

Mark Scheme (Results)

October 2021

Pearson Edexcel International Advanced Subsidiary Level in Physics (WPH13) Paper 1 Practical Skills in Physics I

Question	Answer		Mark
Number			
1(a)	Heating (to 100 °C) – suitable method described	(4)	
	(e.g. water bath, kettle)	(1)	
	Cooling (to 10 °C) – suitable method described		
	(e.g. ice bath, freezer)	(1)	2
1(b)	• Use of uncertainty = half resolution (0.005 V)	(1)	
	Percentage uncertainty = 0.07 (%)	(1)	2
	Accept use of resolution (0.01 V), giving percentage uncertainty of		
	0.15% for MP2 only		
	Example calculation		
	Percentage uncertainty = (0.005/6.85) × 100%		
	Percentage uncertainty = 0.073%		
1(c)(i)	Line of best fit drawn up to <i>V</i> axis	(1)	
1(0)(1)	Value between 8.2 and 8.6 (V)	(1)	2
	Value between 6.2 and 6.0 (V)	(1)	_
	MP1 – accept a straight line of best fit covering at least the first 5 plots		
	MP2 – if a line of best fit is drawn, the value given must match the y-axis		
	intercept ± 1 mm and be within the range stated		
1(c)(ii)	• Use of $12 \text{ V} = \sum \text{p.d.}$	(1)	
1(C)(11)	 Use of V = IR 	(1)	
	Correct value calculated with unit	(1)	3
	Correct value calculated with drift	(1)	3
	Note – ecf from 1(c)(i) applies		
	MP1 & 2 can be awarded for correct use of the potential divider ratios		
	rule		
	(e.g., $V_{\text{fixed res}}$ / 12 V = 4700 Ω / (4700 Ω + R_{therm})		
	Example calculation		
	$V_{\text{therm}} = 8.4 \text{ V}$		
	$V_{\text{fixed}} = 3.6 \text{ V}$		
	V = IR		
	$3.6 \text{ V} = I \times 4.7 \times 10^3 \Omega$		
	$I = 3.6 \text{ V} / 4.7 \times 10^3 \Omega = 7.7 \times 10^{-4} \text{ A}$		
	V = IR		
	$8.4 \text{ V} = 7.7 \times 10^{-4} \text{ A} \times R$		
	$R = 8.4 \text{ V} / 7.7 \times 10^{-4} \text{ A} = 1.1 \times 10^{4} \Omega$		

1(d)	• Calculates $V \times \theta$ for at least two pairs of values from the graph/table		
	Or calculates proportional change for at least two pairs of values	(1)	
	Conclusion consistent with values calculated	(1)	2
	Do not award MP2 if temperatures are not converted to Kelvin		
	Example calculation		
	Pair 1 $V \times \theta$ = 3.5 V × (60 + 273 K) = 1170 V K		
	Pair 2 $V \times \theta = 5.7 \text{ V} \times (30 + 273 \text{ K}) = 1730 \text{ V} \text{ K}$		
	Total for question 1		11

Question Number	Answer		Mark
2(a)	 Path difference between microwaves reflected from metal plate and reflected from glass plate Or phase difference between microwaves reflected from metal plate and reflected from glass plate (Reflected) waves superpose/interfere (at the receiver) As d is varied, path/phase difference changes causing constructive and destructive interference 	(1) (1) (1)	3
2(b)(i)	 Determines the mean distance between maxima λ = 2 × distance between maxima λ = 2.8 cm rounded to 2 s.f. 	(1) (1) (1)	3
	Example calculation Mean distance between maxima = $(1.2 \text{ cm} + 1.6 \text{ cm} + 1.2 \text{ cm} + 1.5 \text{ cm})/4$ Mean distance between maxima = 1.38 cm $\lambda = 2 \times 1.38 \text{ cm}$ $\lambda = 2.8 \text{ cm}$		
2(b)(ii)	• Use of $c = f\lambda$ • $f = 1.1 \times 10^{10}$ Hz Note – allow ecf from 2(b)(i) Example calculation $c = f\lambda$ 3.0×10^8 m s ⁻¹ = $f \times 0.028$ m $f = 3.0 \times 10^8$ m s ⁻¹ / 0.028 m $f = 1.1 \times 10^{10}$ Hz	(1) (1)	2
	Total for question 2		8

