

National Qualifications

Physics Relationships Sheet

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DATA SHEET

COMMON PHYSICAL QUANTITIES

Quantity	Symbol	Value	Quantity	Symbol	Value
Speed of light in vacuum	с	3∙00 × 10 ⁸ m s ⁻¹	Planck's constant	h	6·63 × 10 ⁻³⁴ J s
Magnitude of the charge on an electron	е	1∙60 × 10 ⁻¹⁹ C	Mass of electron	m _e	9·11 × 10 ⁻³¹ kg
Universal Constant of Gravitation	G	6·67 × 10 ⁻¹¹ m ³ kg ⁻¹ s ⁻²	Mass of neutron	m _n	1·675 × 10 ⁻²⁷ kg
Gravitational acceleration on Earth	g	9·8 m s ⁻²	Mass of proton	m _p	1·673 × 10 ⁻²⁷ kg
Hubble's constant	H_0	$2.3 \times 10^{-18} s^{-1}$			

REFRACTIVE INDICES

The refractive indices refer to sodium light of wavelength 589 nm and to substances at a temperature of 273 K.

Substance	Refractive index	Substance	Refractive index	
Diamond	2.42	Water	1.33	
Crown glass	1.50	Air	1.00	

SPECTRAL LINES

Element	Wavelength/nm	Colour	Element	Wavelength/nm	Colour
Hydrogen	656	Red	Cadmium	644	Red
	486	Blue-green		509	Green
	434 Blue-violet 410 Violet 397 Ultraviolet			480	Blue
			Lasers		
	389	Ultraviolet	Element	Wavelength/nm	Colour
Sodium	589	Yellow	Carbon dioxide	9550 10590	Infrared
			Helium-neon	633	Red

PROPERTIES OF SELECTED MATERIALS

Substance	Density/kg m ⁻³	Melting Point/K	Boiling Point/K
Aluminium	2·70 × 10 ³	933	2623
Copper	8.96 × 10 ³	1357	2853
Ice	9·20 × 10 ²	273	
Sea Water	1.02×10^{3}	264	377
Water	1.00×10^{3}	273	373
Air	1.29		
Hydrogen	9·0 × 10 ⁻²	14	20

The gas densities refer to a temperature of 273 K and a pressure of 1.01×10^5 Pa.

 $z = \frac{v}{c}$

 $v = H_0 d$

Relationships Sheet

$$\begin{array}{lll} d=\bar{v}t & E_{\pi}=QV & V_{pool}=\sqrt{2}V_{ma} \\ s=\bar{v}t & E=mc^2 & I_{pool}=\sqrt{2}I_{ma} \\ v=u+at & E=hf & Q=It \\ s=ut+\frac{1}{2}at^2 & E_{g}=hf-hf_{0} & v=IR \\ v^2=u^2+2as & E_{2}-E_{1}=hf & P=IV=I^2R=\frac{V^2}{R} \\ s=\frac{1}{2}(u+v)t & T=\frac{1}{f} & R_{T}=R_{T}+R_{2}+\dots \\ W=mg & v=f\lambda & \frac{1}{R_{T}}=\frac{1}{R_{1}}+\frac{1}{R_{2}}+\dots \\ F=ma & d\sin\theta=m\lambda & E=V+Ir \\ E_{\pi}=Fd & n=\frac{\sin\theta}{\sin\theta_{2}} & V_{1}=\left(\frac{R_{1}}{R_{1}+R_{2}}\right)V_{5} \\ E_{g}=mgh & \frac{\sin\theta}{\sin\theta_{2}}=\frac{\lambda}{\lambda_{2}}=\frac{v_{1}}{v_{2}} & \frac{V_{1}}{V_{2}}=\frac{R_{1}}{R_{2}} \\ E_{g}=\frac{1}{2}mv^2 & \sin\theta_{c}=\frac{1}{n} & C=\frac{Q}{V} \\ P=\frac{E}{t} & I=\frac{k}{d^{2}} & E=\frac{1}{2}QV=\frac{1}{2}CV^{2}=\frac{1}{2}\frac{Q^{2}}{C} \\ P=mv & I=\frac{P}{A} \\ Ft=mv-mu & \text{path difference}=m\lambda \text{ or } \left(m+\frac{1}{2}\right)\lambda \text{ where } m=0,1,2\dots \\ F=G\frac{Mm}{r^{2}} & \text{radom uncertainty}=\frac{\max.value - \min.value}{\minber \text{ of values}} \\ t'=\frac{1}{\sqrt{1-\left(V_{C}\right)^{2}}} \\ t'=\frac{1}{\sqrt{v_{v\pm v_{x}}}} \\ z=\frac{\lambda_{abarmal}-\lambda_{rant}}{\lambda_{rant}} \end{array}$$

