

AP/Honors Quiz: Gravity and Circular Motion

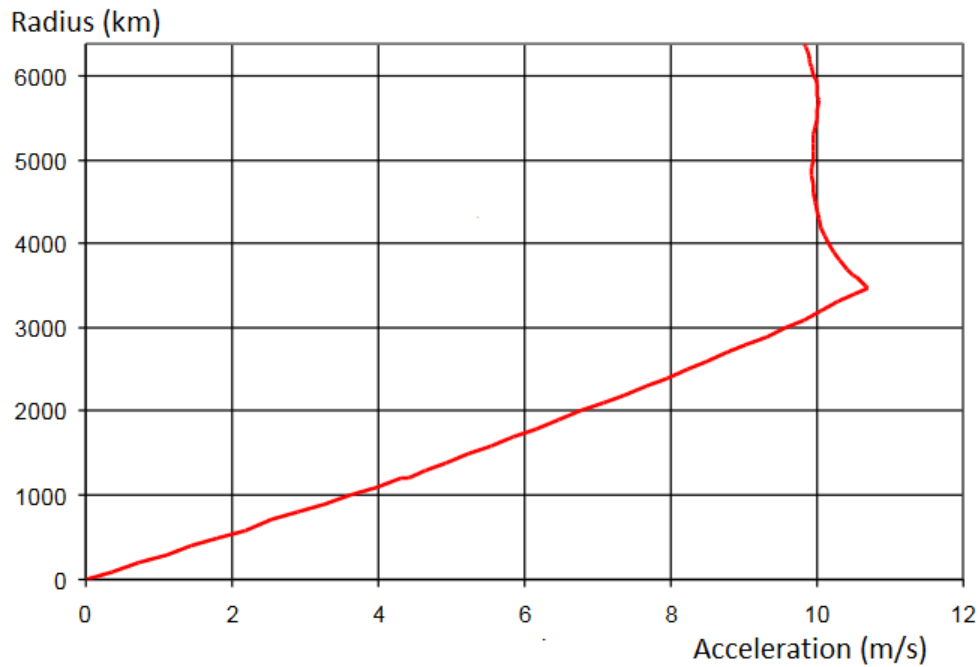
Full Name, Period, AP/Honors:

1 The pull of gravity

- (3 pt, **All**) The radius of Mars is about $R_m = 3000$ km and its density is about $4 \frac{\text{g}}{\text{cm}^3}$. The Earth's radius is $R_e = 6000$ km and its density is about $6 \frac{\text{g}}{\text{cm}^3}$. Which is the closest to the surface gravity of Mars?
 - $1 \frac{\text{m}}{\text{s}^2}$
 - $3.5 \frac{\text{m}}{\text{s}^2}$
 - $7 \frac{\text{m}}{\text{s}^2}$
 - $13.5 \frac{\text{m}}{\text{s}^2}$
- (4 pt **AP**) Two metal spheres with masses M_1 and M_2 and radii R_1 and R_2 are placed far away from each other. The density of both objects is doubled and the radii of both objects are doubled. What happens to the gravitational force between them?
 - 8 times larger
 - 64 times larger
 - 128 times larger
 - 256 times larger
- (4 pt, **Honors**) Two spherical objects have the same mass and the same radius. Which of these statements is **FALSE**?
 - The average densities are the same.
 - The escape speeds are the same.
 - The periods of rotation are the same.
 - The surface gravities are the same.
- ($\ln e^0 - e^{-\infty}$ pt, **All**) Which of the following are true?
 - The answer to the problem above is c if line C below is a lie.
 - The line above is a lie if the answer to the first problem is B.
 - The line above is a lie if the answer to the second problem is A.
 - All of these are lies if your name is not on your paper.

2 Plotting stuff

Here is a real graph relating gravitational acceleration and radius inside the earth.



1. (4 pt, **Honors**) Describe qualitatively how the gravity behaves as we move outward.
2. (2 pt, **AP**) Once you exceed 6500 km, how should gravity scale with distance from the planet's center?
3. (2 pt, **AP**) Approximately how does density scale with radius for radius between 0 and 3000 km? (You may assume that the graph is a straight line between those points.)

3 Escaping a Neutron Star

1. (3 pt, **All**) The escape speed of the sun is about $600 \frac{\text{km}}{\text{s}}$ and the radius of the sun is about $7 \times 10^5 \text{ km}$. A neutron star is a star made up almost entirely of neutrons. They have the mass of about twice the mass of the Sun condensed into a radius of 7 km. Find the escape speed of a neutron star.
2. (2 pt, **All**) How far do we need to be from the surface of the neutron star for it's escape speed to be the same as the sun?

4 An orbit

1. An object is orbiting the sun (mass $M_{\odot}$) at a radius R .
 - (a) (2 pt, **All**) What is the speed of the object?
 - (b) (2 pt, **All**) By what factor would velocity need to change for the orbit to become unbound?