Pearson Edexcel

Mark Scheme (Results)

October 2020

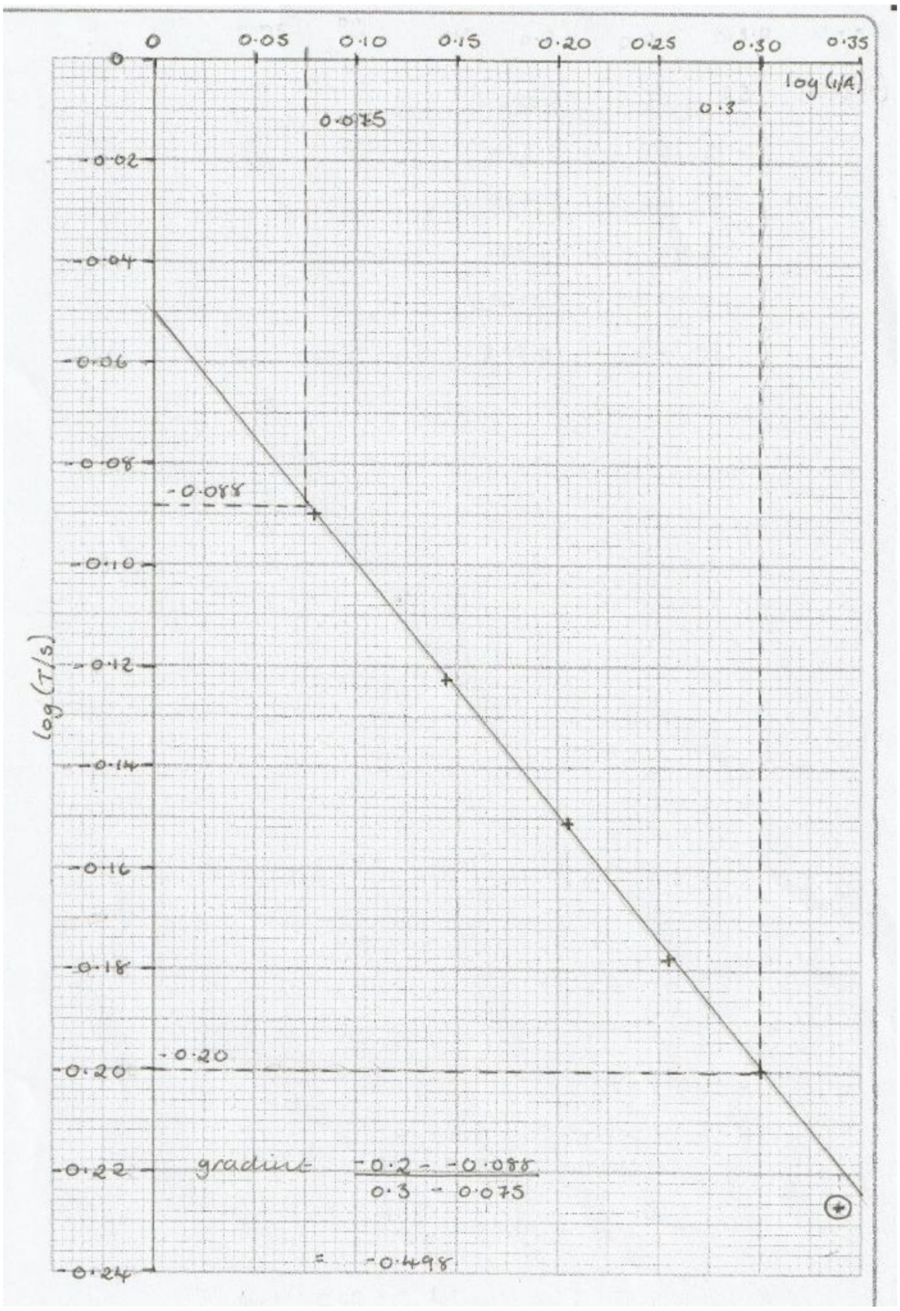
Pearson Edexcel International Advanced Subsidiary/Advanced Level
In Physics (WPH016)
Paper 1: Practical Skills in Physics II

Question number	Answer		Mark
1(a)	Gently push the glider and check that the times to go through each light gate are similar **Or** Put a glider on the track and check it remains stationary **Or** Use a rule and/or set square to check the height of the track is the same in two places **Or** Use a spirit level to check the bubble is central [accept any valid safe alternative practical method]	(1) (1) (1) (1)	**1**
1(b)	Use of $t_2 = 2t_1$ Three correct calculations shown Conclusion consistent with calculation <u>Example of calculation</u> 0.70/0.34 = 2.06 0.39/0.21 = 1.86 0.55/0.28 = 1.96 As all values are approximately equal to 2 then momentum was conserved.	(1) (1) (1)	**3**
1(c)	(If the card is twice as long) the time should double The resolution of the timer is constant **Or** the uncertainty is constant So the percentage uncertainty for the time will halve, improving the investigation	(1) (1) (1)	**3**
			Total mark for Question 1 = 7

