

# Universal Gravitation Concept Review

1. In what way is gravity reduced with distance from the Earth?
2. What would be the difference in your weight if you were five times farther from the center of the Earth than you are now? Ten times?
3. Earth and moon are gravitationally attracted to each other. Does the more massive Earth attract the moon with greater force, the same force, or less force than the moon attracts Earth?
4. What is the magnitude and direction of the gravitational force that acts on a woman who weighs 500 N at the surface of the Earth?
5. If the gravitational force of the sun on the planets suddenly disappears, in what kind of paths would the planets move?
6. The moon “falls” 1.4 mm each second. Does this mean it gets 1.4 mm closer to Earth each second? Would it get closer if its tangential velocity were reduced? Explain.
7. If the moon were twice as massive, would the attractive force of Earth on the moon be twice as large? Of the moon on the Earth?
8. Suppose that an apple at the top of a tree is pulled by Earth’s gravity with a force of 1N. If the tree were twice as tall, would the force of gravity on the apple be only  $\frac{1}{4}$  as strong? Explain your answer.
9. If there is an attractive force between all objects, why do we not feel ourselves gravitating toward massive buildings in our vicinity?
10. Since the moon is gravitationally attracted to the Earth, why does it not simply crash into Earth?
11. The acceleration of objects on the surface of the moon is only  $\frac{1}{6}$  of  $9.8 \text{ m/s}^2$ . From this fact, is it correct to assume that the mass of the moon is therefore  $\frac{1}{6}$  the mass of the Earth?
12. If you stepped into a hole drilled completely through the Earth and made no attempt to grab the edges at either end, what kind of motion would you experience?
13. There are usually alternate explanations for things. Is the following explanation valid? Satellites remain in orbit instead of falling to Earth because they are beyond the main pull of Earth’s gravity?
14. Does the speed of a satellite around Earth depend on its mass? Its distance from Earth? The mass of Earth?
15. If you stopped an Earth satellite dead in its tracks, it would simply crash into Earth. Why then, don’t communication satellites that “hover motionless” above the same spot on Earth crash into the Earth? Hint: The satellites are said to be in geo-synchronous orbit.
16. If an astronaut in an orbiting space shuttle wished to drop something to Earth, how could this be accomplished?
17. The gravitational field strength at Earth’s surface is  $9.8 \text{ N/kg}$ . What is the field strength at the center of the Earth? At a distance one Earth radius beyond the surface?
18. If the Earth were the same size but twice as massive, how would the value of  $G$  change, if at all? How would the value of  $g$  change, if at all?
19. How would the gravitational field ( $\text{N/kg}$ ) at the Earth’s surface be affected if the Earth shrank in size without any change in mass? What would be its relative at the new surface if Earth shrank, to half size? To one tenth size?
20. The weight of an apple near the surface of the Earth is 1N. What is the weight of the Earth in the gravitational field of the apple?