

X069/301

NATIONAL
QUALIFICATIONS
2003

MONDAY, 19 MAY
1.00 PM – 3.30 PM

PHYSICS
HIGHER

Read Carefully

- 1 All questions should be attempted.

Section A (questions 1 to 20)

- 2 Check that the answer sheet is for Physics Higher (Section A).
- 3 Answer the questions numbered 1 to 20 on the answer sheet provided.
- 4 Fill in the details required on the answer sheet.
- 5 Rough working, if required, should be done only on this question paper, or on the first two pages of the answer book provided—**not** on the answer sheet.
- 6 For each of the questions 1 to 20 there is only **one** correct answer and each is worth 1 mark.
- 7 Instructions as to how to record your answers to questions 1–20 are given on page three.

Section B (questions 21 to 29)

- 8 Answer questions numbered 21 to 29 in the answer book provided.
- 9 Fill in the details on the front of the answer book.
- 10 Enter the question number clearly in the margin of the answer book beside each of your answers to questions 21 to 29.
- 11 Care should be taken to give an appropriate number of significant figures in the final answers to calculations.



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 | $9.11 \times 10^{-31} \text{ kg}$ |
| Magnitude of the charge on an electron | e | $1.60 \times 10^{-19} \text{ C}$ | Mass of neutron | m_n | $1.675 \times 10^{-27} \text{ kg}$ |
| Gravitational acceleration on Earth | g | 9.8 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 | 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 | | 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/ 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 $1.01 \times 10^5 \text{ Pa}$.

