

A Level Biology Mathematical Skills Checklist

M0 – Arithmetic and numerical computation

Skill Code	Skill	You may be tested on your ability to:	Skill appears in the following parts of the specification:
M0.1	Recognise and make use of appropriate units in calculations	<ul style="list-style-type: none"> - convert between units e.g. mm³ to cm³ as part of volumetric calculations - work out the unit for a rate e.g. breathing rate 	2.1.1(e), 2.1.2(s), 2.1.4(d), 2.1.4(f), 2.1.5(c), 2.1.5(d), 2.1.5(e), 3.1.1(a), 3.1.1(e), 3.1.2(a), 3.1.2(h), 3.1.3(a), 3.1.3(c), 4.1.1(b), 4.1.1(l), 5.1.2(c), 5.1.5(i), 5.1.5(k), 5.2.1(a), 5.2.1(c), 5.2.1(g), 5.2.2(i), 5.2.2(k), 5.2.2(l), 6.2.1(h), 6.3.1(b), 6.3.2(a)
M0.2	Recognise and use expressions in decimal and standard form	<ul style="list-style-type: none"> - use an appropriate number of decimal places in calculations, e.g. for a mean - carry out calculations using numbers in standard and ordinary form, e.g. use of magnification - understand standard form when applied to areas such as size of organelles - convert between numbers in standard and ordinary form understand that significant figures need retaining when making conversions between standard and ordinary form, e.g. 0.0050 mol dm⁻³ is equivalent to 5.0 × 10⁻³ mol dm⁻³. 	2.1.1(e), 2.1.1(f), 2.1.1(g), 2.1.2(s), 2.1.4(d), 2.1.4(f), 2.1.5(b), 2.1.5(c), 2.1.5(d), 2.1.5(e), 3.1.1(e), 3.1.3(c), 4.1.1(b), 4.1.1(l), 4.2.1(b), 5.1.5(e), 5.1.5(i), 5.1.5(k), 5.2.1(c), 5.2.1(g), 5.2.2(i), 5.2.2(k), 5.2.2(l), 6.1.2(f), 6.2.1(i), 6.3.1(b), 6.3.2(a)
M0.3	Use ratios, fractions and percentages	<ul style="list-style-type: none"> -calculate percentage yields -calculate surface area to volume ratio -use scales for measuring represent phenotypic ratios (monohybrid and dihybrid crosses). 	2.1.1(e), 2.1.1(f), 2.1.4(d), 2.1.4(f), 2.1.5(d), 2.1.5(e), 3.1.1(a), 3.1.2(a), 3.1.3(a), 4.1.1(b), 4.1.1(l), 4.2.2(h), 5.1.2(c), 5.1.5(k), 5.2.1(a), 5.2.1(g), 6.1.2(b), 6.1.2(c), 6.2.1(h), 6.2.1(i), 6.3.1(b), 6.3.2(a)
M0.4	Estimate results	-estimate results to sense check that the calculated values are appropriate.	3.1.1(a), 3.1.1(e), 3.1.2(a), 3.1.3(a), 5.2.1(a), 6.3.1(b), 6.3.2(a)
M0.5 (full A Level only)	Use calculators to find and use power, exponential and logarithmic functions	-estimate the number of bacteria grown over a certain length of time.	6.2.1(h), 6.3.2(a)
M1 - Handling Data			
M1.1	Use an appropriate number of significant figures	<ul style="list-style-type: none"> -report calculations to an appropriate number of significant figures given raw data quoted to varying numbers of significant figures -understand that calculated results can only be reported to the limits of the least accurate measurement. 	2.1.1(e), 2.1.2(s), 2.1.4(d), 2.1.4(f), 2.1.5(c), 2.1.5(d), 2.1.5(e), 3.1.1(a), 3.1.2(a), 3.1.2(h), 3.1.3(a), 3.1.3(c), 4.1.1(b), 4.1.1(l), 4.2.1(c), 4.2.1(d), 4.2.1(e), 5.1.2(c), 5.1.5(e), 5.1.5(i), 5.1.5(k), 5.2.1(c), 5.2.1(g), 5.2.2(i), 5.2.2(k), 5.2.2(l), 6.2.1(h), 6.3.1(b)
M1.2	Find arithmetic means	-find the mean of a range of data, e.g. the mean number of stomata in the leaves of a plant.	2.1.5(c), 2.1.5(d), 2.1.5(e), 3.1.3(c), 4.1.1(b), 4.1.1(l), 4.2.2(f), 5.1.5(e), 5.1.5(i), 5.1.5(k), 5.2.2(l), 6.2.1(i)

