GradeMax

Pearson

Mark Scheme (Results)

January 2026

Pearson Edexcel International Advanced Subsidiary level In Physics
WPH13/01

GradeMax

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General Marking Guidance

- All candidates must receive the same treatment. Examiners must mark the first candidate in exactly the same way as they mark the last.
- Mark schemes should be applied positively. Candidates must be rewarded for what they have shown they can do rather than penalised for omissions.
- Examiners should mark according to the mark scheme not according to their perception of where the grade boundaries may lie.
- There is no ceiling on achievement. All marks on the mark scheme should be used appropriately.
- All the marks on the mark scheme are designed to be awarded. Examiners should always award full marks if deserved, i.e. if the answer matches the mark scheme. Examiners should also be prepared to award zero marks if the candidate's response is not worthy of credit according to the mark scheme.
- Where some judgement is required, mark schemes will provide the principles by which marks will be awarded and exemplification may be limited.
- When examiners are in doubt regarding the application of the mark scheme to a candidate's response, the team leader must be consulted.
- Crossed out work should be marked UNLESS the candidate has replaced it with an alternative response.

Mark scheme notes

Underlying principle

The mark scheme will clearly indicate the concept that is being rewarded, backed up by examples. **It is not a set of model answers.**

1. Mark scheme format

1.1 You will not see 'wtte' (words to that effect). Alternative correct wording should be credited in every answer unless the MS has specified specific words that must be present. Such words will be indicated by underlining e.g. 'resonance'

1.2 Bold lower case will be used for emphasis e.g. '**and**' when two pieces of information are needed for 1 mark.

1.3 Round brackets ( ) indicate words that are not essential e.g. "(hence) distance is increased".

1.4 Square brackets [ ] indicate advice to examiners or examples e.g. [Do not accept gravity] [ecf].

2. Unit error penalties

2.1 A separate mark is not usually given for a unit but a missing or incorrect unit will normally mean that the final calculation mark will not be awarded.

2.2 This does not apply in 'show that' questions or in any other question where the units to be used have been given, for example in a spreadsheet.

2.3 The mark will not be awarded for the same missing or incorrect unit only once within one clip in epen.

2.4 Occasionally, it may be decided not to insist on a unit e.g the candidate may be calculating the gradient of a graph, resulting in a unit that is not one that should be known and is complex.

2.5 The mark scheme will indicate if no unit error is to be applied by placing brackets around the unit.

3. Significant figures

3.1 Use of too many significant figures in the theory questions will not prevent a mark being awarded if the answer given rounds to the answer in the MS.

3.2 Too few significant figures will mean that the final mark cannot be awarded in 'show that' questions where one more significant figure than the value in the question is needed for the candidate to demonstrate the validity of the given answer.

3.3 The use of one significant figure might be inappropriate in the context of the question e.g. reading a value off a graph. If this is the case, there will be a clear indication in the MS.

3.4 The use of g = 10 m s^{-2} or 10 N kg^{-1} instead of 9.81 m s^{-2} or 9.81 N kg^{-1} will be penalised by one mark (but not more than once per clip). Accept 9.8 m s^{-2} or 9.8 N kg^{-1}

3.5 In questions assessing practical skills, a specific number of significant figures will be required e.g. determining a constant from the gradient of a graph or in uncertainty calculations. The MS will clearly identify the number of significant figures required.

4. Calculations

4.1 **use of** the formula means that the candidate demonstrates substitution of physically correct values, although there may be conversion errors e.g. power of 10 error.

4.2 If a 'show that' question is worth 2 marks, then both marks will be available for a reverse working. If the question is worth 3 marks then only 2 marks will be available.

4.3 The mark scheme will show a correctly worked answer for illustration only.

5. Graphs

5.1 A mark given for axes requires both axes to be labelled with quantities and units, and drawn the correct way round.

5.2 Sometimes a separate mark will be given for units or for each axis if the units are complex. This will be indicated on the mark scheme.

5.3 A mark given for choosing a scale requires that the chosen scale allows all points to be plotted, spreads plotted points over more than half of each axis and is not an awkward scale e.g. multiples of 3, 7 etc.

