



Mark Scheme (Results)

October 2022

Pearson Edexcel International Advanced
Subsidiary Level in Physics (WPH13)
Paper 01: Unit 3 Practical Skills in Physics I

Question Number	Answer	Mark
1(a)(i)	<p>Mark 1(a)(i) and (ii) holistically to ensure approach used in 1(a)(i) matches the approach used in 1(a)(ii)</p> <ul style="list-style-type: none"> Measures length of top and bottom edges, and calculates mean (Accept inclusion of additional measurements taken horizontally) (1) Length of card = 0.065 m (1) <p>Example of calculation Length of top edge = 6.6 cm Length of bottom edge = 6.4 cm Mean length = (6.6 cm + 6.4 cm)/2 = 6.5 cm</p>	2
1(a)(ii)	<p>EITHER</p> <ul style="list-style-type: none"> Use of half the range of values if multiple length values measured Or use of max distance from the mean if multiple length values measured (1) % uncertainty = 1.5% (accept 2%) (1) <p>OR</p> <ul style="list-style-type: none"> Use of half ruler resolution if a single length value is measured/shown in 1(a)(i) (1) % uncertainty = 0.77% (accept 0.8%) (1) <p>Accept uncertainty = full the resolution for MP1, giving and answer of 1.5% for MP2 for this approach.</p> <p>Allow e.c.f. from 1(a)(i) for both approaches.</p> <p>Example of calculation Half range = 0.1 cm % uncertainty = (0.1 cm / 6.5 cm) × 100% = 1.5%</p>	2
1(b)(i)	<ul style="list-style-type: none"> Use of $v = s/t$ (1) $v = 0.512 \text{ (m s}^{-1}\text{)}$ to 3 s.f. (1) Use of $p = mv$ (1) $p = 0.140 \text{ (kg m s}^{-1}\text{)}$ to 3 s.f. (1) <p>(accept p recorded to same s.f. as v, if v recorded to 1 or 2 s.f.)</p> <p>Example of calculation $v = s/t = 0.105 \text{ m} / 0.205 \text{ s} = 0.512 \text{ m s}^{-1}$ $p = mv = 0.274 \text{ kg} \times 0.512 \text{ m s}^{-1} = 0.140 \text{ kg m s}^{-1}$</p>	4
1(b)(ii)	<ul style="list-style-type: none"> Calculates percentage difference between the total momentum before and after (1) The (percentage) difference is small so momentum is conserved Or a conclusion consistent with a comparison of student's values (1) <p>Example of calculation Percentage difference = $((0.143 \text{ kg m s}^{-1} - 0.140 \text{ kg m s}^{-1}) / 0.143 \text{ kg m s}^{-1}) \times 100\%$ Percentage difference = 2.1%</p>	2

Question Number	Answer	Mark
1(c)	<ul style="list-style-type: none"> Different force could be applied each time Or the force could be applied for a different time (1) The time/velocity/momentum/acceleration for the moving glider is likely to be the different for each repeat (1) Increasing uncertainty (in momentum) (1) MP3 is dependent on either of MP1 or MP2	3
1(d)	<ul style="list-style-type: none"> Light gates and data logger eliminate (human) reaction time (1) Or using the stopwatch would include a (human) reaction time Which would reduce the effect of <u>random</u> error (in the time for the glider to travel) (1) Or reducing the uncertainty (in time for the glider to travel) 	2
Total for question 1		15

Question Number	Answer	Mark
2(a)	<ul style="list-style-type: none"> (m increases so) number of charge carriers increases (1) Since $I = nAvq$, as n increases I increases (1) The resistance decreases (and resistivity decreases) (1) MP3 is dependent on either MP1 or MP2	3
2(b)(i)	<ul style="list-style-type: none"> States that points lie on a straight line (1) States that the straight line passes through origin (1) So $1/\rho$ is proportional to m (1) MP3 dependent on MP1 and MP2 If no other marks are awarded, allow only 1 mark for a straight line drawn through the origin and a statement that $1/\rho$ is proportional to m .	3
2(b)(ii)	<ul style="list-style-type: none"> There are only four data points (1) The range of masses is too small Or no data for masses less than 5 g Or no data for masses greater than 8 g (1) 	2
Total for question 2		8

