OCR GCSE 9-1 Gateway Physics Equations

You need to learn these formulae:

**P1 Matter**

density \( (kg/m^3) = \frac{mass (kg)}{volume (m^3)} \quad \rho = \frac{m}{V} \)

**P2 Forces**
distance travelled \( (m) = speed (m/s) \times time (s) \quad s = v \times t \)

acceleration \( (m/s^2) = \frac{change in velocity (m/s)}{time (s)} \quad a = \frac{(v - u)}{t} \)
kineastic energy \( (J) = 0.5 \times mass (kg) \times (speed (m/s))^2 \quad KE = \frac{1}{2} mv^2 \)

force \( (N) = mass (kg) \times acceleration (m/s^2) \quad F = \text{ma} \)

work done \( (J) = force (N) \times distance (m) \) (along the line of action of the force) \( WD = F \times D \)

power \( (W) = work done (J)/time (s) \quad P = \frac{WD}{t} \)

momentum \( (kgm/s) = mass (kg) \times velocity (m/s) \quad p = mv \)

*Pressure (Pa) = Force (N) / Area (m^2) (Separate Science only)*

weight = gravity force \( (N) = mass (kg) \times gravitational field strength, g (N/kg) \quad F = W = mg \)

(in a gravity field) potential energy \( (J) = mass (kg) \times height (m) \times gravitational field strength, g (N/kg) \quad GPE = mgh \)

*Moment of a force (Nm) = force (N) \times distance (m) (normal to the direction of the force) (Separate Science only)*

**P3 Electricity**

charge flow \( (C) = current (A) \times time (s) \quad Q = It \)

potential difference \( (V) = current (A) \times resistance (\Omega) \quad V = IR \)

energy transferred \( (J) = current (A) \times potential difference (V) \quad E = QV \)

power \( (W) = potential difference (V) \times current (A) = (current (A))^2 \times resistance (\Omega) \quad P = IV = I^2R \)

energy transferred \( (J, kW) = power (W, kW) \times time (s, h) \quad E = Pt \)

**P5 Waves**

wave speed \( (m/s) = frequency (Hz) \times wavelength (m) \quad v = f\lambda \)

**P7 Energy**
efficiency = useful output energy transfer \( (J) / input energy transfer \( (J) \)

**P8 Global Challenges**

Stopping distance \( (m) = thinking distance \( (m) + braking distance (m) \)

You will be given these formulae in the exam:

**P1 Matter**

change in thermal energy \( (J) = mass (kg) \times specific heat capacity (J/kg°C) \times change in temperature (°C) \quad E = mC\Delta T \)

thermal energy for a change in state \( (J) = mass (kg) \times specific latent heat (J/kg) \quad E = mL \)

*for gases: pressure (Pa) \times volume (m^3) = constant (for a given mass of gas and at a constant temperature) (Separate Science only)*

*pressure due to a column of liquid (Pa) = height of column (m) \times density of liquid (kg/m^3) \times g (N/kg) (Triple only) (Separate Science only)*

**P2 Forces**

\( (final velocity (m/s))^2 - (initial velocity (m/s))^2 = 2 \times acceleration (m/s^2) \times distance (m) \quad v^2 - u^2 = 2as \)

energy transferred in stretching \( (J) = 0.5 \times spring constant (N/m) \times (extension (m))^2 \quad E = \frac{1}{2} ke^2 \)

**P4 Magnetism**

force on a conductor (at right angles to a magnetic field) carrying a current \( (N) = magnetic field strength (T) \times current (A) \times length (m) \) (Higher only) \( F = BIl \)

*Potential difference across primary coil (V) / potential difference across secondary coil (V) = Number of turns in primary coil / number of turns in secondary coil (Higher only) (Separate Science only)*

\( V_p = N_p \)

\( V_s = N_s \)