M1.3	Construct and interpret frequency tables and diagrams, bar charts and histograms	-represent a range of data in a table with clear headings, units and consistent decimal places -interpret data from a variety of tables, e.g. data relating to organ function -plot a range of data in an appropriate format, e.g. enzyme activity over time represented on a graph -interpret data for a variety of graphs, e.g. explain electrocardiogram traces.	2.1.2(s), 2.1.4(d), 2.1.4(f), 2.1.5(c), 2.1.5(d), 2.1.5(e), 3.1.1(e), 3.1.2(h), 3.1.3(c), 4.1.1(b), 4.1.1(g), 4.1.1(l), 4.2.1(b), 4.2.1(f), 4.2.2(f), 5.1.2(c), 5.1.3(c), 5.1.5(a), 5.1.5(e), 5.1.5(i), 5.1.5(k), 5.2.1(c), 5.2.1(g), 5.2.2(i), 5.2.2(k), 5.2.2(l), 6.2.1(h), 6.2.1(i), 6.3.1(b), 6.3.1(e), 6.3.2(a)
M1.4	Understand simple probability	-use the terms probability and chance appropriately -understand the probability associated with genetic inheritance.	4.2.1(b), 5.1.5(e), 6.1.2(b), 6.1.2(c), 6.2.1(i), 6.3.1(e)
M1.5	Understand the principles of sampling as applied to scientific data	-analyse random data collected by an appropriate means, e.g. use Simpson's index of diversity to calculate the biodiversity of a habitat.	4.1.1(b), 4.1.1(l), 4.2.1(b), 4.2.1(c), 4.2.1(d), 4.2.1(e), 6.3.1(e)
M1.6	Understand the terms mean, median and mode	-calculate or compare the mean, median and mode of a set of data, e.g. height/mass/ size of a group of organisms.	2.1.5(c), 2.1.5(d), 2.1.5(e), 3.1.3(c), 4.2.1(b), 4.2.2(f), 5.1.5(a), 5.1.5(e), 5.1.5(i), 5.1.5(k), 5.2.2(l), 6.2.1(i), 6.3.1(b)
M1.7	Use a scatter diagram to identify a correlation between two variables	-interpret a scattergram, e.g. the effect of lifestyle factors on health.	4.1.1(b), 4.1.1(l), 4.2.1(b), 4.2.1(f), 4.2.2(f), 6.3.1(e)
M1.8	Make order of magnitude calculations	-use and manipulate the magnification formula magnification = size of image/size of real object	2.1.1(e)
M1.9	Select and use a statistical test	-the chi squared test (χ^2) to test the significance of the difference between observed and expected results -the Student's t-test -the Spearman's rank correlation coefficient.	4.2.1(b), 5.1.5(e), 6.1.2(c), 6.3.1(e)
M1.10	Understand measures of dispersion, including standard deviation and range	-calculate the standard deviation -understand why standard deviation might be a more useful measure of dispersion for a given set of data e.g. where there is an outlying result.	2.1.5(e), 4.2.1(b), 4.2.2(f), 5.1.5(e), 5.1.5(k), 5.2.2(l), 6.2.1(i), 6.3.1(e)
M1.11	Identify uncertainties in measurements and use simple techniques to determine uncertainty when data are combined	-calculate percentage error where there are uncertainties in measurement.	2.1.4(d), 2.1.4(f), 2.1.5(c), 2.1.5(d), 2.1.5(e), 3.1.3(c), 5.2.1(g)
M2 – Algebra			
M2.1	Understand and use the symbols: =, 1, <, «, », >, ~, α		2.1.5(d), 2.1.5(e), 3.1.1(a), 3.1.2(a), 3.1.3(a), 5.1.2(c), 6.1.2(c)
M2.2	Change the subject of an equation	-use and manipulate equations, e.g. magnification.	2.1.1(e), 2.1.2(s), 5.2.1(c), 6.1.2(f)

