**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)