8825 – 6711M

Diploma Programme
Programme du diplôme
Programa del Diploma

Markscheme

November 2025

Physics

Standard level

Paper 1

9 pages

Subject Details: Physics SL Paper 1B Markscheme

Mark Allocation
Candidates are required to answer ALL questions. Maximum total = [20 marks].

1. Each row in the "Question" column relates to the smallest subpart of the question.

2. The maximum mark for each question subpart is indicated in the "Total" column.

3. Each marking point in the "Answers" column is shown by means of a tick (✓) at the end of the marking point.

4. A question subpart may have more marking points than the total allows. This will be indicated by "max" written after the mark in the "Total" column. The related rubric, if necessary, will be outlined in the "Notes" column.

5. An alternative wording is indicated in the "Answers" column by a slash (/). Either wording can be accepted.

6. An alternative answer is indicated in the "Answers" column by "***OR***" between the alternatives. Either answer can be accepted.

7. Words in angled brackets **« »** in the "Answers" column are not necessary to gain the mark.

8. Words that are underlined are essential for the mark.

9. The order of marking points does not have to be as in the "Answers" column, unless stated otherwise in the "Notes" column.

10. If the candidate's answer has the same "meaning" or can be clearly interpreted as being of equivalent significance, detail and validity as that in the "Answers" column then award the mark. Where this point is considered to be particularly relevant in a question it is emphasized by ***OWTTE*** (or words to that effect) in the "Notes" column.

11. Remember that many candidates are writing in a second language. Effective communication is more important than grammatical accuracy.

12. Occasionally, a part of a question may require an answer that is required for subsequent marking points. If an error is made in the first marking point then it should be penalized. However, if the incorrect answer is used correctly in subsequent marking points then **follow through** marks should be awarded. When marking, indicate this by adding **ECF** (error carried forward) on the script. "Allow ECF" will be displayed in the "Notes" column.

13. Do **not** penalize candidates for errors in units or significant figures, **unless** it is specifically referred to in the "Notes" column.

14. CNA refers to a correct numerical answer.

15. Allow reasonable substitutions where in common usage, *eg* ^{c} for rad.

Question			Answers	Notes	Total
1.	a	i	«20.6(0) – (– 0.3(0)) = » 20.9 mm ✓	Unit not required.	[1]
1	a	ii	Error in reading = 0.1 + 0.1 = «0.2 mm» 1% ✓	Full calculation gives 0.96%. Allow answer to more than 1 s.f. Allow ECF from ai)	[1]
1	b		Make multiple measurements **AND** average **OR** Make multiple measurements across different diameters **OR** Zero the caliper✓	Do not allow use of multiple metal spheres	[1]
1	c	i	% uncertainty in $M = \frac{0.2}{54.0} \times 100$ ***OR*** 0.37% ✓ «Overall uncertainty = 0.37 + (3 × *candidate answer to a(ii)*) » « (0.37 + 3 × 1.0) =» 3.4% ✓	Unrounded uncertainties lead to 3.2% Allow 3% or 4% to 1 s.f. Allow ECF from aii)	[2]
1	c	ii	« $0.034 \times 11.3 \times 10^3$ = 0.4 × 10^3 » $(11.3 \pm 0.4) \times 10^3 \,\mathrm{kg\,m^{-3}}$ ✓	Do not allow an absolute uncertainty expressed to more than 1 s.f. Allow ECF from ci) Unit not required	[1]

Question			Answers	Notes	Total
2	a		3 time periods identified **OR** $T = «\frac{1}{f} =» \frac{1}{6.3}$ **OR** 0.16 ✓ $«3T = \frac{3}{6.3} =»$ 0.48s ✓	Unit not required	**[2]**
2	b		**ALTERNATIVE 1** Identifies distance travelled as 14 cm✓ Rearrangement or use of $a = \frac{2s}{t^2}$ $« \frac{2 \times 0.14}{0.48^2} »$ ✓ 1.2 **AND** m s^{-2} ✓ **ALTERNATIVE 2** - award [2 max] Identifies distance travelled in one oscillation ✓ e.g. 1.6 cm for first oscillation, 4.6 cm for second oscillation, 7.8 cm for third oscillation «Use of $v = u + at$ **OR** $v^2 = u^2 + 2as$ » 1.2 **AND** m s^{-2} ✓	Marks may only be awarded from one alternative. Marks awarded for distance from the graph must be in the context of either ALT1 or ALT2 techniques Award [2 max] if full range of data is not used e.g. first 1 or 2 oscillations Accept 14.1 / 14.2 cm Allow ECF from a) Allow answer in range 1.2 – 1.3 m s^{-2} to allow for rounding differences from 2a Units must be consistent with value, e.g. $1.2 \times 10^3 \text{ mm s}^{-2}$ etc Allow $\pm$ 0.1 cm on these values Allow answer in range 1.2 – 1.3 m s^{-2} to allow for rounding differences from 2a Units must be consistent with value, e.g. 1.2 x 10^3 mm s^{-2} etc	**[3]**

