Gravity Quiz 1

Name_____ Date_____

1. A newly discovered planet is found to have twice the radius and five times the mass of Earth. If the acceleration of gravity at the surface of Earth is g, the acceleration of gravity at the surface of the new planet is

(A) $\frac{2g}{5}$

(B) $\frac{4g}{5}$

(C) g

(D) $\frac{5g}{4}$

(E) $\frac{5g}{2}$

A ball is tossed straight up from the surface of a small, spherical asteroid with no atmosphere. The ball rises to a height equal to the asteroid's radius and then falls straight down toward the surface of the asteroid.

2. The acceleration of the ball at the top of its path is

(A) at its maximum value for the ball's flight

(B) equal to the acceleration at the surface of the asteroid

(C) equal to one-half the acceleration at the surface of the asteroid

(D) equal to one-fourth the acceleration at the surface of the asteroid

(E) zero

3. What forces, if any, act on the ball while it is on the way up?

(A) Only a decreasing gravitational force that acts downward

(B) Only an increasing gravitational force that acts downward

(C) Only a constant gravitational force that acts downward

(D) Both a constant gravitational force that acts downward and a decreasing force that acts upward

(E) No forces act on the ball.

4. The distance between the centers of Earth and the Moon is D. If the mass of the Earth is M_E and the mass of the Moon is M_M, which of the following is a correct expression for the magnitude of the acceleration of an object that is located halfway between the two bodies, a distance $\frac{1}{2}D$ from their centers?

(A) $4G\frac{(M_E-M_M)}{D^2}$

(B) $2G\frac{(M_E-M_M)}{D^2}$

(C) $G\frac{(M_E+M_M)}{D^2}$

(D) $2G\frac{(M_E+M_M)}{D^2}$

(E) $4G\frac{(M_E+M_M)}{D^2}$

5. The estimated mass and radius of Planet X are used to calculate the minimum escape speed, v_c, for an object launched from the surface of the planet. If the actual mass and/or radius of the planet are slightly different from the estimated values, how will the actual escape speed v_a for the surface of Planet X compare to v_c ?

(A) $v_a = v_c$ regardless of any difference in mass or radius.

(B) $v_a > v_c$ if the actual mass is greater and the actual radius is less than their estimated values.

(C) $v_a > v_c$ if the actual mass is less and the actual radius is greater than their estimated values.

(D) $v_a < v_c$ if the actual mass is greater and the actual radius is the same as their estimated values.

(E) $v_a < v_c$ if the actual mass is the same as and the actual radius is less than their estimated values.

6. A satellite needs a speed of v to maintain a circular orbit of altitude $h = \frac{1}{4}R_p$ above the surface of a planet of radius R_p . An identical satellite orbits the planet at an altitude of $2h$. The speed of the second satellite is

(A) $\frac{1}{2}v$

(B) $\frac{1}{\sqrt{2}}v$

(C) $\sqrt{\frac{5}{6}}v$

(D) $\sqrt{\frac{6}{5}}v$

(E) $\frac{6}{5}v$

7. A rocket is launched from the surface of Earth with a speed v_0 that will allow the rocket to escape the gravitational field of Earth. The same rocket is now launched from a different planet with the same mass as Earth and four times the radius of Earth. Which of the following is a correct expression for the escape speed from the surface of the new planet?

(A) $\frac{1}{4}v_0$

(B) $\frac{1}{2}v_0$

(C) $\frac{1}{\sqrt{2}}v_0$

(D) v_0

(E) $2v_0$

8. The escape speed for a rocket at Earth's surface is v_e. What would be the rocket's escape speed from the surface of a planet with twice Earth's mass and the same radius as Earth?

(A) $2v_e$
(B) $\sqrt{2}v_e$
(C) v_e
(D) $\frac{v_e}{\sqrt{2}}$
(E) $\frac{v_e}{2}$

9. Scientists observing a faraway star use Newton's law of universal gravitation and Kepler's laws of planetary motion to map out its motion. Scientists notice that periodically the star does not follow the predicted path. The star most likely does not follow the predicted path because

(A) the scientists do not have an accurate measurement of the mass of the star
(B) Newton's law of universal gravitation does not yield accurate predictions for faraway objects
(C) Kepler's laws of planetary motion do not apply to the motion of stars
(D) there is probably a large planetary object nearby whose gravitational pull is not being taken into account
(E) there is probably a large star nearby whose gravitational pull is not being taken into account

10. The acceleration due to gravity at Earth's surface is g. Astronauts are traveling to another planet that has three times the radius and four times the mass of Earth. The acceleration due to gravity at the surface of the other planet is

(A) $\frac{4}{9}g$
(B) g
(C) $\frac{4}{3}g$
(D) $\frac{16}{9}g$
(E) $\frac{9}{4}g$