1) You are making a circular turn in your car on a horizontal road when you hit a big patch of ice, causing the force of friction between the tires and the road to become zero. While the car is on the ice, it
   A) moves along a straight–line path in its original direction.
   B) continues to follow a circular path, but with a radius larger than the original radius.
   C) moves along a path that is neither straight nor circular.
   D) moves along a straight–line path toward the center of the circle.
   E) moves along a straight–line path away from the center of the circle.

2) When a car goes around a circular curve on a horizontal road at constant speed, what force causes it to follow the circular path?
   A) gravity
   B) the normal force from the road
   C) the friction force from the road
   D) No force causes the car to do this because the car is traveling at constant speed and therefore has no acceleration.

3) A car goes around a circular curve on a horizontal road at constant speed. What is the direction of the friction force on the car due to the road?
   A) perpendicular to the curve inward
   B) tangent to the curve opposite to the direction of the car's motion
   C) perpendicular to the curve outward
   D) tangent to the curve in the forward direction
   E) There is no friction on the car because its speed is constant.

4) If you swing a bucket of water fast enough in a vertical circle, at the highest point the water does not spill out. This happens because an outward force balances the pull of gravity on the water.
   A) True B) False

5) When a car goes around a banked circular curve at the proper speed speed for the banking angle, what force cause it to follow the circular path?
   A) the friction force from the road
   B) gravity
   C) the normal force from the road
   D) No force causes the car to do this because the car is traveling at constant speed and therefore has no acceleration.

6) Two cars go around a banked curve at the proper speed for the banking angle. One car has tires with excellent traction, while the other car has bald slippery tires. Which of these cars is more likely to slide on the pavement as it goes around the curve?
   A) Neither car will slide. B) the car with the new tires
   C) the car with the bald tires D) It depends on if the pavement is wet or dry.

7) Two small balls, A and B, attract each other gravitationally with a force of magnitude F. If we now double both masses and the separation of the balls, what will now be the magnitude of the attractive force on each one?
   A) F B) $8F$ C) $16F$ D) $F/4$ E) $4F$

8) A spaceship is traveling to the Moon. At what point is it beyond the pull of Earth's gravity?
   A) when it gets above the atmosphere B) when it is closer to the Moon than it is to Earth
   C) when it is half–way there D) It is never beyond the pull of Earth's gravity.

9) If you stood on a planet having a mass four times that of Earth's mass, and a radius two times that of Earth's radius, you would weigh

A) two times less than you do on Earth.
B) two times more than you do on Earth.
C) four times more than you do on Earth.
D) the same as you do on Earth.

10) The reason an astronaut in an earth satellite feels weightless is that

A) the astronaut is at a point in space where the effects of the moon's gravity and the earth's gravity cancel.
B) the astronaut is beyond the range of the earth's gravity.
C) the astronaut is falling.
D) this is a psychological effect associated with rapid motion.
E) the astronaut's acceleration is zero.

11) If Earth had twice its present mass but it orbited at the same distance from the sun as it does now, its orbital period would be

A) 6 months.
B) 4 years.
C) 2 years.
D) 3 years.
E) 1 year.

12) Halley's Comet is in a highly elliptical orbit around the sun. Therefore the orbital speed of Halley's Comet, while traveling around the sun,

A) is constant.
B) decreases as it nears the Sun.
C) increases as it nears the Sun.
D) is zero at two points in the orbit.

13) A particularly scary roller coaster contains a loop–the–loop in which the car and rider are completely upside down. If the radius of the loop is 13.2 m, with what minimum speed must the car traverse the loop so that the rider does not fall out while upside down at the top? Assume the rider is not strapped to the car.

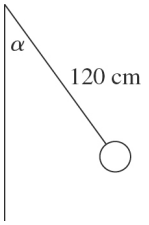
14) A 1000–kg car is moving at 30 m/s around a horizontal unbanked curve whose diameter is 0.20 km. What is the magnitude of the friction force required to keep the car from sliding?

