

2.3 AS UNIT 3

Unit 3: Further Mechanics A

Written examination: 1 hour 30 minutes

13 $\frac{1}{3}$ % of A level qualification (33 $\frac{1}{3}$ % of AS qualification)

70 marks

The subject content is set out on the following pages. There is no hierarchy implied by the order in which the content is presented, nor should the length of the various sections be taken to imply any view of their relative importance.

Candidates will be expected to be familiar with the knowledge, skills and understanding implicit in AS Mathematics. Where specific content requires knowledge of concepts or results from A2 Mathematics, this will be made explicit in the Guidance section of the content.

Topics	Guidance
2.3.1 Momentum and Impulse	
Understand and use momentum and impulse. Understand and use conservation of momentum. Understand and use Newton's Experimental Law for (i) the direct impact of two bodies moving in the same straight line, (ii) the impact of a body moving at right-angles to a plane.	Problems will be restricted to the one-dimensional case.
2.3.2 Hooke's Law, Work, Energy and Power	
Solve problems involving light strings and springs obeying Hooke's Law.	
Understand and use work, energy and power. Understand and use gravitational potential energy, kinetic energy, elastic energy. Understand and use conservation of energy. Understand and use the Work-energy Principle.	Calculation of work done by using change of energy.

Topics	Guidance
2.3.3 Circular Motion	
Understand and use circular motion.	Angular speed ω and the use of $v = r\omega$. Radial acceleration in circular motion in the form $r\omega^2$ and $\frac{v^2}{r}$.
Understand and use the motion of a particle in a horizontal circle with uniform angular speed.	Problems on banked tracks including the condition for no side slip. The conical pendulum. The motion of a particle in a horizontal circle where the particle is <ul style="list-style-type: none"> (i) constrained by two strings, (ii) threaded on one string, (iii) constrained by one string and a smooth horizontal surface. <i>Knowledge of resolution of forces in any given direction is assumed.</i>
Understand and use the motion in a vertical circle.	To include the determination of points where the circular motion breaks down (e.g. loss of contact with a surface or a string becoming slack). The condition for a particle to move in complete vertical circles when <ul style="list-style-type: none"> (i) it is attached to a light string, (ii) it is attached to a light rigid rod, (iii) it moves on the inside surface of a sphere. The tangential component of the acceleration is not required. <i>Knowledge of resolution of forces in any given direction is assumed.</i>
2.3.4 Differentiation and Integration of Vectors	
Differentiate and integrate vectors in component form with respect to a scalar variable. Understand and use vector quantities including displacement, velocity, acceleration, force and momentum.	Extends to vectors in 3 dimensions. Resultants of vector quantities. Simple applications including the relative motion of two objects and the determination of the shortest distance between them. <i>Knowledge of 3-D vectors is assumed.</i>