2008 F=ma Exam: Problem 23

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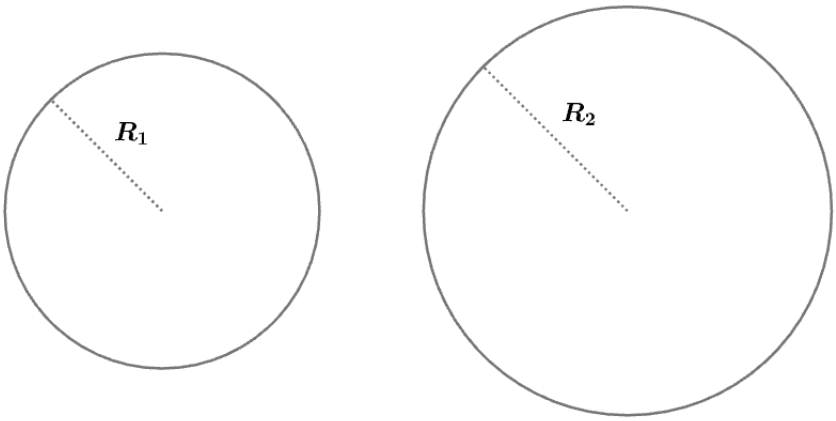

- (a) Recall the escape velocity is given by
$$v_{\text{esc}} = \sqrt{\frac{2GM}{R}} \propto \sqrt{\frac{R^3}{R}} = R$$
which would depend on radius.
- (b) Recall the acceleration due to gravity is given by
$$g = \frac{GM}{R^2} \propto \frac{R^3}{R} = R^2$$
which would depend on radius.
- (c) Recall from Kepler's 3rd law
$$T \propto \sqrt{\frac{r^3}{M}}$$
For $r = R$,
$$T \propto \sqrt{\frac{R^3}{R^3}} = 1$$
which is independent of radius.
- (d) Recall from Kepler's 3rd law
$$T \propto \sqrt{\frac{r^3}{M}} \propto \frac{1}{\sqrt{R^3}}$$
which would depend on radius.
- (e) Not applicable.

Thus, the answer is $\boxed{\text{C}}$.