Hong Kong Diploma of Secondary Education Examination

Physics

The following list of data, formulae and relationships will be provided in the question papers for candidates' reference:

List of data, formulae and relationships

Data

molar gas constant	$R = 8.31\ \text{J mol}^{-1}\ \text{K}^{-1}$
Avogadro constant	$N_A = 6.02 \times 10^{23}\ \text{mol}^{-1}$
acceleration due to gravity	$g = 9.81\ \text{m s}^{-2}$ (close to the Earth)
universal gravitational constant	$G = 6.67 \times 10^{-11}\ \text{N m}^2\ \text{kg}^{-2}$
speed of light in vacuum	$c = 3.00 \times 10^8\ \text{m s}^{-1}$
charge of electron	$e = 1.60 \times 10^{-19}\ \text{C}$
electron rest mass	$m_e = 9.11 \times 10^{-31}\ \text{kg}$
permittivity of free space	$\varepsilon_0 = 8.85 \times 10^{-12}\ \text{C}^2\ \text{N}^{-1}\ \text{m}^{-2}$
permeability of free space	$\mu_0 = 4\pi \times 10^{-7}\ \text{H m}^{-1}$
atomic mass unit	$\text{u} = 1.661 \times 10^{-27}\ \text{kg}$ (1 u is equivalent to 931 MeV)
astronomical unit	$\text{AU} = 1.50 \times 10^{11}\ \text{m}$
light year	$\text{ly} = 9.46 \times 10^{15}\ \text{m}$
parsec	$\text{pc} = 3.09 \times 10^{16}\ \text{m} = 3.26\ \text{ly} = 206265\ \text{AU}$
Stefan constant	$\sigma = 5.67 \times 10^{-8}\ \text{W m}^{-2}\ \text{K}^{-4}$
Planck constant	$h = 6.63 \times 10^{-34}\ \text{J s}$

Rectilinear motion

For uniformly accelerated motion :

$$v = u + at$$

$$s = ut + \frac{1}{2}at^2$$

$$v^2 = u^2 + 2as$$

Mathematics

Equation of a straight line	$y = mx + c$
Arc length	$= r\theta$
Surface area of cylinder	$= 2\pi rh + 2\pi r^2$
Volume of cylinder	$= \pi r^2 h$
Surface area of sphere	$= 4\pi r^2$
Volume of sphere	$= \frac{4}{3}\pi r^3$

For small angles, $\sin\theta \approx \tan\theta \approx \theta$ (in radians)

Astronomy and Space Science	
$U = -\dfrac{GMm}{r}$	gravitational potential energy
$P = \sigma AT^4$	Stefan's law
$\left\lvert\dfrac{\Delta f}{f_0}\right\rvert \approx \dfrac{v}{c} \approx \left\lvert\dfrac{\Delta\lambda}{\lambda_0}\right\rvert$	Doppler effect

Energy and Use of Energy	
$E = \dfrac{\Phi}{A}$	illuminance
$\dfrac{Q}{t} = \kappa\dfrac{A(T_H - T_C)}{d}$	rate of energy transfer by conduction
$U = \dfrac{\kappa}{d}$	thermal transmittance U-value
$P = \dfrac{1}{2}\rho Av^3$	maximum power by wind turbine

Atomic World	
$\dfrac{1}{2}m_e v_{max}^2 = hf - \phi$	Einstein's photoelectric equation
$E_n = -\dfrac{1}{n^2}\left\{\dfrac{m_e e^4}{8h^2\varepsilon_0^2}\right\} = -\dfrac{13.6}{n^2}\ \text{eV}$	energy level equation for hydrogen atom
$\lambda = \dfrac{h}{p} = \dfrac{h}{mv}$	de Broglie formula
$\theta \approx \dfrac{1.22\lambda}{d}$	Rayleigh criterion (resolving power)