15) A 1000–kg car is slowly picking up speed as it goes around a horizontal unbanked curve whose radius is 100 m. The coefficient of static friction between the tires and the road is 0.35. At what speed will the car begin to skid sideways?

16) A car moving at a steady 10 m/s on a level highway encounters a depression that has a circular cross–section with a radius of 30 m. The car maintains its speed as it drives through the depression. What is the normal force exerted by the seat of the car on a 60.0–kg passenger when the car is at the bottom of the depression?

17) In order to simulate weightlessness for astronauts in training, they are flown in a vertical circle. If the passengers are to experience weightlessness, how fast should an airplane be moving at the top of a vertical circle with a radius of 2.5 km?

18) A 20–g bead is attached to a light 120 cm–long string as shown in the figure. If the angle α is measured to be 18°, what is the speed of the mass?



19) A future use of space stations may be to provide hospitals for severely burned persons. It is very painful for a badly burned person on Earth to lie in bed. In a space station, the effect of gravity can be reduced or even eliminated. How long should each rotation take for a doughnut–shaped hospital of 200–m radius so that persons on the outer perimeter would experience 1/10 the normal gravity of Earth?

20) What is the proper banking angle for an Olympic bobsled to negotiate a 100–m radius turn at 35 m/s without skidding?

21) When a spacecraft is launched from the earth toward the sun, at what distance from the earth will the gravitational forces due to the sun and the earth cancel?
Earth's mass is 5.97×10^{24} kg, the sun's mass is 1.99×10^{30} kg, and the Earth–sun distance is 1.5×10^{11} m.

22) At a given point above Earth's surface, the acceleration due to gravity is equal to 7.8 m/s^2. What is the altitude of this point above Earth's surface? ($G = 6.67 \times 10^{-11}$ N • m^2/kg^2, $M_{earth} = 5.97 \times 10^{24}$ kg, $R_{earth} = 6.38 \times 10^6$ m)

23) What would be the weight of a 59.1–kg astronaut on a planet twice as massive as Earth and having twice Earth's radius?

24) A satellite orbits the Earth once every 6.0 hours in a circle. What are the magnitude and direction of the acceleration of the satellite? ($G = 6.67 \times 10^{-11}$ N • m^2/kg^2, $M_{earth} = 5.97 \times 10^{24}$ kg)

25) Suppose NASA wants a satellite to revolve around Earth 5 times a day. What should be the radius of its orbit if we neglect the presence of the Moon? ($G = 6.67 \times 10^{-11}$ N • m^2/kg^2, $M_{earth} = 5.97 \times 10^{24}$ kg)

26) A satellite that is in a circular orbit 230 km above the surface of the planet Zeeman–474 has an orbital period of 89 min. The radius of Zeeman–474 is 6.38×10^6 m. What is the mass of this planet? ($G = 6.67 \times 10^{-11}$ N • m^2/kg^2)

27) If the earth were twice as far from the sun as it presently is, how long (in terms of the present year) would it take it to make one orbit around the sun?

28) It takes the planet Jupiter 12 years to orbit the sun once in a nearly circular orbit. Assuming that Jupiter's orbit is truly circular, what is the distance from Jupiter to the sun, given that the distance from the earth to the sun is 1.5×10^{11} m?

Answer Key
Testname: HW_CH05_CIRCULAR_MOTION_GRAVITATION

1) A
2) C
3) A
4) B
5) C
6) A
7) A
8) D
9) D
10) C
11) E
12) C
13) 11.4 m/s
14) 9000 N
15) 19 m/s
16) 790 N
17) 160 m/s
18) 1.1 m/s
19) 1.5 min
20) 51°
21) 2.6×10^{8} m
22) 770 km
23) 290 N
24) 1.4 m/s^2 toward the center of the earth
25) 1.44×10^{7} m
26) 6.0×10^{24} kg
27) 2.8 years
28) 7.9×10^{11} m