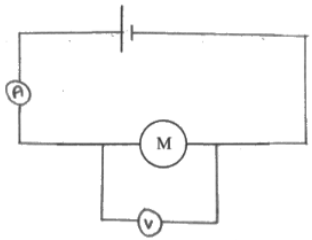
5.4 Points should be plotted to within 1 mm.

5.5 For a line mark there must be a thin continuous line which is the best-fit line for the candidate's results.

Question Number	Answer	Additional Guidance	Mark
1(a)(i)	• Height the sphere is released from **(1)** **Or** (initial) velocity of sphere • Distance from end of track/block to cup **Or** Alignment of cup with track **(1)**	Accept alternative wording – not height of block **[Accept initial position of cup]** [Accept angle of the track for MP2 only] Ignore mass/volume of sphere/cup, length of track If distance *d* stated do not award MP2	**2**
1(a)(ii)	• Check (and correct) for zero error **(1)** • To eliminate/reduce <u>systematic error</u> **(1)** MP2 dependent on MP1	[Accept "Calibrate for zero (error)" or method] [Accept phonetic spellings – not system or systemic]	**2**
1(b)	• There are not enough sets of data (to draw a graph) **(1)** • Inconsistent decimal places in values of *d* **(1)** • More readings are needed below 16.1 g **Or** The range of masses is too small **Or** Repeat values of *d* not recorded **(1)**	Ignore references to intervals, units and anomalies [Accept significant figures, allow "mean"] Do not accept inconsistent decimal places for mass – do not award MP2. [Do not accept "No evidence of repeats"]	**3**
1(c)	**EITHER** • Plot a graph of distance against 1/mass **(1)** • It should be a straight line (through the origin if the relationship is inversely proportional) **(1)** MP2 dependent on MP1 **OR** • Take several pairs of readings from the line of best fit **(1)** • Calculate distance × mass and check it is constant **(1)** MP2 dependent on MP1	[Accept g for mass, allow 1/distance v mass] [Should indicate at least two pairs/corresponding values. Accept g for mass] [Allow constant k if k defined – accept use of the formula. Allow similar/close. Not "common multiplier"	**2**
	Total for question 1		**9**

Question Number	Answer	Additional Guidance	Mark
2(a)(i)	• Uses at least four values to calculate mean **(1)** • Mean t = 0.48 s to 2 d.p. **(1)**	Example of calculation Mean $t = \frac{(0.45 + 0.51 + 0.41 + 0.55 + 0.49)\text{ s}}{5} = 0.482\text{ s} = 0.48\text{ s}$	**2**
2(a)(ii)	• Uses half range Accept furthest from the mean **(1)** • Percentage uncertainty = 15(%) e.c.f (a)(i) **(1)** [Allow maximum 3 s.f.]	Example of calculation Half range $= \frac{(0.55 - 0.41)\text{ s}}{2} = 0.07\text{ s}$ Percentage uncertainty $= \frac{0.07\text{ s}}{0.48\text{ s}} \times 100 = 14.6\%$	**2**
2(a)(iii)	• There will be a delay between hearing the sound and starting / stopping the stopwatch **(1)** • Which will vary for each student **(1)**	[Accept reference to reaction time.] [Ignore references to random, systematic or parallax error]	**2**
2(b)(i)	• Determines no. divisions between loud sound and echo min 7.8 to 9.4 **(1)** • Calculates no. divisions × time per division **(1)** • t = 0.43 s range 415 to 444 ms **(1)**	Example of calculation No. divisions = 8.8 – 0.2 = 8.6 $t = 8.6 \times 50 \times 10^{-3}\text{ s} = 0.43\text{ s}$	**3**
2(b)(ii)	• 10 (ms) **(1)**	[Accept 0.01 s (must have units)]	**1**
2(b)(iii)	• Uses (double) uncertainty of half resolution [Allow if 10ms used] **(1)** • %U = 2% given to 1 or 2 s.f. e.c.f. 2(b)(i) and 2(b)(ii) **(1)** [Accept answer for half resolution]	Example of calculation $\%U = \frac{10 \times 10^{-3}\text{ s}}{0.43\text{ s}} \times 100 = 2.32\%$	**2**
2(b)(iv)	• Use of $v = \frac{s}{t}$ **(1)** • s = 71 m e.c.f. 2(b)(i) allow up to nearest cm **(1)** [Answers in range 68.48m to 73.26m do not need to be checked]	Example of calculation $s = \frac{vt}{2} = \frac{330\text{ m s}^{-1} \times 0.43\text{ s}}{2} = 71.0\text{ m}$	**2**