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Additional Relationships

Circle

circumference = $2\pi r$

area = πr^2

Sphere

 $area=4\pi r^2$

volume = $\frac{4}{3}\pi r^3$

Trigonometry

$$\sin \theta = \frac{opposite}{hypotenuse}$$

 $\cos \theta = \frac{adjacent}{hypotenuse}$

 $\tan \theta = \frac{opposite}{adjacent}$

 $\sin^2\theta + \cos^2\theta = 1$

Moment of inertia

point mass $I = mr^2$

rod about centre $I = \frac{1}{12}ml^2$

rod about end $I = \frac{1}{3}ml^2$

disc about centre $I = \frac{1}{2}mr^2$

sphere about centre $I = \frac{2}{5}mr^2$

Table of standard derivatives

f(x)	f'(x)
sin <i>ax</i>	acosax
cosax	$-a\sin ax$

Table of standard integrals

f(x)	$\int f(x)dx$
sin <i>ax</i>	$-\frac{1}{a}\cos ax + C$
cosax	$\frac{1}{a}\sin ax + C$

CfE Higher Physics

Relationships Sheet

0	,									
		87 Fr 2,8,18,32, 18,8,1 Francium	55 Cs 2,8,18,18, 8,1 Caesium	37 Rb 2,8,18,8,1 Rubidium	19 K 2,8,8,1 Potassium	2,8,1 Sodium	Lithium 11	3 Li 2,1	Hydrogen	Group 1
	Lar	88 Ra 2,8,18,32, 18,8,2 Radium	56 Ba 2,8,18,18, 8,2 Barlum	38 Sr 2,8,18,8,2 Strontium	20 Ca 2,8,8,2 Calcium	2,8,2 Magnesium	Beryllium 12	4 Be 2,2	(2)	Group 2
Actinides	Lanthanides	89 Ac 2,8,18,32, 18,9,2 Actinium	57 La 2,8,18,18, 9,2 Lanthanum	39 Y 2,8,18,9,2 Yttrium	21 Sc 2,8,9,2 Scandium	(3)				
89 Ac 2,8,18,32, 18,9,2 Actinium	57 La 2,8,18, 18,9,2 Lanthanum	104 Rf 2,8,18,32, 32,10,2 Rutherfordium	72 Hf 2,8,18,32, 10,2 Hafnium	40 Zr 2,8,18, 10,2 Zirconium	22 Ti 2,8,10,2 Titanium	(4)			ney	Kov
90 Th 2,8,18,32, 18,10,2 Thorium	58 Ce 2,8,18, 20,8,2 Cerium	105 Db 2,8,18,32, 32,11,2 Dubnium	73 Ta 2,8,18, 32,11,2 Tantalum	41 Nb 2,8,18, 12,1 Niobium	23 V 2,8,11,2 Vanadium	(5)			Ato]
91 Pa 2,8,18,32, 20,9,2 Protactinium	59 Pr 2,8,18,21, 8,2 Praseodymium	106 Sg 2,8,18,32, 32,12,2 Seaborgium	74 W 2,8,18,32, 12,2 Tungsten	42 Mo 2,8,18,13, 1 Molybdenum	24 Cr 2,8,13,1 Chromium	6)		Name	Atomic number Symbol Flectron arrangement	
92 U 2,8,18,32, 21,9,2 Uranium	60 Nd 2,8,18,22, 8,2 Neodymium	107 Bh 2,8,18,32, 32,13,2 Bohrium	75 Re 2,8,18,32, 13,2 Rhenium	43 Tc 2,8,18,13, 2 Technetium	25 Mn 2,8,13,2 Manganese	(7)	Francition		ber	U
