Physics

Students will be given the following in any tests or exams, as required:
- calculation formulae
- values of constants
- SI prefixes

Students should be able to:

Newton's Laws

Calculate the net force on an object given the forces acting

Answer questions requiring an understanding of Newton's first law (the law of inertia)

Describe the difference between mass and weight (and calculate one from the other)

Answer questions requiring understanding that friction always acts in the opposite direction to motion and increases with the speed of the object

Answer questions requiring an undersanding of terminal speed

Answer questions requiring an understanding of Newton's second law (F = ma)

Solve problems involving force, mass and acceleration

Describe the action and reaction forces in any given situation

Draw the forces acting in any given system of bodies

Answer questions requiring an understanding of Newton's third law ($\vec{F_1} = -\vec{F_2}$)

Electric Fields, Current Electricity and Magnetism

Explain the following concepts
- electric fields and lines
- electrostatic charging (by contact or by induction, and including the concept of affinity)
- electric fields inside conductors
- electric fields at sharp points
- Coulomb's Law
- proportionality and inverse squared proportionality
- polarisation

Calculate the following
- the force between two charges q_1 and q_2 a distance r apart
- the electric field strength at a distance r from a charge q
- the electric field strength at a point between two charges

Solve problems using any of these formulae

$$F = k\frac{q_1 q_2}{r^2} \qquad E = k\frac{q}{r^2} \qquad W = q\Delta V \qquad \Delta V = \frac{Fd}{q} \qquad \Delta V = Ed \qquad E = \frac{F}{q}$$

Draw the following
- electric field lines around a single charge
- electric field lines between two points
- electric field lines on a conductor (either hollow or solid, and of any shape)
- electric field lines between two plates
- an example of charge polarisation

Answer conceptual question and solve problems requiring understanding of units:
- Volts are joules per coulomb (energy per charge)
- Amperes are coulombs per second (charge per time)

Compare the directions of conventional current and electron flow in a circuit

Explain the concept of magnetic fields

Solve problems involving current, resistance and voltage (using Ohm's Law)

Calculate the total resistance in a circuit with resistors in parallel or series

Solve problems involving power, current and voltage

Draw the magnetic field produced around a current-carrying wire

Identify the direction of force on a current-carrying wire in a magnetic field

Solve problems involving a length of wire carrying a current on some angle through a magnetic field and experiencing a force

Describe and explain the functions of an electromagnet, electric motor, or electrical generator.

Waves and Light topic
Draw a transverse and/or longitudinal wave
- for transverse, label a wavelength, amplitude, crest, trough
- for longitudinal, label a wavelength, compression, rarefaction

Compare the wavelength and frequency of any two waves on the electromagnetic spectrum

Know the order of the wave types on the electromagnetic spectrum (in order of frequency and in order of wavelength)

Solve problems involving frequency and period

Solve problems involving frequency, wavelength and wave speed

For sound waves, relate frequency or wavelength to pitch, and amplitude to volume

Draw a standing wave with any given number of nodes (or state the number of nodes given a diagram of a standing wave)

Describe how a standing wave is produced

Explain the Doppler effect

Explain diffuse and specular reflection

Solve problems involving the refractive indices of two mediums, the angle of incidence and the angle of refraction of a light ray

Explain opaque and transparent objects in terms of absorbed, reflected and transmitted light

Explain object colours under different coloured light