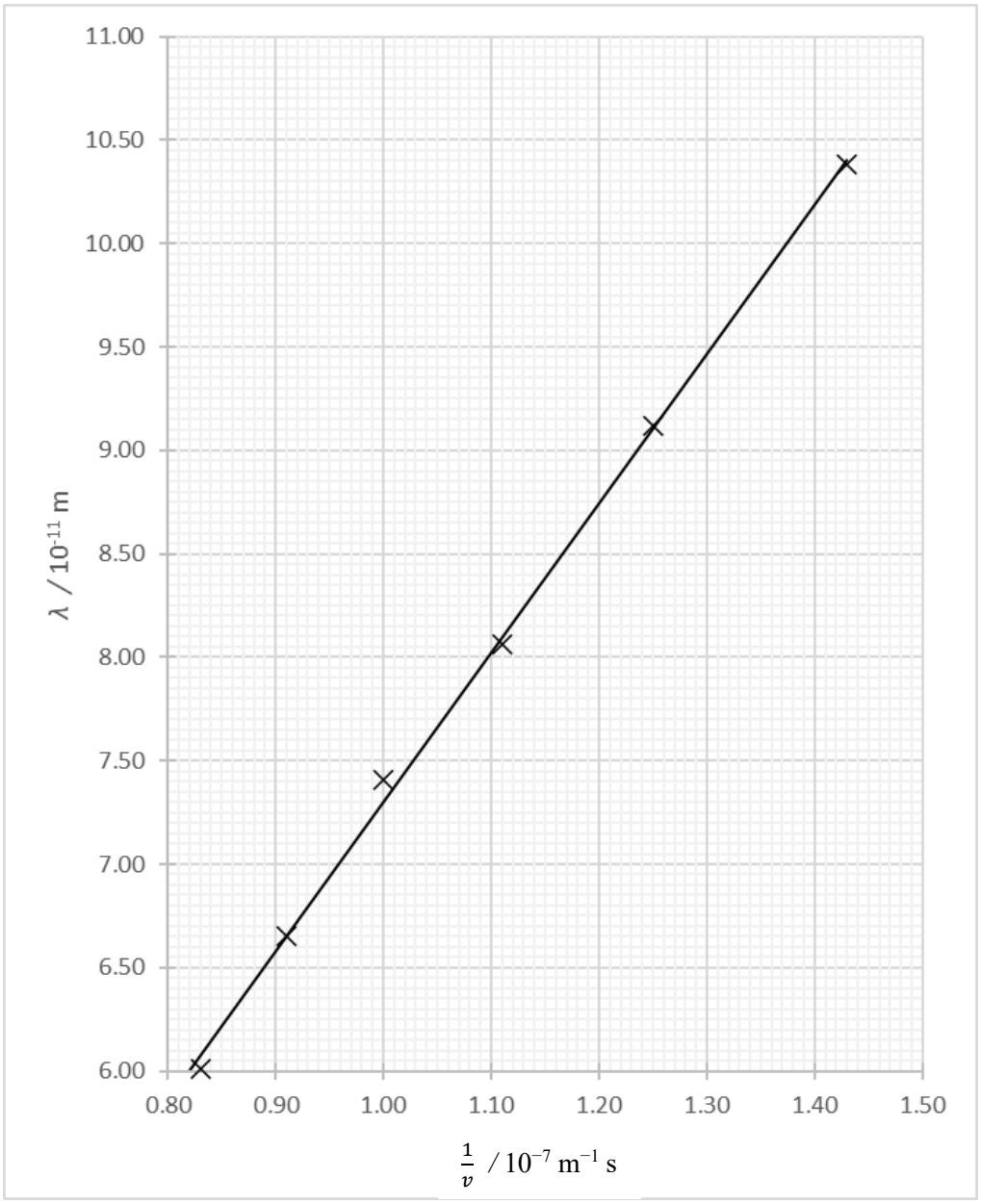
2(c)	• Any TWO from • Speed of light remains constant (in all weather conditions) **(1)** • Laser light will travel further **(1)** • Light is more directional **(1)** • Less interference from other sources with laser **(1)** • Pulse of laser light will be detected before next pulse is emitted **(1)**	Allow converse arguments Ignore light travels faster than sound Idea that sound disperses/attenuates, laser light is focused Idea that it may be difficult to tell which signal is the echo Idea that the sound wave pulses will overlap	**2**
	Total for question 2		**16**