Question			Answers	Notes	Total
2	c	i	Component of g = « g sin 8.0 = » 1.4 « ms^{-2} » **AND** Correct comparison of value in b) ✓ e.g. 1.4 > 1.2 There is a 9 / 15% difference The difference is 0.1 / 0.2	Comparison must match numerical answer to 2b. Allow ECF from 2b.	**[1]**
2	c	ii	**ALTERNATIVE 1** «Experimental value (b) is *less* than accepted value (ci) because of» friction **OR** air resistance ✓ **ALTERNATIVE 2** «Experimental value (b) is *greater* than accepted value (ci) because» cart was released with velocity directed down the ramp ✓ **ALTERNATIVE 3** «Experimental value (b) is equal to accepted value (ci) because» little / no friction is present ✓	Deduction must be consistent with candidate value for 2b and 2ci, so these values must be checked. ALTERNATIVE 2 is an ECF answer from an incorrect ci ALTERNATIVE 3 is an ECF answer from an incorrect ci	**[1]**

Question			Answers	Notes	Total
3	a	i	Curve within all error bars ✓	Must be one curve. Do not allow multiple lines or straight line dot to dot but be lenient about 'smoothness'.	[1]
3	a	ii	**ALTERNATIVE 1** Curve extrapolated to *V*-axis and intercept read correctly within half a square ✓ **ALTERNATIVE 2** Numerical value calculated 48 cm^3 ✓	 Unit not required Expect a value of around 48 cm^3 but allow ECF from ai Unit not required Allow range of ± 2 cm^3	[1]

Question			Answers	Notes	Total
3	b	i	Proposes workable method used to test suggestion. ✓ e.g. check if the half-life / decay constant is constant **OR** Constant ratio test for equal time changes using values from graph line **OR** Value of gradient proportional to V **OR** fits data from points on curve to $\ln V = c - kt$ in some way	Do not allow suggestion of use of plotted points Allow a method which suggest e.g. calculating a half-life and using it to predict another volume	**[1]**
3	b	ii	Calculations must be from an appropriate method method correctly uses two data points on graph ✓ method correctly uses three or more data points with suitable correct comment ✓ (leading to statement that foam experiment is a suitable model)	e.g. one half life or decay constant is calculated correctly e.g a second half-life or decay constant is calculated correctly and recognition that they are the same **OR** half-life / decay constant used to predict a volume at another time Measurements must be checked and within one square vertically / horizontally to the line. Half-life is about 280 s but calculations must be checked	**[2]**

Question			Answers	Notes	Total
3	c		**ALTERNATIVE 1** Recognises that this is three half-lives ✓ «Time = 3 x 280 =» 840 s ✓	Marks may only be awarded from one alternative Unit not required Allow answer in range 780 – 900 s Allow ECF from bii if half-life calculated Do not award ECF from MP1 if a different number of half-lives is concluded.	**[2]**
			ALTERNATIVE 2 Calculates decay constant from half-lfe $\lambda = \frac{\ln 2}{280}$ **OR** $2.5\times10^{-3}\,\text{s}^{-1}$ ✓ «$V = V_0 e^{-\lambda t}$ *leading to* $t =$ »840 s ✓	Unit not required Allow answer in range 780 – 900 s Allow ECF from bii if half-life calculated	
			ALTERNATIVE 3 Attempts alternative correct non-half-life method based on a minimum of three data points as in (b)(i) ✓ Answer in range 780 – 900 s ✓	Allow ECF from aii	
			ALTERNATIVE 4 Calculation of final volume of foam «$V' = 46\times\frac{1}{8} =$» 5.8 cm^3 ✓ Attempt to extend graph axis and estimate time Answer in range 780 – 900 s ✓	MP2 can only be awarded if some effort is made to extrapolate the graph to the right.	