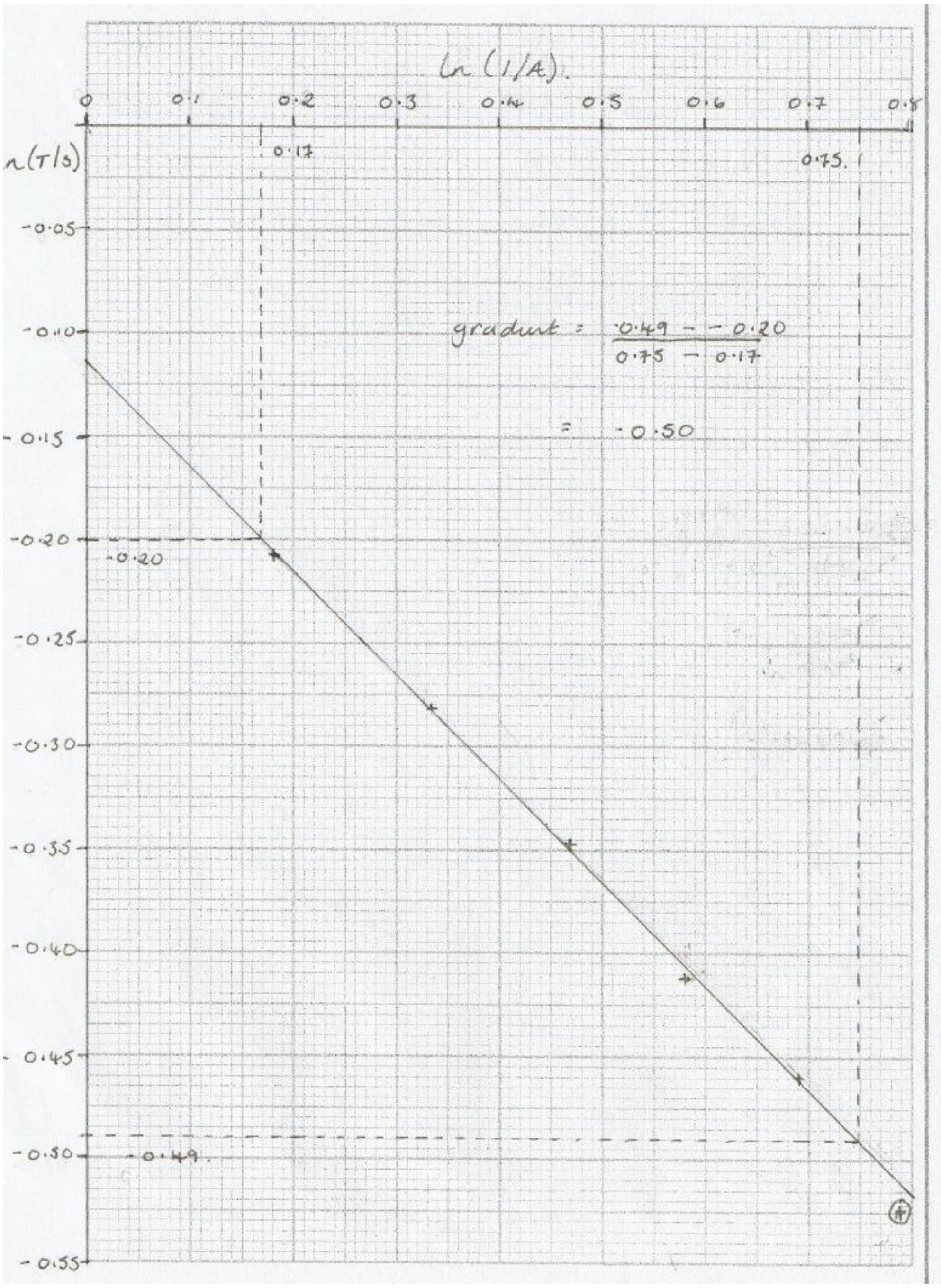
Question number	Answer		Mark
2	Any **SIX** from:		
	Measure the background count (rate)	(1)	
	Ensure the source and detector are in line	(1)	
	Use a metre rule to measure *d*	(1)	
	Measure the count (rate) several times **and** calculate a mean **Or** measure the count (rate) over a long time	(1)	
	Subtract the background count (rate)	(1)	
	Repeat for values of values of *d* up to 50 mm **Or** repeat until the count rate reaches the background count (rate)	(1)	
	Plot a graph of (corrected) count (rate) vs *d*	(1)	
	Sensible comment on safety based on distance, shielding or time	(1)	**6**
Total mark for Question 2 = 6			

