Suggested answers for SJPO 2013 Special Round

Q1. 6 blocks

Q2. $R = \frac{l\omega\, cos\theta}{g}\left[l\omega\, sin\theta + \sqrt{l^2\omega^2 sin^2\theta + 2g(lcos\theta + H)}\right] - l\, sin\theta$

Q3. $\propto = 5;\ \beta = \frac{1}{2}$

Q4. (a) $5.0 \times 10^{-4} kg$
(b) $1.7\ \times\ 10^{-4} kg$

Q5. $v = \sqrt{{v_0}^2 + \frac{8}{3}\pi G\rho_0 {R_0}^3(\frac{1}{R} - \frac{1}{R_0})}$
Expands till $v = 0$

Q6. (a) $T = \frac{P_0V_0}{4R}$

(b) $\Delta Q = \frac{441}{800}P_0V_0$

Q7. (a) $2.29mm$
(b) $0.42m$

Q8. (a) 1.5Ω ; 1.5Ω
(b) $1.625\Omega, 1.5\Omega$

Q9. 55

Q10. (a) $\frac{\sqrt{2}}{2}R$
(b) $\frac{\sqrt{6}}{2}R$

Q11. (a) $3.91 \times 10^{26} J$
(b) $1380 Wm^{-2}$
(c) $279K$
(d) Greenhouse effect
(d) $226K$