

**Specimen Paper**

**GCE A LEVEL**

**MARK SCHEME**

**MAXIMUM MARK: 30**

**SYLLABUS/COMPONENT: 9702/05**

**PHYSICS**

**Paper 5 (Planning, Analysis and Evaluation)**

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## 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  $f = 1/\text{period}$

#### *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

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## Question 2

### Analysis, conclusions and evaluation (15 marks)

#### Approach to data analysis (1 mark)

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

#### Table of results (2 marks)

- Table Column headings 1  
 $R^2 / \text{cm}^2$  and  $E^3 / \text{MeV}^3$   
 Allow  $R^2 (\text{cm}^2)$  and  $E^3 (\text{MeV}^3)$

- 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  $\Delta$  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 =  $c^2$  1  
 Does not have to be explicitly stated: may be implicit from working  
 Check in part (a)

- (d) Value of  $c$  1  
 = 0.107 (allow  $\pm 0.007$ )

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

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**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
	0.007 (allow $\pm 0.001$ )	
	Allow 7%	