Question number	Answer		Mark
3(a)	Any **THREE** from Measure multiple oscillations and divide by the number of oscillations Repeat **and** calculate a mean Use a timing marker (at the centre of the oscillations) Start timing after several oscillations have completed	 (1) (1) (1) (1)	3
3(b)(i)	Variable resistor	(1)	1
3(b)(ii)	log $T = n$ log I is in the form of $y = mx$ (+ c) (hence if the relationship is valid) it will be a straight line (through the origin) with a gradient of n	(1) (1)	2
3(c)(i)	log$I$ values correct with minimum 2 decimal places log$T$ values correct and minimum 2 decimal places Axes labelled: y as log(T / s) and x as log (I / A) Most appropriate scales for both axes Plots accurate to ± 1mm Best fit line with even spread of plots	(1) (1) (1) (1) (1) (1)	6
3(c)(ii)	Correct calculation of gradient using large triangle shown Value of n in range 0.49 to 0.53 Value of n given to 2 or 3 s.f., negative, no unit <u>Example of calculation</u> $n = \frac{-0.2 - -0.088}{0.3 - 0.075} = \frac{-0.112}{0.225} = -0.498$	(1) (1) (1)	3
3(c)(iii)	log $T = n$log$I$ + log$k$ is in the form of $y = mx + c$ The graph shows a (non-zero) y intercept Hence the value of k is not equal to 1 (so the prediction is correct) **Or** the value of c is not zero (so the prediction is correct)	(1) (1) (1) (1)	4
	Total mark for Question 3 = 19		

I/A	*T*/s	log(*I*/A)	log(*T*/s)
1.20	0.813	0.079	-0.090
1.40	0.754	0.146	-0.123
1.60	0.706	0.204	-0.151
1.80	0.663	0.255	-0.178
2.00	0.631	0.301	-0.200
2.20	0.593	0.342	-0.227



I/A	*T*/s	ln(*I*/A)	ln(*T*/s)
1.20	0.813	0.182	-0.207
1.40	0.754	0.336	-0.282
1.60	0.706	0.470	-0.348
1.80	0.663	0.588	-0.411
2.00	0.631	0.693	-0.460
2.20	0.593	0.788	-0.523



Question number	Answer		Mark
4(a)(i)	Digital / vernier calipers	(1)	**1**
4(a)(ii)	Any **PAIR** from: Check for zero error to eliminate systematic error **OR** Repeat at different places **and** calculate a mean to reduce the effect of random errors [MP2 dependent on MP1]	 (1) (1) (1) (1)	**2**
4(a)(iii)	area of slot = 1.03 (cm^2) Calculation of U shown U = 0.02 (cm^2) [d.p. consistent with area] Example of calculation Area of slot = $a \times b$ = 0.47 cm × 2.19 cm = 1.03 cm^2 %U in Area = (0.01/0.47) × 100 + (0.005/2.19) × 100 = 2.13% + 0.23% = 2.4% U = 1.03 cm^2 × 2.4% = 0.02 cm^2 Area of slot = 1.03 cm^2 ± 0.02 cm^2	(1) (1) (1)	**3**
4(b)(i)	Use of area = $\pi d^2/4$ Area = 10.4 (cm^2) [ecf 4(a)(iii) 3 s.f. only] Example of calculation Whole area = $\pi d^2/4 = \pi \times (3.81\text{ cm})^2/4$ = 11.4 cm^2 Shaded area = whole area – area of slot = 11.4 cm^2 – 1.03 cm^2 = 10.4 cm^2	(1) (1)	**2**
4(b)(ii)	Calculation of %U in d using 0.005 shown Double %U in d shown U= 0.05 (cm^2) [ecf 4(a)(iii)] Example of calculation %U in d^2 = 2 × 0.005/3.81 × 100 = 0.26% U in whole area = 11.4 cm^2 × 0.26% = 0.03 cm^2 U in shaded area = 0.03 cm^2 + 0.02 cm^2 = 0.05 cm^2	(1) (1) (1)	**3**

4(c)(i)	Use of $\rho = \frac{m}{V}$ (1) ρ = 8.47 (g cm^{-3}) [ecf 4(b)(i), 3 s.f. only] (1) <u>Example of calculation</u> V = 10.4 cm^2 × 1.137 cm = 11.8 cm^3 ρ = 100 g / 11.8 cm^3 = 8.47 g cm^{-3}	(1) (1)	**2**
4(c)(ii)	Calculation of half range in t shown Addition of %U in t and %U in shaded area shown % U in ρ = 0.66% [ecf 4(b)(ii)] <u>Example of calculation</u> Half range in t = (11.39 − 11.35)/2 = 0.02 mm %U in t = (0.02/11.37) × 100 = 0.18% % U in shaded area = (0.05/10.4) × 100 = 0.48% % U in ρ = 0.18% + 0.48% = 0.66%	(1) (1) (1)	**3**
4(d)	Correct calculation of upper and/or lower limit shown [ecf 4(c)] With comparison of limit with value for brass and valid conclusion based on comparison **OR** Correct calculation of %D shown [ecf 4(c)] Comparison of %D with %U and valid conclusion based on comparison <u>Example of calculation</u> Uncertainty in $\rho = 8.47$ g cm^{-3} × 0.66% = ± 0.06 g cm^{-3} Range of ρ ισ 8.41 g cm^{-3} to 8.53 g cm^{-3} The value for brass lies within this range therefore the mass could be made of brass **OR** Uncertainty in $\rho = 8.47$ g cm^{-3} × 0.66% = ± 0.06 g cm^{-3} %D = $\frac{8.5-8.47}{8.5}$ × 100% = 0.35% As the %D is less than the %U the mass could be made of brass	(1) (1) (1) (1)	**2**
			Total mark for Question 4 = 18