Question Number	Answer	Additional Guidance	Mark
3(a)	• Motor connected in series with cell/battery **and** ammeter **(1)** • Voltmeter connected in parallel with motor only **(1)** [Allow if voltmeter across battery unless there are other resistive components in circuit]]	Ignore other components. Standard symbols only. <u>Example of circuit</u>  	**2**
3(b)(i)	**EITHER** • Stand may topple over **(1)** • Clamp/fix (the stand) to the bench **Or** Place a heavy mass on (the base of) the stand **(1)** **OR** • String may break (and damage eyes) **(1)** • Wear goggles **(1)** **OR** • Mass may fall (and damage feet) **(1)** • Ensure feet are not under the mass **(1)**	Do not accept holding the stand [Allow large for heavy, not just mass, accept mass of 10kg+] [Allow eye protection, safety glasses/spectacles, not just glasses] [Accept idea of standing away from the mass, safety shoes/boots, cushions/box under mass]	**2**
3(b)(ii)	• Use a set square to ensure the metre rule is vertical **(1)** **Or** Use a set square to ensure metre rule is perpendicular to the floor/ground • Clamp/place metre rule close/near to the mass **Or** Read the height from the bottom of the mass **(1)** **Or** Attach a marker to the mass/string • Use set square to read off the scale **Or** View the scale perpendicularly **(1)**	Accept spirit level or plumb line. Ignore "straight". Must have reference point. Accept parallel to mass/string. Do not accept bench unless defined as vertical or surface unless defined as horizontal. Accept close to string/object not height/bench. Do not allow "next to".	**3**

		[Accept "at eye-level"] Do not accept "vertically", "horizontally" or "parallel"	
3(c)	• Power of motor = VI **and** power of lifting mass = $\frac{mgl}{t}$ **Or** Power of motor = VI **and** power of lifting mass = Fv with $F=mg$ **and** $v=l/t$ **Or** Energy transferred to motor = VIt **and** energy transferred to lifting mass = mgl **(1)** • Therefore efficiency = $\frac{mgl}{VIt}$ **(1)** • So $l = \left(\frac{efficiency \times VI}{mg}\right) t$ **(1)** • (Compares to $y = mx$ where) the gradient = $\frac{\text{efficiency} \times IV}{mg}$ so student's statement is correct **(1)** MP4 dependent on MP3 Can work backwards but gets messy!	For power of motor allow power input, total power For power of lifting mass allow and power output, useful power For energy to motor allow energy input, total energy For energy for lifting allow and energy output, useful energy, gravitational potential energy, work done Allow MP1 if defined in efficiency formula given in MP2 Do not accept formulae just as written in the formula sheet. MP3: for formula rearranged into $y=mx$ MP4: for stating the gradient and conclusion. May see this spread over several lines. Needs clear link to gradient. **<u>Alternative MP3 and MP4</u>** • So $efficiency = \frac{l}{t} \times \frac{mg}{VI}$ subbing into or rearranging formula • The gradient of the graph is $\frac{l}{t}$ so the student's statement is correct Gradient of graph = speed	**4**
3(d)	**EITHER** • Data logger will measure distance and time simultaneously **(1)** • Error caused by delay in stopping stopwatch at a specific height will be reduced/eliminated **(1)** **OR** • Data logger has a high sampling rate **(1)** • The accuracy of the graph will be improved **(1)**	Ignore references to parallax error and resolution Accept reference to reducing/eliminating reaction time Accept more readings will be taken in a given time or idea of continuous readings Do not accept automatically plotting graph	**2**
	Total for question 3		**13**

