Physics formulae and data booklet

Scalars and vectors

force due to gravity (weight)	$F_g = mg$
gravitational field strength near the surface of the Earth	$g = 9.8 \text{ N kg}^{-1}$

Linear motion

displacement	s = final position – initial position
average speed	$v_{av} = \dfrac{d}{\Delta t}$
average velocity	$v_{av} = \dfrac{s}{\Delta t}$
	$v_{av} = \dfrac{u + v}{2}$
average acceleration	$a_{av} = \dfrac{\Delta v}{\Delta t}$
equations of motion with constant acceleration	$v = u + at$
	$s = \dfrac{1}{2}(u + v)t$
	$s = ut + \dfrac{1}{2}at^2$
	$s = vt - \dfrac{1}{2}at^2$
	$v^2 = u^2 + 2as$
acceleration due to gravity at Earth's surface	$g = 9.8 \text{ m s}^{-2}$

Momentum and force

Newton's second law	$F_{net} = ma$
	$F_{net} = \dfrac{m(v - u)}{\Delta t}$
momentum	$p = mv$
law of conservation of momentum	$\Sigma p_{before} = \Sigma p_{after}$
where two objects collide and remain separate	$m_1u_1 + m_2u_2 = m_1v_1 + m_2v_2$
where two objects collide and combine together	$m_1u_1 + m_2u_2 = m_3v_3$
where one object breaks apart into two objects in an explosive collision	$m_1u_1 = m_2v_2 + m_3v_3$
impulse	$I = \Delta p = mv - mu = F\Delta t$

Equilibrium of forces

torque	$\tau = r_{\perp}F$
translational equilibrium in one dimension	$F_{net} = 0$
translational equilibrium in two dimensions	$F_{net,\,x} = 0$ and $F_{net,\,y} = 0$
static equilibrium	$F_{net} = 0$ and $\tau_{net} = 0$
rotational equilibrium	$\Sigma\tau_{clockwise} = \Sigma\tau_{anticlockwise}$

Energy, work and power

work	$W = Fs$
kinetic energy	$E_k = \frac{1}{2}mv^2$
gravitational potential energy	$E_g = mg\Delta h$
Hooke's law	$F = -k\Delta x$
elastic potential energy	$E_s = \frac{1}{2}k\Delta x^2$
power required to keep an object moving at a constant speed	$P = Fv_{av}$
efficiency of energy transfer (in %)	efficiency $(\eta) = \frac{\text{useful energy transferred}}{\text{total energy supplied}} \times 100\%$ $= \frac{\text{useful energy out}}{\text{total energy in}} \times 100\%$