Measurement Techniques

Mark Scheme 3

Level	International A Level
Subject	Physics
Exam Board	CIE
Topic	Measurement Techniques
Sub Topic	
Paper Type	Theory
Booklet	Mark Scheme 3

Time Allowed: **52 minutes**

Score: **/43**

Percentage: **/100**

A*	A	B	C	D	E	U
>85%	'77.5%	70%	62.5%	57.5%	45%	<45%

1 **(a) (i)** amplitude scale reading 2.2 (cm)
amplitude = 2.2×2.5 = 5.5 mV [2]

(ii) time period scale reading = 3.8 (cm)
time period = $3.8 \times 0.5 \times 10^{-3} = 0.0019$ (s)

frequency f = 1 / 0.0019 = 530 (526) Hz A1 [3]

(iii) uncertainty in reading = ± 0.2 in 3.8 (cm) or 5.3% or 0.2 in 7.6 (cm)
or 2.6% [allow other variations of the distance on the x-axis]

actual uncertainty = 5.3% of 526 = 27.7 or 28 Hz
or 2.6% of 526 = 13 or 14 A1 [2]

(b) frequency = 530 ± 30 Hz or 530 ± 10 Hz [1]

2 **(a** $d = v \times t$ C1
$t = 0.2 \times 4$ (allow $t = 0.2 \times 2$) C1
$d = 3 \times 10^8 \times 0.8 \times 10^{-6}$ OR $3 \times 10^8 \times 0.4 \times 10^{-6}$ C1
d = 240 m hence distance from source to reflector = 120 m A1 [4]

(b) speed of sound 300 cf speed of light 3×10^8 OR time = 240 / 300 (= 0.8)
OR time = 120 / 300 (= 0.4) C1
sound slower by factor of 10^6 OR time for one division 0.8 / 4
OR time for one division 0.4 / 2 C1
time base setting 0.2 s cm^{-1} [unit required] A1 [3]

3 **(a)** *either* $P \propto V^2$ *or* $P = V^2/R$ ……
reduction = $(230^2 - 220^2)/230^2$
= 8.5 % …….. A1 [2]

(b) **(i)** zero …… A1 [1]

(ii) 0.3(0) A …….. A1 [1]

(c) **(i)** correct plots to within ± 1 mm …… B1 [1]

(ii) reasonable line/curve through points giving current as 0.12 A
allow ± 0.005A) …… B1 [1]

(iii) $V = IR$ ……
$V = 0.12 \times 5.0$
= 0.6(0) V …….. A1 [2]

(d) circuit acts as a potential divider/current divides/current in AC not the same as current in BC …… B1
resistance between A and C not equal to resistance between C and B ……. B1
or current in wire AC × R is not equal to current in wire BC × R B1 [2]
any 2 statements

4	**(a)**		uses a tangent (anywhere), not a single point	C1	
			draws tangent at correct position	B1	
			acceleration = 1.7 ± 0.1	A2	[4]
			(*outside 1.6 → 1.8 but within 1.5 → 1.9, allow 1 mark*)		
	(b)	**(i)**	because slope (of tangent of graph) is decreasing	M1	
			acceleration is decreasing	A1	[2]
		(ii)	e.g. air resistance increases (with speed)		
			(angle of) slope of ramp decreases	B1	[1]
	(c)	**(i)**	scatter of points about line	B1	[1]
		(ii)	intercept / line does not go through origin	B1	[1]

5	**(a**		work done in moving unit positive charge	M1	
			from infinity (to the point)	A1	[2]
	(b)	**(i)**	inside the sphere, the potential would be constant	B1	[1]
		(ii)	for point charge, Vx is constant	B1	
			co-ordinates clear and determines two values of Vx at least 4 cm apart	M1	
			conclusion made clear	A1	[3]
	(c)	q	$= 4\pi\varepsilon_0 Vx$		
		q	$= 4\pi \times 8.85 \times 10^{-12} \times 180 \times 1.0 \times 10^{-2}$	M1	
			$= 2.0 \times 10^{-10}$ C	A1	[2]