ASSESSMENT and QUALIFICATIONS ALLIANCE

Mark scheme June 2003

GCE

Physics A

Unit PHAP

Units 5 - 9 : PHAP

1 **AO3a : *planning*:**

measurements:
(to measure the amplitude of signal produced in search coil)
use voltmeter or ammeter (any type) ✓
capable of measuring ac signal, e.g. cro (not digital) ✓
(to monitor decay of signal)
use stopwatch to measure the time elapsed between measurements
of amplitude of signal produced in search coil as signal decays ✓
[use data logger ✓, use of appropriate (named) sensor ✓,
method for retrieval of data explained, e.g. output to pc or cro ✓]

strategy:
records regularly (monitors continuously) amplitude of signal
produced in search coil ✓
[for data logger method, sketch graph of amplitude vs time allowed]
performs sensible quantitative test on this data
e.g. draw graph of signal amplitude vs time to determine rate of
decay of signal [find time for fractional change in amplitude] ✓
repeat procedure with tuning forks of different natural frequencies) ✓
draw graph to quantitatively compare tuning forks
(multiple amplitude/time plots not accepted) ✓

control:
(while taking measurements) do not move magnet
[ensure position or orientation of tuning fork (relative to search
coil) does not change] ✓

difficulties:
(*difficulty* + *how overcome* = 2)

any **two** of the following:

reduce uncertainty in measuring amplitude of signal produced
by search coil (✓)
by waiting for transient oscillations to die away and/or
increasing amplitude of signal (reduce impact of background noise
and/or use strong magnet or search coil with many turns
and/or increasing Y-gain of cro {change range of meter (✓)]

confirm frequency of tuning fork (✓)
(calibrate) using suitable method (e.g. using cro and microphone
or by forced oscillation method e.g. resonance tube) (✓)

✓✓✓✓ max *(8)*

(*8*)

2 AO3b : *implementing*

(a)	*accuracy*	T in range 14.5 to 23.0 (s)	✓
(b)	*tabulation*	T/s R/Ω	✓✓
	readings	6 further sets of T and R (mark deducted for each missing) (mark deducted if no T (including T_0) is calculated from nT where n or $\Sigma n \geq 2$, for each incorrect R value	✓✓
	significant figures	all T (including T_0) to 0.1(0) s consistent recording of R values (accept 2.2, 6.9, 10(.0), 12.2, 14.7 and 16.9 kΩ)	✓ ✓
(c)	*quality*	at least 6 points to ± 2 mm of straight line of positive gradient (providing suitably-scaled graph drawn)✓	

(*8*)

3 AO3c : *applying evidence and drawing conclusions*
processing

(c)	*axes*	marked T/s, R/(k)Ω (½ deducted for each missing, rounded down)	✓✓
	scale	suitable (e.g. 8 × 8) [5 × 5, 2 × 8, 8 × 2 ✓]	✓✓
	points	7 points plotted correctly including $R = 0$ with straight best-fit line drawn	✓

deductions

(d)(i)	G from suitable Δ (e.g. 8 × 8)	✓
(d)(ii)	$\frac{T_0}{G}$ in range 11.5 to 12.5, or 12 kΩ [11.0 to 13.0 kΩ ✓]	✓✓

(*8*)

4 AO3d : *evaluating evidence and procedures*

(e)(i) this is when T is least [R is zero, R is smallest] ✓
uncertainty is greatest when reading (voltage) is changing (most) rapidly ✓

(e)(ii) labelled sketch (before and after sketches accepted) with labelled axes:
original line : straight of positive gradient with intercept
new line : straight line of reduced gradient [curve of decreasing positive gradient] (✓)
and lower intercept (✓)

explanation

capacity discharges more quickly [current increased]	(✓)
because circuit resistance is reduced	(✓)
when (lower resistance) meter is connected in parallel with circuit	(✓)
	✓✓✓✓ (*6*)
	(*22*)