UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

GCE Advanced Subsidiary Level and GCE Advanced Level

MARK SCHEME for the October/November 2007 question paper

9702 PHYSICS

9702/05 Paper 5 (Planning, Analysis and Evaluation), maximum raw mark 30

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Question 1

Planning (15 marks)

Defining the problem (3 marks)

P1 *p* is the independent variable or vary *p.* [1]

P2 *A* is the dependent variable or determine *A* for different *p.* [1]

P3 Keep the incident amplitude constant (allow volume of sound or power/intensity output). [1]

Methods of data collection (5 marks)

M1 Labelled diagram of a workable arrangement including source of sound – glass window – detector of sound. [1]
Allowed sources: loudspeaker, bell, buzzer, siren but not musical instruments.
Allowed detectors: microphone, sound meter, sound detector.

M2 Method of measuring pressure. Use bourdon gauge/manometer or pressure gauge [1]
Do not allow barometer or pressure meter.

M3 Method of reducing pressure. Use (vacuum) pump to withdraw air from glass window. [1]

M4 Method of measuring amplitude. Measure amplitude from oscilloscope. [1]

M5 Perform experiment in quiet room. [1]

Method of analysis (2 marks)

A1 Appropriate quantities plotted i.e. A^2 against p; or lg A against lg p or A against $\sqrt{p}$. [1]

A2 Relationship to be correct i.e. graph is a straight line through the origin. [1]
Gradient should equal 0.5 if lg A against lg p plotted.
An explicit statement is required.

Safety considerations (1 mark)

S1 Relevant safety precaution related to either the use of glass or intensity of sound, [1]
e.g. wear ear defenders, switch on sound source for short period of time.
Protection (goggles/safety screen) in case glass breaks.
Awareness of low pressures in glass.
Do not allow gloves because glass is sharp.

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Additional detail (4 marks).

D1/2/3/4 Relevant points might include: [4]
Method of ensuring that output from speaker is constant.
Method of reducing sound reflections from e.g. foam/speaker & microphone close to glass.
Window perpendicular to sound source.
Detail explaining use of oscilloscope to measure amplitude.
Difficulty in measuring amplitude at small pressures/use a loud incident source.
Control (or monitoring) of one additional variable e.g. temperature, frequency, distances.
Allow time for the temperature/pressure between the glass to stabilise.
Discussion of attenuation in air/frame/glass.

[Total: 15]

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Question 2

Analysis, conclusions and evaluation (15 marks)

Approach to data analysis (1 mark)

(a) lg I = n lg V + lg k
Relationship confirmed by straight line. [1]

Table of results (2 marks)

(b) Correct column of lg (V/V). [1]
Correct column of lg (I/A) [1]

lg (V/V)	lg (I/A)
0.301 or 0.30	0.079 or 0.08
0.602 or 0.60	0.230 or 0.23
0.778 or 0.78	0.322 or 0.32
0.903 or 0.90	0.380 or 0.38
1.000 or 1.00	0.431 or 0.43
1.079 or 1.08	0.477 or 0.48

2 or 3 dp needed (except allow 4 dp for last two rows in lg V).
Allow small rounding errors in the 3 dp. Must be exact for 2 dp.

Graph (3 marks)

(c) (i) Points plotted correctly. All six required for this mark. Circle error(s). [1]

(ii) Line of best-fit. Must be within tolerances. [1]
Worst acceptable straight line. Line should be clearly labelled. [1]

Conclusion (4 marks)

(iii) Gradient of best-fit line (range 0.500 to 0.525 or check substitution). [1]
If points incorrect, then check size of Δ and substitution within half a small square.

(iv) y-intercept. Must be negative. Check substitution from point on best-fit line. [1]

(d) Method of determining k (= $10^{\text{candidate's } y\text{-intercept}}$). [1]
Value of n = candidate's gradient value and in the range 0.500 to 0.525. [1]
Answers to k and n should be to 2 or 3 sf.

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Treatment of errors (5 marks)

(b) Errors in lg I allow 2 or 3 dp. [1]
Values should descend from 0.04 to 0.01.

(c) (i) Error bars in lg I plotted correctly [1]

(iii) Error in gradient [1]
Method of determining absolute error

(iv) Error in y-intercept [1]
Method of determining absolute error

(d) Method for error in k and error in n (same as error in gradient) [1]

[Total: 15]

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