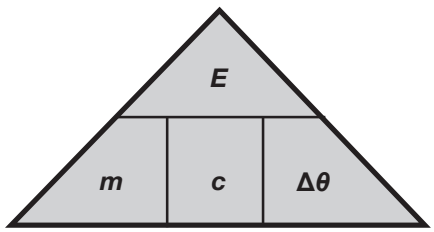
Thermal physics

- Boyle's Law:
  pressure × volume = constant
  pV = constant
  $p_1V_1 = p_2V_2$

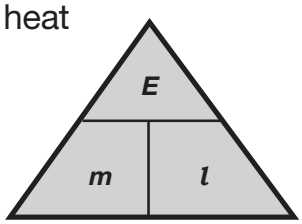
- thermal capacity = mass × specific heat capacity
  $C = mc$



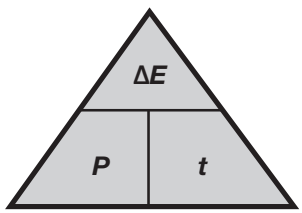
- change in energy = mass × specific heat capacity × change in temperature
  $E = mc\Delta\theta$



- energy transferred = mass × specific latent heat
  $E = ml$

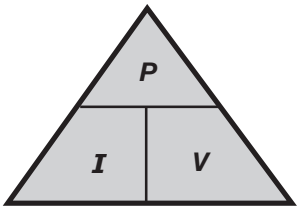


- energy transferred = power × time
  $\Delta E = Pt$



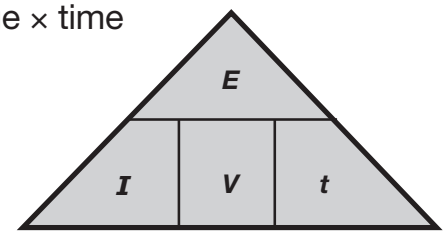
❍ power = current × voltage

$P = IV$



❍ energy transferred = current × voltage × time

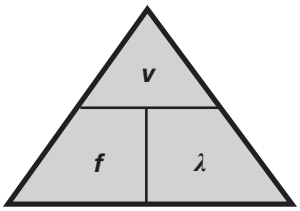
$E = IVt$



Properties of waves, including light and sound

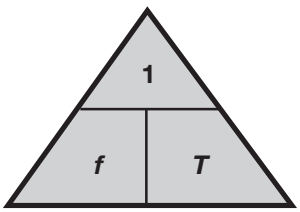
❍ velocity = frequency × wavelength

$v = f\lambda$



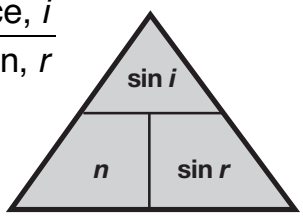
❑ $\text{frequency} = \dfrac{1}{\text{period}}$

$f = \dfrac{1}{T}$



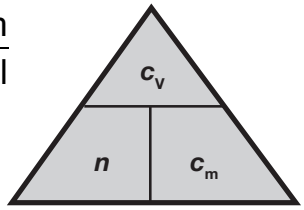
❍ $\text{refractive index} = \dfrac{\text{sine of angle of incidence, } i}{\text{sine of angle of refraction, } r}$

$n = \dfrac{\sin i}{\sin r}$



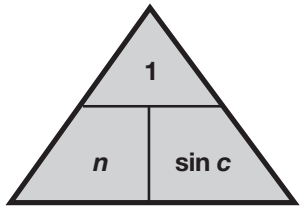
❍ $\text{refractive index} = \dfrac{\text{speed of light in vacuum}}{\text{speed of light in material}}$

$n = \dfrac{c_v}{c_m}$



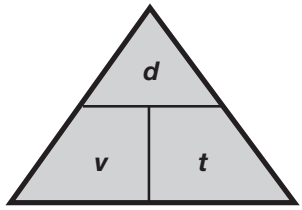
❍ refractive index = $\frac{1}{\text{sine of critical angle}}$

$$n = \frac{1}{\sin c}$$



❑ distance = speed × time

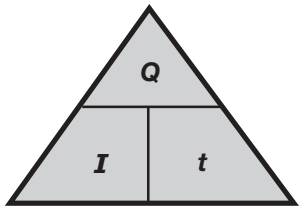
$$d = vt$$



Electricity and magnetism

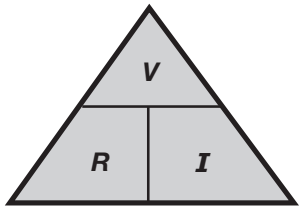
❍ current = $\frac{\text{charge}}{\text{time}}$

$$I = \frac{Q}{t}$$



❑ resistance = $\frac{\text{voltage}}{\text{current}}$

$$R = \frac{V}{I}$$

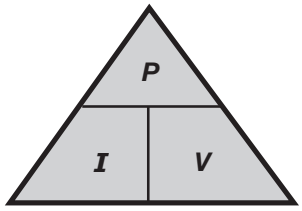


❑ total resistance in series: $R_t = R_1 + R_2$

❍ total resistance in parallel: $\frac{1}{R_t} = \frac{1}{R_1} + \frac{1}{R_2}$

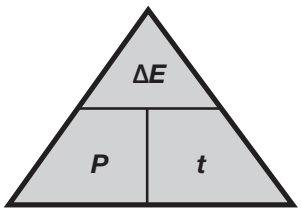
❍ power = current × voltage

$$P = IV$$



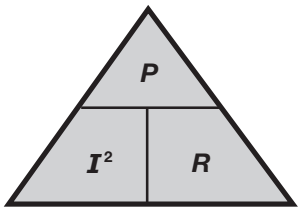
- energy transferred = power × time

  $\Delta E = Pt$



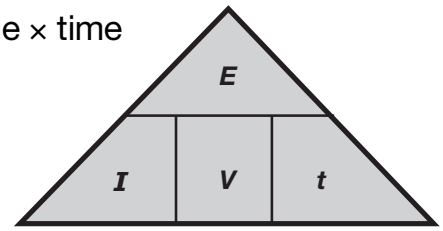
- power = current^2 × resistance

  $P = I^2R$



- energy transferred = current × voltage × time

  $E = IVt$



- For a transformer:

$$\frac{\text{voltage in primary coil}}{\text{voltage in secondary coil}} = \frac{\text{number of turns in primary}}{\text{number of turns in secondary}}$$

$$\frac{V_p}{V_s} = \frac{N_p}{N_s}$$

- For a 100% efficient transformer:

  voltage in primary × current in primary

  = voltage in secondary × current in secondary

  $V_p I_p = V_s I_s$

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