Name: Instructor's

PHYSICS 2101 – 2
Instructor: Julian Frank
Quizz 9 - Spring 2000 - Wednesday April 26

Part I – Multiple Choice Questions (2 pts/question; total – 4 pts) Identify the correct answers by placing a check between the brackets [ ]

1) What is the acceleration of gravity at a distance of \( R \) above the surface of the Earth? (Here \( R \) is the Earth’s radius and you may ignore any effects of rotation).

[ ] \( 2g \).
[ ] \( g \).
[ ] \( g/2 \).
[ ] \( g/4 \).
[ ] \( g/6 \).

\[ a_g = \frac{GM}{r^2} \quad r = 2R \]

2) The escape velocity from the surface of the Earth is \( v_{esc} = \sqrt{2GM/R} = 11.2 \text{ km/s} \). What minimum velocity is required to escape Earth’s gravity from a distance of \( 4R \) from the Earth’s center?

[ ] \( 22.4 \text{ km/s} \).
[ ] \( 11.2 \text{ km/s} \).
[ ] \( 5.6 \text{ km/s} \).
[ ] \( 2.8 \text{ km/s} \).
[ ] \( 1.4 \text{ km/s} \).

\[ R \to 4R \quad \frac{v_{esc}}{2} \to v_{esc} \]

Part II – Problem (6 pts)

The diagram shows a hollow spherical shell of uniform mass density, having inner and outer radii \( a \) and \( b \) respectively. Suppose that the total mass of the shell is \( M \). Write down an expression for the gravitational acceleration outside \((r > b)\) and inside \((r < a)\). Sketch a graph showing qualitatively how the magnitude of the gravitational acceleration varies with \( r \), including the region of the shell itself \( a < r < b \).

\[ a_g = \frac{GM}{r^2}, \text{ SHELL THEOREM} \]

\( r > b \)

\[ a_g = \frac{GM}{r^2}, \text{ SHELL THEOREM} \]

\( r < a \)

\[ a_g = 0, \text{ SHELL THEOREM} \]

\[ \frac{GM}{b^2}, \text{ SHELL THEOREM} \]