93 Np 2,8,18,32, 22,9,2 Neptunium	61 Pm 2,8,18,23, 8,2 Promethium	108 Hs 2,8,18,32, 32,14,2 Hassium	76 Os 2,8,18,32, 14,2 Osmium	44 Ru 2,8,18,15, 1 Ruthenium	26 Fe 2,8,14,2 Iron					
94 Pu 2,8,18,32, 24,8,2 Plutonium	62 Sm 2,8,18,24, 8,2 Samarium	109 Mt 2,8,18,32, 32,15,2 Meitnerium	77 Ir 2,8,18,32, 15,2 Iridium	45 Rh 2,8,18,16, 1 Rhodium	27 Co 2,8,15,2 Cobalt	(9)	ń			
95 Am 2,8,18,32, 25,8,2 Americium	63 Eu 2,8,18,25, 8,2 Europium	110 Ds 2,8,18,32, 32,17,1 Darmstadtium	78 Pt 2,8,18,32, 17,1 Platinum	46 Pd 2,8,18, 18,0 Palladium	28 Ni 2,8,16,2 Nickel	(10)				1
96 Cm 2,8,18,32, 25,9,2 Curium	64 Gd 2,8,18,25, 9,2 Gadolinium	111 Rg 2,8,18,32, 32,18,1 Roentgenium	79 Au 2,8,18, 32,18,1 Gold	47 Ag 2,8,18, 18,1 Silver	29 Cu 2,8,18,1 Copper	(11)				
97 Bk 2,8,18,32 27,8,2 Berkelium	65 Tb 2,8,18,27 8,2 Terbium	111 112 Rg 2,8,18,32, 2,8,18,32, 32,18,1 32,18,2 Roentgenium Copernicium	80 Hg 2,8,18, 32,18,2 Mercury	48 Cd 2,8,18, 18,2 Cadmium	30 Zn 2,8,18,2 Zinc	(12)				
98 Cf 2,8,18,32, 28,8,2 Californium	66 Dy 2,8,18,28, 8,2 Dysprosium		81 Tl 2,8,18, 32,18,3 Thallium	49 In 2,8,18, 18,3 Indium	31 Ga 2,8,18,3 Gallium	2,8,3 Aluminium	Boron 13	5 8 2,3	(13)	Group 3
99 Es 2,8,18,32, 29,8,2 Einsteinium	67 Ho 2,8,18,29, 8,2 Holmium		82 Pb 3, 2,8,18, 3, 32,18,4 m Lead	50 Sn 18,4 18,4 18,4 Tin	32 Ge ,3 2,8,18,4 n Germanium	S 2	-	2,4 C 6	(14)	3 Group 4
100 Fm 2,8,18,32, 30,8,2 Fermium	68 Er 2,8,18,30, 8,2 Erbium		83 Bi 3, 2,8,18, 4 32,18,5 Bismuth	51 Sb 3, 2,8,18, 18,5 Antimony	33 As ,4 2,8,18,5 um Arsenic	2, Phos	N.	2,5	(15)	4 Group 5
101 Md 2,8,18,32, 31,8,2 Mendelevium	69 Tm 2,8,18,31, 8,2 Thulium		84 Po 2,8,18, 5 32,18,6 h Polonium	52 Te 2,8,18, 18,6 18,6 18,6	34 Se 5 2,8,18,6 c Selenium	ς γ	0	2,6 2,6	(16)	5 Group 6
102 No 2,8,18,32 32,8,2 Nobelium	70 Yb 2,8,18,32 8,2 Ytterbium		85 At 3, 2,8,18, 6 32,18,7 m Astatine	53 	35 Br ,6 2,8,18,7 m Bromine	Ω N	2	9 F 2,7	(17)	6 Group 7
103 Lr 2,8,18,32, 32,9,2 Lawrencium	71 Lu 2,8,18,32, 9,2 Lutetium		86 Rn 3, 2,8,18, 7 32,18,8 Radon	54 Xe 18, 18, 18, 8 Xenon	36 Kr ,7 2,8,18,8 ie Krypton			10 Ne 2,8	Helium	7 Group 0 (18)
			00.4	`	- 00					•

Electron Arrangements of Elements

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