**Oscillations**

1. Simple harmonic motion (dynamics and energy relationships)

*Students should understand simple harmonic motion, so they can*:

1. Sketch or identify a graph of displacement as a function of time, and determine from such a graph the amplitude, period, and frequency of the motion.
2. Write down an appropriate expression for displacement of the form Asin (wt) or Acos (wt) to describe the motion.
3. State the relations between acceleration, velocity, and displacement, and identify points in the motion where these quantities are zero or achieve their greatest positive and negative values.
4. State and apply the relation between frequency and period.
5. State how the total energy of an oscillating system depends on the amplitude of the motion, sketch or identify a graph of kinetic or potential energy as a function of time, and identify points in the motion where this energy is all potential or all kinetic.
6. Calculate the kinetic and potential energies of an oscillating system as functions of time, sketch or identify graphs of these functions, and prove that the sum of kinetic and potential energy is constant.
7. Mass on a spring

*Students should be able to apply their knowledge of simple harmonic motion to the case of a mass on a spring, so they can*:

1. Apply the expression for the period of oscillation of a mass on a spring.
2. Analyze problems in which a mass hangs from a spring and oscillates vertically.
3. Analyze problems in which a mass attached to a spring oscillates horizontally.
4. Pendulum and other oscillations

*Students should be able to apply their knowledge of simple harmonic motion to the case of a pendulum, so they can*:

1. Apply the expression for the period of a simple pendulum.
2. State what approximation must be made in deriving the period.