Name: _____ **Class:** _____ **Date:** _____ **ID: A**

Cp physics web review chapter 7 gravitation and circular motion

Multiple Choice

Identify the choice that best completes the statement or answers the question.

____ 1. What is the term for the net force directed toward the center of an object's circular path?
a. circular force
b. centrifugal force
c. centripetal force
d. orbital force

____ 2. Which of the following can be a centripetal force?
a. friction
b. gravity
c. tension
d. all of the above

____ 3. The centripetal force on an object in circular motion is
a. perpendicular to the plane of the object's motion.
b. in the plane of the object's motion and perpendicular to the tangential speed.
c. in the plane of the object's motion and in the same direction as the tangential speed.
d. in the plane of the object's motion and in the direction opposite the tangential speed.

____ 4. When a car makes a sharp left turn, what causes the passengers to move toward the right side of the car?
a. centripetal acceleration
b. centripetal force
c. centrifugal force
d. inertia

____ 5. When calculating the gravitational force between two extended bodies, you should measure the distance
a. from the closest points on each body.
b. from the most distant points on each body.
c. from the center of each body.
d. from the center of one body to the closest point on the other body.

____ 6. Two small masses that are 10.0 cm apart attract each other with a force of 10.0 N. When they are 5.0 cm apart, these masses will attract each other with what force?
($G = 6.673 \times 10^{-11}\ \text{N}\bullet\text{m}^2/\text{kg}^2$)
a. 5.0 N
b. 2.5 N
c. 20.0 N
d. 40.0 N

____ 7. Which has greater linear speed, a horse near the outside rail of a merry-go-round or a horse near the inside rail?
a. The inside horse
b. The outside horse
c. Neither—they both have the same linear speed.

____ 8. A car travels in a circle with constant speed. The net force on the car
a. is zero because the car is not accelerating.
b. is directed forward, in the direction of travel.
c. is directed toward the center of the curve.
d. none of the above

____ 9. If Earth's mass decreased to one half its original mass, with no change in radius, then your weight would _____.
   a. stay the same
   b. decrease to one half your original weight
   c. decrease to one quarter your original weight
   d. none of the above

____ 10. The gravitational force between two massive spheres
   a. is always an attraction.
   b. depends on how massive they are.
   c. depends inversely on the square of the distances between them.
   d. all of the above

____ 11. A very massive object A and a less massive object B move toward each other under the influence of mutual gravitation. Which force, if either, is greater?
   a. The force on B
   b. The force on A
   c. Both forces are the same.

____ 12. A planet has half the mass of the Earth and half the radius. Compared to its weight on Earth, an apple on this planet would weigh _____.
   a. twice as much
   b. one-fourth as much
   c. half as much
   d. the same
   e. zero

____ 13. Suppose the gravitational force between two spheres is 30 N. If the magnitude of each mass doubles, what is the force between the masses?
   a. 8 N
   b. 15 N
   c. 30 N
   d. 60 N
   e. 120 N

Problem

A 35 kg child moves with uniform circular motion while riding a horse on a carousel. The horse is 3.2 m from the carousel's axis of rotation and has a tangential speed of 2.6 m/s.

14. What is the child's centripetal acceleration?

15. What is the centripetal force on the child?

16. Two trucks with equal mass are attracted to each other with a gravitational force of 6.7×10^{-4} N. The trucks are separated by a distance of 3.0 m. What is the mass of one of the trucks? ($G = 6.673 \times 10^{-11}$ N•m^2/kg^2)

17. A planet has twice the mass of Earth. How much larger would the radius of the planet have to be for the gravitational field strength, *g,* at the planet's surface to be the same as on Earth's surface?

18. You sit at the outer rim of a Ferris wheel that rotates at 2 revolutions per minute (RPM). What would your rotational speed be if you were instead clinging to a position halfway from the center to the outer rim?
19. Imagine you are standing atop a ladder so tall that you are 2 Earth radii from Earth's center. What is your weight at the top of the ladder, relative to your weight on the ground?
20. A woman whose mass is 70 kg on Earth's surface is in a spacecraft at a height of twice Earth's radius (that is, 3 Earth radii) above Earth's surface. What is her mass (not weight) there?

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Answer Section

MULTIPLE CHOICE

1. C
2. D
3. B
4. D
5. C
6. D
7. B
8. C
9. B
10. D
11. C
12. A
13. E

PROBLEM

14. $2.1\ \text{m/s}^2$

    Given
    $v_t = 2.6\ \text{m/s}$

    $r = 3.2\ \text{m}$

    Solution
    $$a_c = \frac{v_t^2}{r} = \frac{(2.6\ \text{m/s})^2}{3.2\ \text{m}} = 2.1\ \text{m/s}^2$$

15. 74 N

    Given
    $m = 35\ \text{kg}$

    $v_t = 2.6\ \text{m/s}$

    $r = 3.2\ \text{m}$

    Solution
    $$F_c = \frac{mv_t^2}{r} = \frac{(35\ \text{kg})(2.6\ \text{m/s})^2}{3.2\ \text{m}} = 74\ \text{N}$$

16. 9.5×10^3 kg

Given

$m_1 = m_2$

$r = 3.0\,\text{m}$

$F_g = 6.7 \times 10^{-4}\,\text{N}$

$G = 6.673 \times 10^{-11}\,\text{Nm}^2/\text{kg}^2$

Solution

$m_1 = m_2$

$$F_g = G\frac{m_1 m_2}{r^2} = G\frac{{m_1}^2}{r^2}$$

$${m_1}^2 = \frac{F_g r^2}{G}$$

$$m_1 = \sqrt{\frac{F_g r^2}{G}} = \sqrt{\frac{\left(6.7 \times 10^{-4}\,\text{N}\right)(3.0\,\text{m})^2}{6.673 \times 10^{-11}\,\text{Nm}^2/\text{kg}^2}} = 9.5 \times 10^3\,\text{kg}$$

17. The planet's radius would have to be larger by a factor of $\sqrt{2}$.

    Given

    $r_p = 2r_E$

    $g_p = g_E$

    Solution

    $g_p = G\frac{m_p}{r_p^{\,2}}$

    $g_E = G\frac{m_E}{r_E^{\,2}}$

    $g_p = g_E$

    $G\frac{m_p}{r_p^{\,2}} = G\frac{m_E}{r_E^{\,2}}$

    $m_p = 2m_E$

    $G\frac{2m_E}{r_p^{\,2}} = G\frac{m_E}{r_E^{\,2}}$

    $\frac{2}{r_p^{\,2}} = \frac{1}{r_E^{\,2}}$

    $r_p^{\,2} = 2r_E^{\,2}$

    $r_p = \sqrt{2r_E^{\,2}} = \sqrt{2}\,r_E$

18. 2 RPM
19. $\frac{1}{4}$ as much
20. 70 kg