Medical Physics	
$\theta \approx \dfrac{1.22\lambda}{d}$	Rayleigh criterion (resolving power)
power $= \dfrac{1}{f}$	power of a lens
$L = 10\log\dfrac{I}{I_0}$	intensity level (dB)
$Z = \rho c$	acoustic impedance
$\alpha = \dfrac{I_r}{I_0} = \dfrac{(Z_2 - Z_1)^2}{(Z_2 + Z_1)^2}$	intensity reflection coefficient
$I = I_0 e^{-\mu x}$	transmitted intensity through a medium

A1. $E = mc\,\Delta T$ energy transfer during heating and cooling

A2. $E = l\,\Delta m$ energy transfer during change of state

A3. $pV = nRT$ equation of state for an ideal gas

A4. $pV = \frac{1}{3}Nm\overline{c^2}$ kinetic theory equation

A5. $E_K = \frac{3RT}{2N_A}$ molecular kinetic energy

B1. $F = m\frac{\Delta v}{\Delta t} = \frac{\Delta p}{\Delta t}$ force

B2. moment $= F \times d$ moment of a force

B3. $E_P = mgh$ gravitational potential energy

B4. $E_K = \frac{1}{2}mv^2$ kinetic energy

B5. $P = Fv$ mechanical power

B6. $a = \frac{v^2}{r} = \omega^2 r$ centripetal acceleration

B7. $F = \frac{Gm_1m_2}{r^2}$ Newton's law of gravitation

C1. $\Delta y = \frac{\lambda D}{a}$ fringe width in double-slit interference

C2. $d\sin\theta = n\lambda$ diffraction grating equation

C3. $\frac{1}{u} + \frac{1}{v} = \frac{1}{f}$ equation for a single lens

D1. $F = \frac{Q_1Q_2}{4\pi\varepsilon_0 r^2}$ Coulomb's law

D2. $E = \frac{Q}{4\pi\varepsilon_0 r^2}$ electric field strength due to a point charge

D3. $E = \frac{V}{d}$ electric field between parallel plates (numerically)

D4. $R = \frac{\rho l}{A}$ resistance and resistivity

D5. $R = R_1 + R_2$ resistors in series

D6. $\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2}$ resistors in parallel

D7. $P = IV = I^2R$ power in a circuit

D8. $F = BQv\sin\theta$ force on a moving charge in a magnetic field

D9. $F = BIl\sin\theta$ force on a current-carrying conductor in a magnetic field

D10. $B = \frac{\mu_0 I}{2\pi r}$ magnetic field due to a long straight wire

D11. $B = \frac{\mu_0 NI}{l}$ magnetic field inside a long solenoid

D12. $\varepsilon = N\frac{\Delta\Phi}{\Delta t}$ induced e.m.f.

D13. $\frac{V_s}{V_p} \approx \frac{N_s}{N_p}$ ratio of secondary voltage to primary voltage in a transformer

E1. $N = N_0 e^{-kt}$ law of radioactive decay

E2. $t_{\frac{1}{2}} = \frac{\ln 2}{k}$ half-life and decay constant

E3. $A = kN$ activity and the number of undecayed nuclei

E4. $\Delta E = \Delta mc^2$ mass-energy relationship

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Combined Science (Physics part)

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$E = mc\,\Delta T$	energy transfer during heating and cooling
$E = l\,\Delta m$	energy transfer during change of state
$F = m\frac{\Delta v}{\Delta t} = \frac{\Delta p}{\Delta t}$	force
$E_P = mgh$	gravitational potential energy
$E_K = \frac{1}{2}mv^2$	kinetic energy
$P = Fv$	mechanical power
$R = \frac{\rho l}{A}$	resistance and resistivity
$R = R_1 + R_2$	resistors in series
$\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2}$	resistors in parallel
$P = IV = I^2R$	power in a circuit
$\frac{V_s}{V_p} \approx \frac{N_s}{N_p}$	ratio of secondary voltage to primary voltage in a transformer