

6 Calculation specific guidance

Correct answers to calculations should be given full credit even if there is no working or incorrect working, **unless** the question states 'show your working'.

For questions in which the number of significant figures required is not stated, credit should be awarded for correct answers when rounded by the examiner to the number of significant figures given in the mark scheme. This may not apply to measured values.

For answers given in standard form, (e.g. $a \times 10^n$) in which the convention of restricting the value of the coefficient (a) to a value between 1 and 10 is not followed, credit may still be awarded if the answer can be converted to the answer given in the mark scheme.

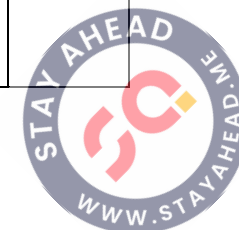
Unless a separate mark is given for a unit, a missing or incorrect unit will normally mean that the final calculation mark is not awarded. Exceptions to this general principle will be noted in the mark scheme.

7 Guidance for chemical equations

Multiples / fractions of coefficients used in chemical equations are acceptable unless stated otherwise in the mark scheme.

State symbols given in an equation should be ignored unless asked for in the question or stated otherwise in the mark scheme.

Question	Answer	Marks
1(a)	Value of L in the range 0.987–0.993 m.	1
	Value of $y_1 > y_2$.	1
	Correct calculation of y .	1
1(b)	Five sets of readings of m and y (different values) showing the correct trend and without help from the Supervisor scores 5 marks, four sets scores 4 marks etc.	5
	Range: Must include values of $m \leq 100$ g and $m \geq 140$ g.	1
	Column headings: Each column heading must contain a quantity, a unit and a separating mark where appropriate. The presentation of the quantity and unit must conform to accepted scientific convention e.g. y / cm .	1
	Consistency: All raw values of y_1 and y_2 must be given to the nearest mm only.	1
1(c)(i)	Axes: Sensible scales must be used, no awkward scales (e.g. 3:10). Scales must be chosen so that the plotted points occupy at least half the graph grid in both x and y directions. Scales must be labelled with the quantity that is being plotted. Scale markings should be no more than three large squares apart.	1
	Plotting of points: All observations in the table must be plotted on the grid. Diameter of plotted points must be \leq half a small square. Points must be plotted to an accuracy of half a small square.	1
	Quality: All observations in the table (at least 4) must be plotted on the grid. Trend of points on graph must be correct. It must be possible to draw a straight line that is within ± 2.0 cm (to scale) on the y / cm axis (normally y -axis) of all plotted points.	1



Question	Answer	Marks
1(c)(ii)	<p>Line of best fit: Judge by balance of all points on the grid about the candidate's line (at least 4 points). There must be an even distribution of points either side of the line along the full length. If there are 5 or more points, allow one anomalous point only if clearly indicated by the candidate. Line must not be kinked or thicker than half a small square.</p>	1
1(c)(iii)	<p>Gradient: The hypotenuse of the triangle used must be greater than half the length of the drawn line. The method of calculation must be correct. Do not allow $\Delta x / \Delta y$. Both read-offs must be accurate to half a small square in both the x and y directions.</p>	1
	<p>y-intercept: Correct read-off from a point on the line and substituted into $y = mx + c$. Read-off must be accurate to half a small square in both x and y directions. or Intercept read directly from the graph with read-off at $x = 0$ accurate to half a small square.</p>	1
1(d)	<p>Value of A = candidate's gradient and value of B = candidate's intercept. The values must not be fractions.</p>	1
	<p>Units for A (e.g. cm g^{-1}) and B (m, cm or mm) correct.</p>	1
1(e)	<p>Calculation of R correct [= $2(L - B) / A$] and given to three significant figures.</p>	1



Question	Answer	Marks
2(a)	Value of D in the range 2.300–2.500 cm with unit and to the nearest 0.01 cm or 0.001 cm.	1
	Value of d in the range 1.100–1.300 cm with unit and to the nearest 0.01 cm or 0.001 cm.	1
2(b)(i)	Value of L in the range 29–31 cm with unit and to the nearest 0.1 cm.	1
2(b)(ii)	Final value of l in the range 40–80 cm with unit. Raw readings to the nearest mm.	1
	Evidence of repeats.	1
2(b)(iii)	Percentage uncertainty in l based on an absolute uncertainty of 2–5 mm. If repeated readings have been taken, then the uncertainty can be half the range (but not zero) if the working is clearly shown. Correct method of calculation to obtain percentage uncertainty.	1
2(b)(iv)	Correct calculation of $(l - L)^2$.	1
2(c)	Second value of D .	1
	Second values of L and l .	1
	Quality: Second value of $l <$ first value of l .	1
2(d)(i)	Two values of k calculated correctly.	1
2(d)(ii)	Valid comment consistent with calculated values of k , testing against a criterion stated by the candidate.	1



Question	Answer	Marks
2(e)(i)	<p>A Two readings are not enough to draw a (valid) conclusion (not “not enough for accurate results”, “few readings”).</p> <p>B Problem in placing cylinder A on the line (e.g. because cylinder covers line when placed).</p> <p>C Narrow strip so A (or C) not centrally placed at release.</p> <p>D A (or C) not hitting B ‘full on’.</p> <p>E Large step at bottom of strip causes deviation.</p> <p>F Uneven friction of surface of bench.</p> <p>G Difficult to measure L (or l) with a reason e.g. parallax/rule not touching edge of ramp.</p> <p><i>1 mark for each point up to a maximum of 4.</i></p>	4
2(e)(ii)	<p>A Take more readings <u>and</u> plot a graph or take more readings <u>and</u> compare k values (not “repeat readings” on its own).</p> <p>B Improved method of releasing A (or C) from the same height each time e.g. a stop.</p> <p>C Use wider strip.</p> <p>D Improved method of guiding A (or C) after rolling down strip e.g. place apparatus in a channel.</p> <p>E Use a thinner strip/bevelled edge.</p> <p>F Provide smoother/more even surface for A (or C) to roll horizontally.</p> <p>G Improved method to measure L (or l) e.g. place apparatus on a grid of 1 mm graph paper/use set square.</p> <p><i>1 mark for each point up to a maximum of 4.</i></p>	4

