

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.

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

(continued on the next page)

Turn over

2. Electricity

power = current × voltage

$$P = I \times V$$

**energy transferred = current × voltage
× time**

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

voltage = current × resistance

$$V = I \times R$$

charge = current × time

$$Q = I \times t$$

energy transferred = charge × voltage

$$E = Q \times V$$

3. Waves

wave speed = frequency × wavelength

$$v = f \times \lambda$$

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

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

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

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

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

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

4. Energy resources and energy transfers

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

(continued on the next page)

Turn over

work done = force × distance moved

$$W = F \times d$$

gravitational potential energy = mass × gravitational field strength × height

$$GPE = m \times g \times h$$

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

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

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

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

(continued on the next page)

Turn over

5. Solids, liquids and gases

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

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

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

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

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

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

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

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

(continued on the next page)

Turn over

pressure \times volume = 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.

1. Forces and Motion

momentum = mass × velocity

$$p = m \times v$$

force = $\frac{\text{change in momentum}}{\text{time taken}}$

$$F = \frac{(mv - mu)}{t}$$

**moment = force ×
perpendicular distance from the pivot**

5. Solids, liquids and gases

**change in thermal energy = mass ×
specific heat capacity ×
change in temperature**

$$\Delta Q = m \times c \times \Delta T$$

(continued on the next page)

Turn over

6. Magnetism and electromagnetism

relationship between input and output voltages for a transformer

$$\frac{\text{input (primary) voltage}}{\text{output (secondary) voltage}} = \frac{\text{primary turns}}{\text{secondary turns}}$$

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