



Rewarding Learning

ADVANCED SUBSIDIARY (AS)
General Certificate of Education
2017

Physics
Assessment Unit AS 3B
assessing

**Practical Techniques
and Data Analysis**

[SPH32]
THURSDAY 15 JUNE, MORNING

**MARK
SCHEME**

						AVAILABLE MARKS	
1	Regular x-scale (major division 0.1)			[1]		8	
	Regular y-scale (major division 400 or 500)			[1]			
	Axes labelled with quantity			[1]			
	Axes units included with solidus and consistent with scale and values			[1]			
	Plotting points			[3]			
	[–1] each mistake to [0]						
	Trend line			[1]			
[Penalty –1 if axes are reversed]							
2	(a)	Gradient = $(y_2 - y_1)/(x_2 - x_1)$ – correct points	subs	[1]		8	
		Gradient calculated from their values		[1]			
		Gradient = 49 (48–50 quality)		[1]			
		Unit = Pa °C ^{–1} (or correct alternative)		[1]	[4]		
		[Penalty –1 if $\Delta x < 10^\circ\text{C}$]					
	(b)	(i) EFL drawn			[1]		
		(ii)	Gradient difference		[1]		
			divided by BFL gradient		[1]		
			%U consistent with gradients		[1]		[3]
3	(a)	a = 12		[1]		5	
		$-a^{0.5}b = c$	[1]				
		b = 4 (must follow from correct physics. Not from a = 3.46) (ecf from a)		[1]	[3]		
	(b)	Unit of a = eV		[1]			
		Unit of b = none		[1]	[2]		
4	(a)	(i)	Period = 1.21 (s)		[2]		10
			(1.2, 1.206, 1.2061)		[1]	[2]	
		(ii)	Mean = 29.55		[2]		
			(28.58)		[1]	[2]	
			[Penalty –1 sig fig]				
		(iii)	95.0		[1]		
			Rule accurate to 1 mm (other values)		[1]	[2]	
	(b)	(i)	Increase time duration measured				
			1 period too short		[1]		
		Reduces <u>percentage</u> uncertainty		[1]	[2]		
(ii)	Repeatability implies reliability/notice anomalies		[1]				
	Averaging (improves accuracy)		[1]	[2]			

					AVAILABLE MARKS	
5	(a) (i)	$\%U = \frac{0.1}{14.5} \times 100$	subs	[1]	9	
		$\%U = 0.7 \%$		[1] [2]		
	(ii)	$U_{(470)} = 47 \Omega$ or $U_{(320)} = 16 \Omega$		[1]		
		$U_{(790)} = 63 \Omega$ (ecf from $U_{(470)} + U_{(320)}$)		[1]		
		$\%U = 8\%$		[1] [3]		
		[15% – 0/3]				
	(b)	$\%U(V^2) = 2(0.7) = 1.4\%$		[1]		
		$\%UP = 1.4\% \text{ (ecf*)} + 8\% \text{ (ecf*)} = 9.4\%$		[1]		
		$P = 0.266 \text{ (W)}$		[1]		
		$UP = 0.025 \text{ (W)}$ ecf P		[1] [4]		
		ecf (from 15% in (a)(ii) leads to 0.044W) gets 4/4				
	max/min method					
	Max:	Correct calculation of V^2 max = 213.2	[1]			
		Correct calculation of R min = 727	[1]			
		$P_{\text{max}} = 0.293$ (ecf their V^2 and R)				
		$P = 0.266$	[1]			
$\Delta P = 0.027$ (ecf their $P_{\text{max}} - P$)		[1]				
Min:	V^2 min = 207.4	[1]				
	$R_{\text{max}} = 853$	[1]				
	$P_{\text{min}} = 0.243$					
	$P = 0.266$	[1]				
	$\Delta P = 0.023$	[1]				
6	(a)	Length of interrupt card		[1]	10	
	(b)	Air track reduces friction		[1]		
		Pulley (reduces friction)		[1]		
		$\therefore$ Resultant force = weight (mg), m = suspended mass		[1] [3]		
	(c)	Problem: accelerated mass increases/mass of system is not constant		[1]		
		(Stick) slotted masses to trolley		[1]		
		Transfer slotted masses to suspended mass		[1] [3]		
	(d)	Light gates separation <0.76m		[1]		
		Trolley passes through gates before masses hit the ground		[1]		
		Mass on ground means zero resultant force/force not constant for duration of one run		[1] [3]		
Total					50	