Specimen Paper

GCE A LEVEL

MARK SCHEME

MAXIMUM MARK: 30

SYLLABUS/COMPONENT: 9702/05

PHYSICS
Paper 5 (Planning, Analysis and Evaluation)

Question 1

Planning (15 marks)

Defining the problem (3 marks)

p is the independent variable OR vary *p* **1**

f is the dependent variable OR measure *f* and *p* **1**

Variable to be controlled **1**
e.g. temperature, frequency of sound source

Methods of data collection (5 marks)

Workable arrangement **2**
Should include container, source of sound, pump, microphone, CRO
Doubtful arrangement, poor diagram or one missing detail scores one mark

Method of varying *p* **1**
e.g. use of pump to remove air or valve to allow air in

Method of measuring *p* **1**
e.g. Bourdon gauge/pressure gauge/manometer

Method of measuring *f* **1**
Should include reference to CRO timebase and *f* = 1/period

Method of analysis (2 marks)

Plot *f* against p^2 **1**

Equation is correct if graph is a straight line through the origin **1**

Safety considerations (1 mark)

Safety precaution, e.g. screen/goggles/fuses **1**

Additional detail (4 marks)

Additional details **4**
Relevant points might include:
Second variable to be controlled
Method of controlling variables
Specified sound source (e.g. electric bell/buzzer/speaker)
Use of signal generator with speaker
Difficulty of detecting quiet sounds at low pressures
Using CRO *y*-sensitivity to adjust for sound levels
Need to seal points where wires pass through bell jar
Monitor temperature with thermometer

Question 2

Analysis, conclusions and evaluation (15 marks)
Approach to data analysis (1 mark)

(a) $R^2 = c^2E^3$, so expect a straight line through the origin **1**

Table of results (2 marks)

Table Column headings **1**
R^2 / cm^2 and E^3 / MeV^3
Allow R^2 (cm^2) and E^3 (MeV^3)

Table Values of R^2 and E^3 **1**

16.0	156
18.9	183
23.0	221
25.5	248
32.5	310

All correct for one mark.
3 significant figures required (allow 4 s.f.)

Graph (3 marks)

Graph Points plotted correctly **1**
All five required for the mark

Graph Line of best fit **1**
Must be within tolerances.

Graph Worst acceptable straight line **1**
Must be within tolerances.

Conclusion (4 marks)

(c)(iii) Gradient of best-fit line **1**
The hypotenuse of the Δ must be greater than half the length of the drawn line.
Read-offs must be accurate to half a small square.
Check for $\Delta y/\Delta x$ (i.e. do not allow $\Delta x/\Delta y$).

(d) Gradient = c^2 (= 0.107) **1**
Does not have to be explicitly stated: may be implicit from working

(d) Value of c **1**
= 0.327 (allow 0.320–0.350)

(d) Unit of c **1**
cm MeV$^{-3/2}$

Treatment of errors (5 marks)

Table — Errors in R^2 — **1**

0.4
0.4 allow 0.5
0.5 allow 0.4
0.5
0.6

Graph — Error bars plotted correctly — **1**

(c)(iii) — Error in gradient — **1**

Must be calculated using gradient of worst acceptable straight line

(d) — Method of finding error in *c* — **1**

i.e. limit of error range in *c* from square root of limit of error range in gradient
Allow 0.5 x percentage error in gradient

(d) — Value for error in *c* — **1**

0.009 (allow ± 0.007–± 0.011)