

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.

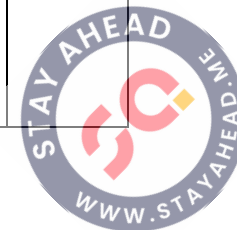
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Question	Answer	Marks
1(a)	Value of final L in the range 38.0–42.0 cm with unit.	1
	Values of I_1 and I_2 each less than 1 A and each with unit.	1
	$I_1 > I_2$.	1
1(b)	Six (or more) sets of readings of L (different values), I_1 and I_2 with correct trend (as L increases, I_1 increases and I_2 decreases) and without help from the Supervisor scores 4 marks, five sets scores, 3 marks etc.	4
	Range: $L_{\min} \leq 10.0$ cm and $L_{\max} \geq 70.0$ cm.	1
	Column headings: Each column heading must contain a quantity and a unit where appropriate. The presentation of quantity and unit must conform to accepted scientific convention e.g. L / cm, I_1 / mA. $I_2 / (I_1 - I_2)$ must have no unit.	1
	Consistency: <u>All</u> values of L must be given to the nearest 0.1 cm.	1
	Significant figures: All values of $I_2 / (I_1 - I_2)$ must be given to the same number of s.f. (or one more than) the least number of s.f. in I_1 , I_2 and $(I_1 - I_2)$ values.	1
	Calculation: Values of $I_2 / (I_1 - I_2)$ are correct.	1



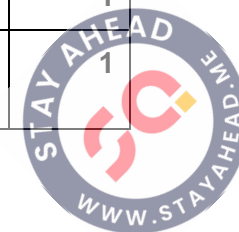
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Question	Answer	Marks
1(c)(i)	<p>Axes: Axes must be labelled with the correct quantities. Scales must be chosen so that the plotted points occupy at least half the graph grid in both the x and y directions. Scale markings are no more than 2 cm (one large square) apart. Sensible scales must be used. Scales must not be awkward (e.g. 3:10 or fractions).</p>	1
	<p>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 in both x and y directions.</p>	1
	<p>Quality: Trend of points on graph must be negative. All points in the table must be plotted (at least 5). It must be possible to draw a straight line that is within ± 5 cm (± 0.05 m) to scale on the L axis of <u>all</u> plotted points.</p>	1
1(c)(ii)	<p>Line of best fit: 'Best fit' is judged by the balance of all points on the grid (at least 5 points) about the candidate's line. There must be an even distribution of points either side of the line along the full length. Lines must not be kinked or thicker than half a square.</p> <p>Some candidates may choose to identify an anomalous point. If they identify one point as anomalous (e.g. by circling or labelling) then this point is to be disregarded when judging the line of best fit. There must be at least 5 points left after the anomalous point is disregarded.</p>	1
1(c)(iii)	<p>Gradient: The hypotenuse of the triangle used should be greater than half the length of the drawn line. Both read-offs must be accurate to half a small square in both the x and y directions. The method of calculation must be correct, not $\Delta x / \Delta y$. The gradient sign on the answer line must be consistent with the graph drawn.</p>	1
	<p>y-intercept: Intercept read directly from the graph where $L = 0$ and accurate to half a small square in y direction. or Correct read-off from a point on the line substituted correctly into $y = mx + c$ or an equivalent expression. Read-off accurate to half a small square in both x and y directions.</p>	1



Question	Answer	Marks
1(d)	Value of P = candidate's gradient and value of Q = candidate's y -intercept. Values must not be written as fractions or given to only one significant figure.	1
1(d)	Unit for P correct e.g. cm^{-1} or m^{-1} or mm^{-1} and no unit for Q .	1

Question	Answer	Marks
2(a)(i)	Value(s) of θ to the nearest degree.	1
	Final value of θ in the range $10\text{--}15^\circ$.	1
2(a)(ii)	Correct calculation of $\cos \theta$.	1
2(b)(i)	Value(s) of V to the nearest cm^3 .	1
	Evidence of repeat values of V .	1
2(b)(ii)	Percentage uncertainty based on an absolute uncertainty in V in range $2\text{--}5 \text{ cm}^3$. Correct method of calculation to find percentage uncertainty e.g. absolute uncertainty $\times 100$ / final V value from (b)(i) . If repeated readings have been taken, then the uncertainty can be half the range (but not zero) if the working is shown clearly.	1
2(c)	Second value of θ .	1
	Second value of V .	1
	Second value of V is greater than first value of V .	1
2(d)(i)	Two values of k calculated correctly. The final k values must not be written as fractions or given to only one significant figure.	1
2(d)(ii)	Justification for significant figures in k linked to significant figures in V and θ (not $\cos \theta$).	1
2(e)	Calculation of percentage difference between candidate's two k values. Comparison of percentage difference with 15% leading to a consistent conclusion.	1



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Question	Answer	Marks
2(f)(i)	<p>A Two readings are not enough to draw a (valid) conclusion (not “not enough for accurate results”, “few readings”).</p> <p>B Difficulty filling container with a reason e.g. overflows as filling or restricted access or small container not level or if put a little too much water in it overflows.</p> <p>C Difficulty measuring accurate value of V with a reason e.g. some water stays in large container or water sticks to outside of small container or water splashes out.</p> <p>D Difficulty with setup e.g. holding trolley <u>and</u> positioning masses at the same time.</p> <p>E Difficulty with alignment with reason e.g. container moves as being filled or container may be replaced in a different position after measuring V or masses hit container.</p> <p>F Difficult to ensure the trolley is held at same position each time.</p> <p><i>1 mark for each point up to a maximum of 4.</i></p>	4
2(f)(ii)	<p>A Take more readings (for different values of θ) <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 filling e.g. pipette/syringe/burette.</p> <p>C Improved method to measure V e.g. measure volume needed to top up smaller container.</p> <p>D Improved method for holding trolley e.g. clamp trolley/stop for trolley.</p> <p>E Detailed method to improve alignment e.g. marked sheet taped on floor.</p> <p>F Improved method of to ensure the same position of release e.g. use of gate/mark ramp/use marker.</p> <p><i>1 mark for each point up to a maximum of 4.</i></p>	4

