Appendix 2: Equations in Physics

This appendix is taken from the document *Biology, Chemistry and Physics GCSE subject content* published by the Department for Education (DfE) in June 2014.

This identifies which equations students are required to recall and apply (list a) and which they are required to select from a list and apply (list b). List b also includes three additional equations to the DfE equations.

a Students should be able to recall and apply all the following equations

Students may be asked to recall, recall and apply, or only apply these equations in the exam papers. If students are required to only apply an equation from this section the equation will be given in the question.

Equations required for higher tier only are shown in bold text. Higher tier only equations will not be required in the foundation tier papers.

Specification reference	Equation
2.6b	distance travelled = average speed × time
2.8	acceleration = change in velocity ÷ time taken $a = \frac{(v-u)}{t}$
2.15	force = mass × acceleration $F = m \times a$
2.16	weight = mass × gravitational field strength $W = m \times g$
2.24	**momentum = mass × velocity** $\boldsymbol{p = m \times v}$
3.1 and 8.8	change in gravitational potential energy = mass × gravitational field strength × change in vertical height $\Delta GPE = m \times g \times \Delta h$
3.2 and 8.9	kinetic energy = $\frac{1}{2}$ × mass × (speed)^2 $KE = \frac{1}{2} \times m \times v^2$
3.11 and 8.15	efficiency = $\frac{(\text{useful energy transferred by the device})}{(\text{total energy supplied to the device})}$
4.6	wave speed = frequency × wavelength $v = f \times \lambda$
	wave speed = distance ÷ time $v = \frac{x}{t}$

Specification reference	Equation
8.6	work done = force × distance moved in the direction of the force $E = F \times d$
8.13	power = work done ÷ time taken $P = \frac{E}{t}$
9.7P	moment of a force = force × distance normal to the direction of the force
10.6	energy transferred = charge moved × potential difference $E = Q \times V$
10.9	charge = current × time $Q = I \times t$
10.13	potential difference = current × resistance $V = I \times R$
10.29	power = energy transferred ÷ time taken $P = \frac{E}{t}$
10.31	electrical power = current × potential difference $P = I \times V$
	electrical power = current squared × resistance $P = I^2 \times R$
14.2	density = mass ÷ volume $\rho = \frac{m}{V}$
15.3	force exerted on a spring = spring constant × extension $F = k \times x$
15.11P	pressure = force normal to surface ÷ area of surface $P = \frac{F}{A}$

b Students should be able to select and apply the following equations

Students may be asked to select and apply these equations in the exam papers. These equations will be given in a formulae sheet at the end of the exam papers.

Equations required for higher tier only are shown in bold text. Higher tier only equations will not be given in the formulae sheet for the foundation tier papers.

Specification reference	Equation
2.9	(final velocity)^2 – (initial velocity)^2 = 2 × acceleration × distance $v^2 - u^2 = 2 \times a \times x$
2.26	**force = change in momentum ÷ time** $\boldsymbol{F = \frac{(mv - mu)}{t}}$
10.27	energy transferred = current × potential difference × time $E = I \times V \times t$
12.13	**force on a conductor at right angles to a magnetic field carrying a current = magnetic flux density × current × length** $\boldsymbol{F = B \times I \times l}$
13.7P	$\frac{\text{potential difference across primary coil}}{\text{potential difference across secondary coil}} = \frac{\text{number of turns in primary coil}}{\text{number of turns in secondary coil}}$ $\boldsymbol{\frac{V_p}{V_s} = \frac{N_p}{N_s}}$
13.10	For transformers with 100% efficiency, potential difference across primary coil × current in primary coil = potential difference across secondary coil × current in secondary coil $V_P \times I_P = V_S \times I_S$
14.8	change in thermal energy = mass × specific heat capacity × change in temperature $\Delta Q = m \times c \times \Delta\theta$
14.9	thermal energy for a change of state = mass × specific latent heat $Q = m \times L$
14.19P	$P_1 \times V_1 = P_2 \times V_2$ to calculate pressure or volume for gases of fixed mass at constant temperature
15.4	energy transferred in stretching = 0.5 × spring constant × (extension)^2 $E = \frac{1}{2} \times k \times x^2$

Specification reference	Equation
15.14P	**pressure due to a column of liquid = height of column × density of liquid × gravitational field strength** $P = h \times \rho \times g$