Question Number	Answer		Additional Guidance	Mark
4(a)	• Axes labelled: y as λ / 10^{-11} m, x as $\frac{1}{v}$ / 10^{-7} m^{-1} s	**(1)**	Do not accept reversed axes or titles as quantity (unit). Axes must cover at least half grid, value of small square in 1, 2 or 5 only [portrait y in 0.5, x in 0.1] Plots within 1 mm [on scales of y: 0.5 or 1, x: 0.1 or 0.2] [Max one mark for plotting on scales y: 2, x: 0.5 or larger] Straight, plots on both sides of line, no rotation Accept graph in landscape	**5**
	• Sensible scales chosen for both axes	**(1)**		
	• All points plotted accurately [on sensible scales] [5 correct = 1, 4 correct = 0]	**(2)**		
	• Reasonable best fit line drawn for plotted points	**(1)**		
4(b)	• Uses large triangle to calculate gradient	**(1)**	[Triangle must cover <u>minimum 3 whole squares in x.</u> Data points from table must lie on line] [Check calculation if value of 7.0 or 7.6] <u>Example of calculation</u> gradient = $\frac{(10.20 - 6.50) \times 10^{-11}}{(1.40 - 0.89) \times 10^{-7}} = \frac{3.70}{0.51} \times 10^{-4} = 7.25 \times 10^{-4}$	**3**
	• Gradient in range 7.00×10^{-4} to 7.58×10^{-4}	**(1)**		
	• Calculated gradient given to 2 or 3 s.f., no unit [Accept unit m^2 s^{-1} only – watch for s or s^{-1}]	**(1)**		
	Note: joining first to last gives 7.28×10^{-4} – triangle just acceptable on x scale of 0.2 but NOT 0.25			
4(c)	• Uses gradient = $\frac{h}{m}$	**(1)**	[Value must come from gradient not one pair of points substituted into formula unless line passes through 0,0] [Bald answer scores 0] <u>Example of calculation</u> h = gradient × m = 7.25×10^{-4} m^2 s^{-1} × 9.11×10^{-31} kg = 6.60×10^{-34} kg m^2 s^{-1}	**2**
	• Value of h consistent with gradient given to 2 or 3 s.f. e.c.f. from (b)	**(1)**		
	Only check if they get exact value of h			
	Gradient range gives 6.38×10^{-34} to 6.91×10^{-34}			
4(d)	**EITHER** • Upper limit of $6.54 \times 10^{-34} = 6.74 \times 10^{-34}$ (kg m^2 s^{-1})	**(1)**	<u>Example of calculation</u>	

	• As 6.74×10^{-34} is greater than 6.63×10^{-34} (J s) then the quoted value of h is consistent **(1)** **OR** • %Difference between 6.54×10^{-34} and 6.63×10^{-34} = 1.4% • As 1.4% is less than 3% then the quoted value of h is consistent **(1)** **(1)**	Upper limit = 6.54×10^{-34} kg m^2 s^{-1} × (1 + 0.03) = 6.74×10^{-34} kg m^2 s^{-1} **Limit of 6.63×10^{-34} used = 0** Example of calculation $\%D = \frac{(6.63 - 6.54) \times 10^{-34}\ \text{J s}}{6.63 \times 10^{-34}\ \text{J s}} \times 100 = 1.4\%$ "Own" value used = 0 for either method	**2**
	Total for question 4		**12**


11.00
10.50
10.00
9.50
9.00
8.50
8.00
7.50
7.00
6.50
6.00
λ / 10-11 m
0.80
0.90
1.00
1.10
1.20
1.30
1.40
1.50
1/v / 10−7 m−1 s