AP Physics - UCM Practice

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

____ 1. A race car travels 40 m/s around a banked (45° with the horizontal) circular (radius = 0.20 km) track. What is the magnitude of the resultant force on the 80-kg driver of this car?
   a. 0.68 kN
   b. 0.64 kN
   c. 0.72 kN
   d. 0.76 kN
   e. 0.52 kN

____ 2. An airplane moves 140 m/s as it travels around a vertical circular loop which has a 1.0-km radius. What is the magnitude of the resultant force on the 70-kg pilot of this plane at the bottom of this loop?
   a. 2.1 kN
   b. 1.4 kN
   c. 0.69 kN
   d. 1.5 kN
   e. 1.3 kN

____ 3. A 4.0-kg mass on the end of a string rotates in a circular motion on a horizontal frictionless table. The mass has a constant speed of 2.0 m/s and the radius of the circle is 0.80 m. What is the magnitude of the resultant force acting on the mass?
   a. 39 N
   b. 20 N
   c. 44 N
   d. 0 N
   e. 30 N

____ 4. A split highway has a number of lanes for traffic. For traffic going in one direction, the radius for the inside of the curve is half the radius for the outside. One car, car A, travels on the inside while another car of equal mass, car B, travels at equal speed on the outside of the curve. Which statement about resultant forces on the cars is correct?
   a. The force on A is half the force on B.
   b. The force on B is half the force on A.
   c. The force on A is four times the force on B.
   d. The force on B is four times the force on A.
   e. There is no net resultant force on either as long as they stay on the road while turning.

____ 5. The equation below is the solution to a problem.

$$\frac{(2.00\ \text{kg})\left(8.00\ \frac{\text{m}}{\text{s}}\right)^2}{5.00\ \text{m}} = 6.00\ \text{N} - (2.00\ \text{kg})\left(9.80\ \frac{\text{m}}{\text{s}^2}\right)(\cos 0°).$$

The best physical representation of this equation is
   a. a sphere of 2.00 kg mass under a 6.00 N tension when at the bottom of a vertical circle.
   b. a sphere of 2.00 kg mass under a 6.00 N tension when at the side of a vertical circle.
   c. a sphere of 2.00 kg mass under a 6.00 N tension when at the top of a vertical circle.
   d. a sphere of 2.00 kg mass at any point on a horizontal circle.
   e. a 2.00 kg gecko running on the ceiling with a speed of 8.00 m/s.

____ 6. The following equation was obtained by solving a physics problem:

$$\frac{\left(16.0\,\frac{\text{m}}{\text{s}}\right)^2}{(75.0\,\text{m})\left(9.80\,\frac{\text{m}}{\text{s}^2}\right)} = \tan 19.2°$$

The best physical representation of the situation is

a. A car traveling at 16.0 m/s is 19.2° into a turn of a quarter circle on a level road.
b. A mass on a string that is originally horizontal has fallen to where the angle between the string and the vertical direction is 19.2°.
c. A mass on a string originally horizontal has fallen 19.2° from the horizontal direction.
d. A car traveling at 16.0 m/s is on a circular curve banked at 19.2°.
e. A car traveling at 16.0 m/s and going over a semicircular mountain-top road is 19.2° down from the top.

____ 7. A car enters a level, unbanked semi-circular hairpin turn of 300 m radius at a speed of 40 m/s. The coefficient of friction between the tires and the road is $m = 0.25$. If the car maintains a constant speed of 40 m/s, it will

a. attempt to dig into the road surface.
b. tend to veer toward the center of the semicircle.
c. arrive safely at the end of the semicircle.
d. tend to veer toward the outside of the circle.
e. veer toward the center for the first quarter-circle, then veer toward the outside for the second quarter-circle.

____ 8. A satellite circles planet Roton every 2.8 h in an orbit having a radius of 1.2×10^7 m. If the radius of Roton is 5.0×10^6 m, what is the magnitude of the free-fall acceleration on the surface of Roton?

a. 31 m/s^2
b. 27 m/s^2
c. 34 m/s^2
d. 40 m/s^2
e. 19 m/s^2

____ 9. What is the magnitude of the free-fall acceleration at a point that is a distance $2R$ above the surface of the Earth, where R is the radius of the Earth?

a. 4.8 m/s^2
b. 1.1 m/s^2
c. 3.3 m/s^2
d. 2.5 m/s^2
e. 6.5 m/s^2

____ 12. What is the gravitational force on a 20-kg satellite circling the Earth (radius = 6.4×10^6 m, mass = 6.0×10^{24} kg) with a period of 5.0 h?

a. 88 N
b. 55 N
c. 36 N
d. 98 N
e. 18 N

____ 13. Planet Roton has a mass of 4.0×10^{23} kg and a radius of 2.0×10^{6} m. With what speed should a space probe be launched from the surface of Roton so as to achieve a maximum distance of 3.0×10^{6} m from the center of Roton?

a. 4.2 km/s
b. 3.9 km/s
c. 3.0 km/s
d. 3.4 km/s
e. 6.0 km/s

____ 14. Two satellites are placed in geosynchronous orbits, orbits with a period of 24 hours, where each satellite hovers over a spot on the Earth's equator. Satellite B has three times the mass of satellite A. What is the relationship between the magnitudes of the gravitational forces of the Earth on the two satellites?

a. $F_B = \frac{1}{9}F_A$.
b. $F_B = \frac{1}{3}F_A$.
c. $F_B = F_A$.
d. $F_B = 3F_A$.
e. $F_B = 9F_A$.

____ 15. A satellite is placed in a geosynchronous orbit. In this equatorial orbit with a period of 24 hours, the satellite hovers over one point on the equator. Which statement is true for a satellite in such an orbit?

a. There is no gravitational force on the satellite.
b. There is no acceleration toward the center of the Earth.
c. The satellite is in a state of free fall toward the Earth.
d. There is a tangential force that helps the satellite keep up with the rotation of the Earth.
e. The force toward the center of the Earth is balanced by a force away from the center of the Earth.

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Answer Section

MULTIPLE CHOICE

1. ANS: B PTS: 1
2. ANS: B PTS: 1
3. ANS: B PTS: 1
4. ANS: B PTS: 1
5. ANS: A PTS: 1
6. ANS: D PTS: 1
7. ANS: D PTS: 1
8. ANS: B PTS: 1
9. ANS: B PTS: 1
10. ANS: D PTS: 1
11. ANS: D PTS: 1
12. ANS: C PTS: 1
13. ANS: C PTS: 1
14. ANS: D PTS: 1
15. ANS: C PTS: 1
16. ANS: C PTS: 1
17. ANS: D PTS: 1
18. ANS: D PTS: 1
19. ANS: B PTS: 1
20. ANS: E PTS: 1