

**3220/202**

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SCOTTISH  
CERTIFICATE OF  
EDUCATION  
1998

FRIDAY, 15 MAY  
1.00 PM – 3.30 PM

PHYSICS  
HIGHER GRADE  
Paper II

**Read carefully**

- 1 All questions should be attempted.
- 2 Enter the question number clearly in the margin beside each question.
- 3 Any necessary data will be found in the Data Sheet on page two.
- 4 Care should be taken not to give an unreasonable number of significant figures in the final answers to calculations.
- 5 Square-ruled paper (if used) should be placed inside the front cover of the answer book for return to the Scottish Qualifications Authority.

**DATA SHEET**  
COMMON PHYSICAL QUANTITIES

Quantity	Symbol	Value	Quantity	Symbol	Value
Speed of light in vacuum	$c$	$3.00 \times 10^8 \text{ m s}^{-1}$	Mass of electron	$m_e$	$9.11 \times 10^{-31} \text{ kg}$
Charge on electron	$e$	$-1.60 \times 10^{-19} \text{ C}$	Mass of neutron	$m_n$	$1.675 \times 10^{-27} \text{ kg}$
Gravitational acceleration	$g$	$9.8 \text{ m s}^{-2}$	Mass of proton	$m_p$	$1.673 \times 10^{-27} \text{ kg}$
Planck's constant	$h$	$6.63 \times 10^{-34} \text{ J s}$			

**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	Glycerol	1.47
Crown glass	1.50	Water	1.33
Ice	1.31	Air	1.00
Perspex	1.49		

**SPECTRAL LINES**

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

**PROPERTIES OF SELECTED MATERIALS**

Substance	Density/ $\text{kg m}^{-3}$	Melting Point/ K	Boiling Point/ K	Specific Heat Capacity/ $\text{J kg}^{-1} \text{ K}^{-1}$	Specific Latent Heat of Fusion/ $\text{J kg}^{-1}$	Specific Latent Heat of Vaporisation/ $\text{J kg}^{-1}$
Aluminium	$2.70 \times 10^3$	933	2623	$9.02 \times 10^2$	$3.95 \times 10^5$	....
Copper	$8.96 \times 10^3$	1357	2853	$3.86 \times 10^2$	$2.05 \times 10^5$	....
Glass	$2.60 \times 10^3$	1400	....	$6.70 \times 10^2$	....	....
Ice	$9.20 \times 10^2$	273	....	$2.10 \times 10^3$	$3.34 \times 10^5$	....
Glycerol	$1.26 \times 10^3$	291	563	$2.43 \times 10^3$	$1.81 \times 10^5$	$8.30 \times 10^5$
Methanol	$7.91 \times 10^2$	175	338	$2.52 \times 10^3$	$9.9 \times 10^4$	$1.12 \times 10^6$
Sea Water	$1.02 \times 10^3$	264	377	$3.93 \times 10^3$	....	....
Water	$1.00 \times 10^3$	273	373	$4.19 \times 10^3$	$3.34 \times 10^5$	$2.26 \times 10^6$
Air	1.29	....	....	....	....	....
Hydrogen	$9.0 \times 10^{-2}$	14	20	$1.43 \times 10^4$	....	$4.50 \times 10^5$
Nitrogen	1.25	63	77	$1.04 \times 10^3$	....	$2.00 \times 10^5$
Oxygen	1.43	55	90	$9.18 \times 10^2$	....	$2.40 \times 10^5$

The gas densities refer to a temperature of 273 K and a pressure of  $1.01 \times 10^5 \text{ Pa}$ .

