

They should be able to

- 1. be able to use the equations for uniformly accelerated motion in one dimension:  $s = (u+v)t/2$ ,  $v = u + at$ ,  $s = ut + \frac{1}{2}at^2$ ,  $v^2 = u^2 + 2as$
- 2. be able to draw and interpret displacement–time, velocity–time and acceleration–time graphs
- 3. know the physical quantities derived from the slopes and areas of displacement–time, velocity–time and acceleration–time graphs, including cases of non-uniform acceleration, and understand how to use the quantities
- 4. CORE PRACTICAL 1: Determine the acceleration of a freely-falling object
- 5. understand scalar and vector quantities and know examples of each type of quantity and recognise vector notation
- 6. be able to resolve a vector into two components at right angles to each other by drawing and by calculation
- 7. be able to find the resultant of two coplanar vectors at any angle to each other by drawing, and at right angles to each other by calculation
- 8. understand how to make use of the independence of vertical and horizontal motion of a projectile moving freely under gravity
- 9. be able to draw and interpret free-body force diagrams to represent forces on a particle or on an extended but rigid body using the concept of centre of gravity of an extended body
- 10. be able to use the equation  $\Sigma F = ma$ , and understand how to use this equation in situations where m is constant (Newton’s second law of motion), including Newton’s first law of motion where a = 0, objects at rest or travelling at constant velocity; use of the term terminal velocity is expected
- 11. be able to use the equations for gravitational field strength  $g = F/m$  and weight  $W = mg$
- 12. know and understand Newton’s third law of motion and know the properties of pairs of forces in an interaction between two bodies
- 13. understand that momentum is defined as  $p = mv$
- 14. know the principle of conservation of linear momentum, understand how to relate this to Newton’s laws of motion and understand how to apply this to problems in one dimension
- 15. be able to use the equation for the moment of a force, moment of force =  $Fx$ , where x is the perpendicular distance between the line of action of the force and the axis of rotation
- 16. be able to use the concept of centre of gravity of an extended body and apply the principle of moments to an extended body in equilibrium
- 17. be able to use the equation for work  $\Delta W = F\Delta s$ , including calculations when the force is not along the line of motion
- 18. be able to use the equation  $E_k = \frac{1}{2}mv^2$  for the kinetic energy of a body
- 19. be able to use the equation  $\Delta E_{\text{grav}} = mg\Delta h$  for the difference in gravitational potential energy near the Earth’s surface
- 20. know, and understand how to apply, the principle of conservation of energy including use of work done, gravitational potential energy and kinetic energy
- 21. be able to use the equations relating power, time and energy transferred or work done  $P = E/t$  and  $P = W/t$
- 22. be able to use the equations efficiency = useful energy output / total energy input and efficiency = useful power output / total power input
- 23. be able to use the equation density  $\rho = m/V$
- 24. understand how to use the relationship upthrust = weight of fluid displaced
- 25. a) be able to use the equation for viscous drag (Stokes’ law)  $F = 6\pi\eta rv$ ; b) understand that this equation applies only to small spherical objects moving at low speeds with laminar flow (or in the absence of turbulent flow) and that viscosity is temperature dependent
- 26. CORE PRACTICAL 2: Use a falling-ball method to determine the viscosity of a liquid
- 27. be able to use the Hooke’s law equation  $\Delta F = k\Delta x$ , where k is the stiffness of the object

- 28. understand how to use the relationships (tensile or compressive) stress = force / cross-sectional area, (tensile or compressive) strain = change in length / original length, and Young modulus = stress / strain
- 29. a) be able to draw and interpret force–extension and force–compression graphs; b) understand the terms limit of proportionality, elastic limit, yield point, elastic deformation and plastic deformation and be able to apply them to these graphs
- 30. be able to draw and interpret tensile or compressive stress–strain graphs, and understand the term breaking stress
- 31. CORE PRACTICAL 3: Determine the Young modulus of a material
- 32. be able to calculate the elastic strain energy  $E_{el}$  in a deformed material sample, using the equation  $\Delta E_{el} = \frac{1}{2}F\Delta x$ , and from the area under the force–extension graph; the estimation of area and hence energy change for both linear and non-linear force–extension graphs is expected

| Stage                                                               | Use                                                                                                                              | Your notes |
|---------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------|------------|
| <div><div>Starter</div><div>10 min · retrieval practice</div></div> | <div>nothing in the Library for this stage yet</div> <div>Handout 01</div> <div>Vocabulary list 01</div>                         |            |
| <div><div>Teach</div><div>the new content</div></div>               | <div>Exercise sheets 1.1, 1.2, 1.3, 1.4, 1.5, 1.6, 1.7, 1.8</div> <div>Past-paper sheets 1.1, 1.2, 1.3, 1.5, 1.6, 1.7, 1.8</div> |            |
| <div><div>Practice</div><div>guided then independent</div></div>    |                                                                                                                                  |            |
| <div><div>Check</div><div>before they leave</div></div>             | <div>nothing in the Library for this stage yet</div> <div>Any unused exercise sheet above</div>                                  |            |
| <div><div>Homework</div><div>set from the Library</div></div>       |                                                                                                                                  |            |

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| <b>Check</b><br>before they leave                | nothing in the Library for this stage yet |            |
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