### NELSON MATHEMATICS FOR CAMBRIDGE INTERNATIONAL A LEVEL

#### MECHANICS 2

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<td>Knowledge of the content of unit M1 is assumed, and candidates may be required to demonstrate such knowledge in answering questions.</td>
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#### Unit M2: Mechanics 2 (Paper 5)

1. **Motion of a projectile**
   - model the motion of a projectile as a particle moving with constant acceleration and understand any limitations of the model;  
   - use horizontal and vertical equations of motion to solve problems on the motion of projectiles, including finding the magnitude and direction of the velocity at a given time of position, the range on a horizontal plane and the greatest height reached;  
   - derive and use the cartesian equations of the trajectory of a projectile, including problems in which the initial speed and/or angle of projection may be unknown.  
   - Pages 1–4  
   - Pages 5–12

2. **Equilibrium of a rigid body**
   - calculate the moment of a force about a point, in two dimensional situations only (understanding of the vector nature of moments is not required);  
   - use the result that the effect of gravity on a rigid body is equivalent to a single force acting at the centre of mass of the body, and identify the position of the centre of mass of a uniform body using considerations of symmetry;  
   - use given information about the position of the centre of mass of a triangular lamina and other simple shapes;  
   - determine the position of the centre of mass of a composite body by considering an equivalent system of particles (in simple cases only, e.g. a uniform L-shaped lamina);  
   - use the principle that if a rigid body is in equilibrium under the action of coplanar forces then the vector sum of the forces is zero and the sum of the moments of the forces about any point is zero, and the converse of this;  
   - solve problems involving the equilibrium of a single rigid body under the action of coplanar forces, including those involving toppling or sliding (problems set will not involve complicated trigonometry).  
   - Pages 52–64  
   - Pages 65–76  
   - Pages 65–76, pages 79–91

3. **Uniform motion in a circle**
   - understand the concept of angular speed for a particle moving in a circle, and use the relation $v = r\omega$;  
   - understand that the acceleration of a particle moving in a circle with constant speed is directed towards the centre of the circle, and use the formulae $r\omega^2$ and $\frac{v^2}{r}$;  
   - solve problems which can be modelled by the motion of a particle moving in a horizontal circle with constant speed.  
   - Pages 34–42

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**Student Book: Nelson Mathematics Cambridge A Level Mechanics 2**

**Syllabus: Cambridge International A Level Mathematics: Mechanics 2 (9709)**
### 4. Hooke’s law

- use Hooke’s law as a model relating the force in an elastic string or spring to the extension or compression, and understand the term modulus of elasticity;  
  - Pages 15–21
- use the formula for the elastic potential energy stored in a string or spring;  
  - Pages 23–25
- solve problems involving forces due to elastic strings or springs, including those where considerations of work and energy are needed.  
  - Pages 26–31

### 5. Linear motion under a variable force

- use \( \frac{dx}{dt} \) for velocity, and \( \frac{dv}{dt} \) or \( v \frac{dx}{dt} \) for acceleration, as appropriate;  
  - Pages 94–102
- solve problems which can be modelled as the linear motion of a particle under the action of a variable force, by setting up and solving an appropriate differential equation (restricted to equations in which the variables are separable).  
  - Pages 94–102