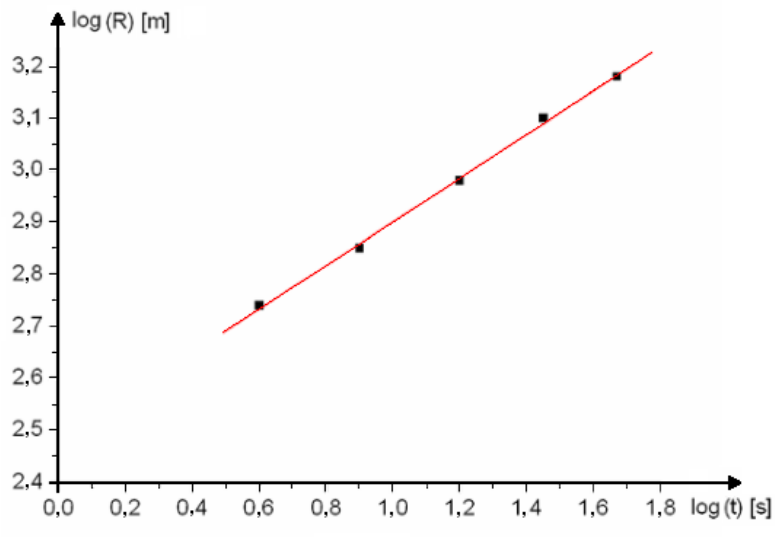
Theoretical Exam - October 27, 2017

# Marking scheme

**Any other solution that leads to correct results will be duly marked**

| No. item | *Theoretical Problem No. 2 – Part A Sir Geoffrey I. Taylor* | | Points |
|---|---|---|---|
| **a.** | For: | | **0.5p** |
| | $R \sim t^{\alpha} \cdot E^{\beta} \cdot \rho^{\gamma}$ | 0.1p | |
| | $L = T^{\alpha} \cdot \left(M \cdot L^2 \cdot T^{-2}\right)^{\beta} \cdot \left(M \cdot L^{-3}\right)^{\gamma}$ | 0.1p | |
| | $\begin{cases} \alpha - 2\beta = 0 \\ 2\beta - 3\gamma = 1 \\ \beta + \gamma = 0 \end{cases}$ | 0.1p | |
| | $\alpha = \frac{2}{5} \qquad \beta = \frac{1}{5} \qquad \gamma = -\frac{1}{5}$ | 0.1p | |
| | $R \sim t^{\frac{2}{5}} \cdot \left(\frac{E}{\rho}\right)^{\frac{1}{5}}$ | 0.1p | |
| **b.** | For: | | **1.5p** |
| | $C \cong 1 \qquad R = t^{\frac{2}{5}} \cdot \left(\frac{E}{\rho}\right)^{\frac{1}{5}}$ | 0.1p | |
| | $\log R = \frac{2}{5} \cdot \log t + \frac{1}{5} \cdot \log \frac{E}{\rho}$ | 0.3p | |
| | $y = A \cdot x + B$, where $\begin{cases} y = \log R \\ x = \log t \\ A = \frac{2}{5} \\ B = \frac{1}{5} \log \frac{E}{\rho} \end{cases}$ | 0.2p | |

| | | | |
|---|---|---|---|
| | *Table 1*<br>$t\,(s)$ \| $R\,(m)$ \| *log t* \| *log R*<br>4 \| 550 \| 0.60 \| 2.74<br>8 \| 700 \| 0.90 \| 2.85<br>16 \| 950 \| 1.20 \| 2.98<br>28 \| 1250 \| 1.45 \| 3.10<br>46 \| 1500 \| 1.67 \| 3.18<br>  <br>*Note: Graf plot of* $\log R = f(\log t)$ *is optional* | 0.5p | |
| | The line fitting for the datasets in Table 1 has the following values of the slope and interception.<br>$\begin{cases} A = 0.42 \\ B = 2.48 \end{cases}$ | 0.2p | |
| | estimation of the amount of energy released at the atomic bomb explosion for which the images in Figure 1<br>$E \approx 3 \cdot 10^{12}\ J$ | 0.2p | |
| *TOTAL SCORE: Theoretical Problem No. 2 – Part A* | | | **2.0p** |