M2.3	Substitute numerical values algebraic equations using appropriate units for physical quantities	-use a given equation e.g. Simpson's-index of diversity	2.1.1(e), 2.1.2(s), 4.2.1(c), 4.2.1(d), 4.2.1(e), 5.2.1(c), 5.2.2(k), 6.1.2(f)
M2.4	Solve algebraic equations	-solve equations in a biological context, e.g. cardiac output = stroke volume × heart rate	2.1.1(e), 2.1.2(s), 3.1.2(h), 4.2.1(c), 4.2.1(d), 4.2.1(e), 5.2.1(c), 5.2.2(i), 5.2.2(l)
M2.5 (full A Level only)	Use logarithms in relation to quantities that range over several orders of magnitude	-use a logarithmic scale in the context of microbiology, e.g. growth rate of a microorganism such as yeast.	6.2.1(h), 6.3.2(a)
M3 - Graphs			
M3.1	Translate information between graphical, numerical and algebraic forms	-understand that data may be presented in a number of formats and be able to use these data, e.g. dissociation curves.	2.1.4(d), 2.1.4(f), 2.1.5(c), 2.1.5(d), 2.1.5(e), 3.1.2(j), 3.1.3(c), 4.1.1(b), 4.1.1(l), 4.2.1(f), 5.1.2(c), 5.1.3(c), 5.1.5(e), 5.1.5(k), 5.2.1(g), 5.2.2(i), 6.2.1(h), 6.3.1(e), 6.3.2(a)
M3.2	Plot two variables from experimental or other data	-select an appropriate format for presenting data, bar charts, histograms, graphs and scattergrams.	2.1.4(d), 2.1.4(f), 2.1.5(c), 2.1.5(d), 2.1.5(e), 3.1.3(c), 4.1.1(b), 4.1.1(l), 4.2.1(b), 5.1.5(e), 5.2.1(g), 5.2.2(i), 5.2.2(l), 6.2.1(h), 6.2.1(i), 6.3.1(e), 6.3.2(a)
M3.3	Understand that $y = mx + c$ represents a linear relationship	-predict/sketch the shape of a graph with a linear relationship, e.g. the effect of substrate concentration on the rate of an enzyme controlled reaction with excess enzyme.	2.1.4(d), 2.1.4(f), 2.1.5(c), 2.1.5(d), 3.1.3(c), 5.2.2(l)
M3.4 (full A Level only)	Determine the intercept of a graph	-read off an intercept point from a graph, e.g. compensation point in plants.	5.2.1(a), 5.2.1(g), 6.2.1(h)
M3.5	Calculate rate of change from a graph showing a linear relationship	-calculate a rate from a graph, e.g. rate of transpiration.	2.1.4(d), 2.1.4(f), 2.1.5(c), 2.1.5(d), 3.1.3(c), 5.2.1(g), 5.2.2(l), 6.2.1(h)
M3.6	Draw and use the slope of a tangent to a curve as a measure of rate of change	-use this method to measure the gradient of a point on a curve, e.g. amount of product formed plotted against time when the concentration of enzyme is fixed.	2.1.4(d), 2.1.4(f), 2.1.5(c), 2.1.5(d), 3.1.3(c), 5.2.1(g), 5.2.2(l), 6.2.1(h)
M4 – Geometry and Trigonometry			
M4.1	Calculate the circumferences, surface areas and volumes of regular shapes	-calculate the circumference and area of a circle -calculate the surface area and volume of rectangular prisms, of cylindrical prisms and of spheres -e.g. calculate the surface area or volume of a cell.	2.1.5(d), 2.1.5(e), 3.1.1(a), 3.1.2(a), 3.1.3(a), 3.1.3(c), 5.2.1(g), 6.2.1(i)