Question	Answer			Mark
Number				
3(a)	Sample of nylon secured at one end (1)			
	• Slotted masses hung from the op	posite end	(1)	
	• Force/mass increased until sampl	e breaks	(1)	
	• $F = mg$ to calculate the force			
	Or use a force meter to measure	the weight of the mass	(1)	4
	MD4 0 2 and be a seed of constant			
2/6)	MP1 & 2 can be awarded from a diag		(1)	
3(b)	Comment identifying an appropriAssociated control measure	ate safety issue	(1)	_
	Associated control measure		(1)	2
	<u>Examples</u>			
	Masses falling on feet			
	 Ensure feet are not underneath 			
	Snapped nylon hitting eyes			
	Wear safety glasses			
3(c)(i)	• Mean diameter = 0.55 (mm)		(1)	
	 Use of half range 			
	Or value furthest from mean		(1)	
	• Percentage uncertainty = 3.6 (%)		(1)	3
	Every least Coloniation			
	Example of Calculation Moon = (0.55 mm + 0.57 mm + 0.54 mm + 0.55 mm)/5			
	Mean = (0.55 mm + 0.57 mm + 0.54 mm + 0.55 mm + 0.53 mm)/5 Mean = 0.55 mm			
	Range = 0.57 mm - 0.53 mm = 0.04 mm			
	Percentage uncertainty = (0.02 mm / 0.55 mm) × 100 % = 3.6 %			
3(c)(ii)	• Use of A = πr^2	0.55 11111, 100 % 5.0 %		
	Or use of A = $\pi d^2/4$		(1)	
	• Use of $\sigma = F / A$ for sample before	absorbing water	(1)	
	• Use of $\sigma = F / A$ for sample after a	_	(1)	
	• Calculation of a percentage change	ge	(1)	5
	• Comparative statement consisten	t with calculated values	(1)	
	Example of Calculation			
	Before	After		
	Бегоге	After		
	$A = \pi r^2$	$A = \pi r^2$		
	-	$A = \pi \times (2.3 \times 10^{-4} \text{ m})^2$		
		$A = 1.66 \times 10^{-7} \text{m}^2$		
		$\sigma = F/A$		
	σ = 65.8 N / 1.59×10 ⁻⁷ m ²	σ = 57.8 N / 1.66×10 ⁻⁷ m ²		
	$\sigma = 4.1 \times 10^8 \text{ Pa}$	$\sigma = 3.5 \times 10^8 \text{ Pa}$		
	Percentage change			
	% difference = $((4.1 \times 10^8 - 3.5 \times 10^8) / 4.1 \times 10^8) \times 100\% = 15\%$			
	Total for question 3			14

Question	Answer		Mark
Number			
-	Max 2 from Inconsistent d.p. in r No repeat readings (for r) All values (of h and r) should be to the nearest mm Or all values (of h and r) should be to 3 d.p. Labels axes with quantities and units Sensible scales Plotting Line of best fit	(1) (1) (1) (1) (1) (2) (1)	2
	0.18 0.16 0.14 0.12 0.1 0.20 0.25 0.30 0.35 0.40 0.45 h/m		
4(b)(i)	• $mgh = \frac{1}{2}mv^2$ • Algebra steps shown leading to $u = \sqrt{2gh}$ Do not accept use of $v^2 = u^2 + 2as$	(1) (1)	2
4(b)(ii)	• See $v=\sqrt{2gr}$ • Shows that $e=\frac{\sqrt{r}}{\sqrt{h}}$ • Gradient = $\frac{\Delta r}{\Delta h}$ therefore gradient = e^2 Accept substitution of $u=\sqrt{2gh}$ and $v=\sqrt{2gr}$ into $e=v/u$ and rearrangement into $y=mx$ format for MP2 and 3	(1) (1) (1)	3
4(c)	 Calculates gradient using large triangle (allow use of e² = r/h) Gradient / e² value between 0.51 and 0.56 Or e value between 0.71 and 0.75 Correct choice of metal for value of e calculated Example of Calculation e² = (0.22 - 0.12)/(0.41 - 0.22) 	(1) (1) (1)	3

	$e^2 = 0.53$	
	e = 0.73 so stainless steel	
4(d)	 Acceleration along the ramp would be smaller, so r would be lower (for a given h) Or friction would reduce velocity, so r would be lower (for a given h) Or friction would dissipate energy, so r would be lower (for a given h) (1) h) (The gradient and) the value obtained for e would be smaller [dependent on MP1] 	2
	Total for question 4	17