



## GCE AS/A LEVEL

2420U20-1A



S24-2420U20-1A

**WEDNESDAY, 22 MAY 2024 – AFTERNOON**

## PHYSICS – AS unit 2

### Data Booklet

A clean copy of this booklet should be issued to candidates for their use during each AS unit 2 Physics examination.

Centres are asked to issue this booklet to candidates at the start of the course to enable them to become familiar with its contents and layout.

#### Values and Conversions

Fundamental electronic charge

$$e = 1.60 \times 10^{-19} \text{ C}$$

Mass of an electron

$$m_e = 9.11 \times 10^{-31} \text{ kg}$$

Acceleration due to gravity at sea level

$$g = 9.81 \text{ ms}^{-2}$$

Gravitational field strength at sea level

$$g = 9.81 \text{ N kg}^{-1}$$

Planck constant

$$h = 6.63 \times 10^{-34} \text{ Js}$$

Speed of light in vacuo

$$c = 3.00 \times 10^8 \text{ ms}^{-1}$$

Stefan constant

$$\sigma = 5.67 \times 10^{-8} \text{ W m}^{-2} \text{ K}^{-4}$$

Wien constant

$$W = 2.90 \times 10^{-3} \text{ mK}$$

$$1 \text{ eV} = 1.60 \times 10^{-19} \text{ J}$$

$\rho = \frac{m}{V}$	$I = \frac{\Delta Q}{\Delta t}$																				
$v = u + at$	$I = nAve$																				
$x = \frac{1}{2}(u + v)t$	$R = \frac{V}{I}$																				
$x = ut + \frac{1}{2}at^2$	$P = IV = I^2R = \frac{V^2}{R}$																				
$v^2 = u^2 + 2ax$	$R = \frac{\rho l}{A}$																				
$\Sigma F = ma$	$V = E - Ir$																				
$p = mv$	$\frac{V}{V_{\text{total}}}\left[\text{or } \frac{V_{\text{OUT}}}{V_{\text{IN}}}\right] = \frac{R}{R_{\text{total}}}$																				
$W = Fx\cos\theta$	$T = \frac{1}{f}$																				
$\Delta E = mg\Delta h$	$c = f\lambda$																				
$E = \frac{1}{2}kx^2$	$\lambda = \frac{a\Delta y}{D}$																				
$E = \frac{1}{2}mv^2$	$d\sin\theta = n\lambda$																				
$Fx = \frac{1}{2}mv^2 - \frac{1}{2}mu^2$	$n = \frac{c}{v}$																				
$P = \frac{W}{t} = \frac{\Delta E}{t}$	$n_1v_1 = n_2v_2$																				
efficiency = $\frac{\text{useful energy transfer}}{\text{total energy input}} \times 100\%$	$n_1\sin\theta_1 = n_2\sin\theta_2$																				
$F = kx$	$n_1\sin\theta_{\text{C}} = n_2$																				
$\sigma = \frac{F}{A}$	$E_{\text{kmax}} = hf - \phi$																				
$\varepsilon = \frac{\Delta l}{l}$	$p = \frac{h}{\lambda}$																				
$E = \frac{\sigma}{\varepsilon}$																					
$W = \frac{1}{2}Fx$																					
$\lambda_{\text{max}} = \frac{W}{T}$																					
$P = A\sigma T^4$																					
	<table><tr><td></td><td colspan="2">leptons</td><td colspan="2">quarks</td></tr><tr><td>particle (symbol)</td><td>electron (e<sup>-</sup>)</td><td>electron neutrino (ν<sub>e</sub>)</td><td>up (u)</td><td>down (d)</td></tr><tr><td>charge (e)</td><td>- 1</td><td>0</td><td>+ <math>\frac{2}{3}</math></td><td>- <math>\frac{1}{3}</math></td></tr><tr><td>lepton number</td><td>1</td><td>1</td><td>0</td><td>0</td></tr></table>		leptons		quarks		particle (symbol)	electron (e <sup>-</sup> )	electron neutrino (ν <sub>e</sub> )	up (u)	down (d)	charge (e)	- 1	0	+ $\frac{2}{3}$	- $\frac{1}{3}$	lepton number	1	1	0	0
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## Mathematical Information

### SI multipliers

Multiple	Prefix	Symbol
$10^{-18}$	atto	a
$10^{-15}$	femto	f
$10^{-12}$	pico	p
$10^{-9}$	nano	n
$10^{-6}$	micro	$\mu$
$10^{-3}$	milli	m
$10^{-2}$	centi	c

Multiple	Prefix	Symbol
$10^3$	kilo	k
$10^6$	mega	M
$10^9$	giga	G
$10^{12}$	tera	T
$10^{15}$	peta	P
$10^{18}$	exa	E
$10^{21}$	zetta	Z

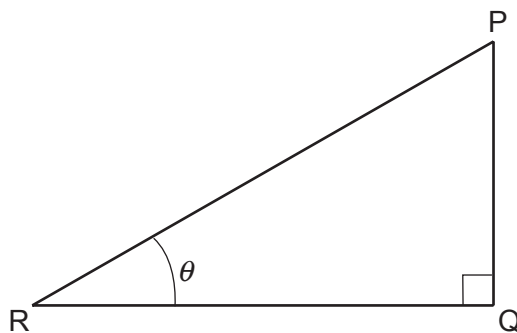
### Areas and Volumes

$$\text{Area of a circle} = \pi r^2 = \frac{\pi d^2}{4}$$

$$\text{Area of a triangle} = \frac{1}{2} \text{ base} \times \text{height}$$

Solid	Surface area	Volume
rectangular block	$2(lh + hb + lb)$	$lbh$
cylinder	$2\pi r(r + h)$	$\pi r^2 h$
sphere	$4\pi r^2$	$\frac{4}{3}\pi r^3$

### Trigonometry



$$\sin \theta = \frac{PQ}{PR}, \quad \cos \theta = \frac{QR}{PR}, \quad \tan \theta = \frac{PQ}{QR}, \quad \frac{\sin \theta}{\cos \theta} = \tan \theta$$

$$PR^2 = PQ^2 + QR^2$$