

## Data

|                              |  |
|------------------------------|--|
| acceleration of free fall    | $g = 9.81 \text{ m s}^{-2}$  |
| speed of light in free space | $c = 3.00 \times 10^8 \text{ m s}^{-1}$  |
| elementary charge            | $e = 1.60 \times 10^{-19} \text{ C}$   |
| unified atomic mass unit     | $1 \text{ u} = 1.66 \times 10^{-27} \text{ kg}$  |
| rest mass of proton          | $m_p = 1.67 \times 10^{-27} \text{ kg}$  |
| rest mass of electron        | $m_e = 9.11 \times 10^{-31} \text{ kg}$  |
| Avogadro constant            | $N_A = 6.02 \times 10^{23} \text{ mol}^{-1}$   |
| molar gas constant           | $R = 8.31 \text{ J K}^{-1} \text{ mol}^{-1}$   |
| Boltzmann constant           | $k = 1.38 \times 10^{-23} \text{ J K}^{-1}$  |
| gravitational constant       | $G = 6.67 \times 10^{-11} \text{ N m}^2 \text{ kg}^{-2}$   |
| permittivity of free space   | $\epsilon_0 = 8.85 \times 10^{-12} \text{ F m}^{-1}$<br>$(\frac{1}{4\pi\epsilon_0} = 8.99 \times 10^9 \text{ m F}^{-1})$ |
| Planck constant              | $h = 6.63 \times 10^{-34} \text{ J s}$   |
| Stefan–Boltzmann constant    | $\sigma = 5.67 \times 10^{-8} \text{ W m}^{-2} \text{ K}^{-4}$   |

## Formulae

|                                |   |
|--------------------------------|---|
| uniformly accelerated motion   | $s = ut + \frac{1}{2}at^2$<br>$v^2 = u^2 + 2as$       |
| hydrostatic pressure           | $\Delta p = \rho g \Delta h$                          |
| upthrust                       | $F = \rho g V$  |
| Doppler effect for sound waves | $f_o = \frac{f_s v}{v \pm v_s}$                       |
| electric current               | $I = Anvq$  |
| resistors in series            | $R = R_1 + R_2 + \dots$                               |
| resistors in parallel          | $\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2} + \dots$ |