ASSESSMENT and QUALIFICATIONS ALLIANCE

Mark scheme June 2003

GCE

Physics A

Unit PHAP

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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 <u>stopwatch</u> 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 <u>quantitative</u> 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*<u>(8)</u>*

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(*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

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

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