

**Paper Reference(s) 4PH1/2PR**  
**Pearson Edexcel International GCSE (9–1)**

**Physics**

**UNIT: 4PH1**

**PAPER: 2PR**

**Friday 14 June 2024 – Afternoon**

**Time: 1 hour 15 minutes**

**Equation Booklet**

**DO NOT RETURN THIS BOOKLET  
WITH THE QUESTION PAPER.**

These equations may be required for both International GCSE Physics (4PH1) and International GCSE Combined Science (4SD0) papers.

<b>1. Forces and Motion</b>
average speed = $\frac{\text{distance moved}}{\text{time taken}}$
acceleration = $\frac{\text{change in velocity}}{\text{time taken}}$  $a = \frac{(v - u)}{t}$
$(\text{final speed})^2 = (\text{initial speed})^2 + (2 \times \text{acceleration} \times \text{distance moved})$  $v^2 = u^2 + (2 \times a \times s)$
force = mass $\times$ acceleration  $F = m \times a$
weight = mass $\times$ gravitational field strength  $W = m \times g$
<b>2. Electricity</b>
power = current $\times$ voltage  $P = I \times V$

## 2. Electricity continued.

energy transferred = current  $\times$  voltage  $\times$  time

$$E = I \times V \times t$$

voltage = current  $\times$  resistance

$$V = I \times R$$

charge = current  $\times$  time

$$Q = I \times t$$

energy transferred = charge  $\times$  voltage

$$E = Q \times V$$

## 3. Waves

wave speed = frequency  $\times$  wavelength

$$v = f \times \lambda$$

$$\text{frequency} = \frac{1}{\text{time period}}$$

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

$$\text{refractive index} = \frac{\sin(\text{angle of incidence})}{\sin(\text{angle of refraction})}$$

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

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### 3. Waves continued.

$$\sin(\text{critical angle}) = \frac{1}{\text{refractive index}}$$

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

### 4. Energy resources and energy transfers

$$\text{efficiency} = \frac{\text{useful energy output}}{\text{total energy output}} \times 100\%$$

$$\text{work done} = \text{force} \times \text{distance moved}$$

$$W = F \times d$$

$$\text{gravitational potential energy} = \text{mass} \times \text{gravitational field strength} \times \text{height}$$

$$\text{GPE} = m \times g \times h$$

$$\text{kinetic energy} = \frac{1}{2} \times \text{mass} \times \text{speed}^2$$

$$\text{KE} = \frac{1}{2} \times m \times v^2$$

$$\text{power} = \frac{\text{work done}}{\text{time taken}}$$

$$P = \frac{W}{t}$$

## 5. Solids, liquids and gases

$$\text{density} = \frac{\text{mass}}{\text{volume}}$$

$$\rho = \frac{m}{V}$$

$$\text{pressure} = \frac{\text{force}}{\text{area}}$$

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

$$\text{pressure difference} = \text{height} \times \text{density} \times \text{gravitational field strength}$$

$$p = h \times \rho \times g$$

$$\frac{\text{pressure}}{\text{temperature}} = \text{constant}$$

$$\frac{p_1}{T_1} = \frac{p_2}{T_2}$$

$$\text{pressure} \times \text{volume} = \text{constant}$$

$$p_1 \times V_1 = p_2 \times V_2$$

## 8. Astrophysics

$$\text{orbital speed} = \frac{2 \times \pi \times \text{orbital radius}}{\text{time period}}$$

$$v = \frac{2 \times \pi \times r}{T}$$

The equations on the following pages will only be required for International GCSE Physics.

These additional equations may be required in International GCSE Physics papers 2P and 2PR.

<b>1. Forces and Motion</b>
<p>momentum = mass × velocity</p> <p><math>p = m \times v</math></p>
<p>force = <math>\frac{\text{change in momentum}}{\text{time taken}}</math></p> <p><math>F = \frac{(mv - mu)}{t}</math></p>
moment = force × perpendicular distance from the pivot
<b>5. Solids, liquids and gases</b>
<p>change in thermal energy = mass × specific heat capacity × change in temperature</p> <p><math>\Delta Q = m \times c \times \Delta T</math></p>
<b>6. Magnetism and electromagnetism</b>
<p>relationship between input and output voltages for a transformer</p> <p><math>\frac{\text{input (primary) voltage}}{\text{output (secondary) voltage}} = \frac{\text{primary turns}}{\text{secondary turns}}</math></p>

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## 6. Magnetism and electromagnetism continued.

input power = output power

$$V_p I_p = V_s I_s$$

for 100% efficiency

## 8. Astrophysics

$$\frac{\text{change in wavelength}}{\text{reference wavelength}} = \frac{\text{velocity of a galaxy}}{\text{speed of light}}$$

$$\frac{\lambda - \lambda_0}{\lambda_0} = \frac{\Delta\lambda}{\lambda_0} = \frac{v}{c}$$

**END OF EQUATION LIST**