Question Number	Answer	Mark
3(a)(i)	<p>Mark 3(a)(i) and (ii) holistically</p> <p>EITHER</p> <ul style="list-style-type: none"> • Measure the height from the paper to the top of the liquid (v) (1) • Measure the height from the paper to the filament/middle of the bulb ($u + v$) (1) • Subtract v to give u (1) <p>OR (1)</p> <ul style="list-style-type: none"> • Measure the height from the filament/middle of the bulb to the top of the liquid (u) (1) • Measure the height from the paper to the filament/middle of the bulb ($u + v$) (1) • Subtract u to give v (1) <p>OR (1)</p> <ul style="list-style-type: none"> • Measure the height from the paper to the top of the liquid (v) • Move the ruler so that zero aligns with the lens • Measure the distance from the lens to the filament/middle of the bulb (u) (1) 	3
3(a)(ii)	<ul style="list-style-type: none"> • Identifies relevant source of uncertainty (1) • Suggest suitable approach to reduce/eliminate the uncertainty (1) <p><u>Examples</u></p> <ul style="list-style-type: none"> • Parallax error when measuring the height of the bulb/lens with the ruler • Use a set square from rule to bulb/lens • Metre rule not vertical • Use a set square to ensure metre rule is perpendicular to the base/paper • Zero error when measuring the height from the lens to the bulb • Check zero on the rule is aligned with top of the liquid • Filament sealed within glass, so cannot measure distance directly • Measure to the middle of the bulb 	2

Question Number	Answer	Mark
3(b)(i)	<ul style="list-style-type: none"> Use of $P = \frac{1}{u} + \frac{1}{v}$ (1) $P = 4.30$ (D) to 3 s.f. (1) <p>Example of calculation</p> $P = \frac{1}{u} + \frac{1}{v}$ $P = \frac{1}{0.615 \text{ m}} + \frac{1}{0.374 \text{ m}} = 4.2998 \text{ D}$ $P = 4.30 \text{ D}$	2
3(b)(ii)	<ul style="list-style-type: none"> Use of $P = \frac{n_{\text{lens}} - n_{\text{air}}}{n_{\text{air}}} \left(\frac{1}{r} \right)$ (1) with $n_{\text{air}} = 1$ (1) $n_{\text{lens}} = 1.3$ (1) <p>Allow e.c.f from 3(b)(i)</p> <p>Example of calculation</p> <p>mean $P = (4.28 \text{ D} + 4.31 \text{ D} + 4.30 \text{ D})/3 = 4.297 \text{ D}$</p> $n_{\text{lens}} = Pr + 1$ $n_{\text{lens}} = (4.297 \text{ D} \times 0.070 \text{ m}) + 1$ $n_{\text{lens}} = 1.3$	3
Total for question 3		10

Question Number	Answer	Mark
4(a)	<div><div><ul style="list-style-type: none">No repeat measurementsInconsistent d.p. for d<p>Or all values of d should be recorded to the same d.p.</p><p>Or measurements of d are not all recorded to the same resolution (of the device)</p></div><div>(1) <</div></div>	

Question Number	Answer	Mark
4(c)(i)	<p>EITHER</p> <ul style="list-style-type: none"> Re-arranges equation and compares to $y = mx (+ c)$ (1) Shows that $m = \frac{l^3}{4wh^3E}$ (1) <p>OR</p> <ul style="list-style-type: none"> Re-arranges equation to $\frac{d}{F} = \frac{l^3}{4wh^3E}$ (1) States that $\frac{d}{F} =$ gradient of the graph plotted (1) 	2
4(c)(ii)	<ul style="list-style-type: none"> Calculates gradient using large triangle (1) Gradient in the range 1.30×10^{-4} to 1.40×10^{-4} (m N⁻¹) (1) <p><u>Example of calculation:</u> Gradient = $(0.0035 - 0.0010) / (26 - 7.5) = 1.35 \times 10^{-4}$</p>	2
4(c)(iii)	<ul style="list-style-type: none"> Use of gradient = $\frac{l^3}{4wh^3E}$ (1) Or use of substituted values of F and d into $E = \frac{l^3 F}{4wh^3 d}$ (1) E value in the range 2.41 GPa to 2.60 GPa <p>Ecf for gradient value in (c)(ii) – but not power of 10 errors in substitution of l, w, or h</p> <p><u>Example of calculation:</u> $E = \frac{l^3}{4wh^3m}$ $E = \frac{(0.30 \text{ m})^3}{4 \times 0.020 \text{ m} \times (0.010 \text{ m})^3 \times 1.35 \times 10^{-4} \text{ m N}^{-1}} = 2.5 \times 10^9 \text{ Pa}$</p>	2
4(d)	<ul style="list-style-type: none"> A thinner beam would cause a larger d (for the same force) (1) Reducing <u>percentage</u> uncertainty (in d) (1) <p>MP2 dependent on MP1</p>	2
4(e)	<ul style="list-style-type: none"> Identifies physics relating to health & safety (1) Suggests a relevant safety issue (1) <p><u>Examples</u></p> <ul style="list-style-type: none"> Glass is brittle, so will snap/break Sharp edges could cause injury by causing cuts Glass is stiffer, so a larger force/mass would be needed A large mass could cause injury if the mass falls on feet 	2
Total for question 4		17