AP 1 Final Review Circular Motion and Gravity

SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question

1) A point on a wheel rotating at 5.00 rev/s is located 0.200 m from the axis. What is the centripetal acceleration? 1) _____

2) A car traveling 20 m/s rounds an 80-m radius horizontal curve with the tires on the verge of slipping. How fast can this car round a second curve of radius 320 m? (Assume the same coefficient of friction between the car's tires and each road surface.) 2) _____

3) The innermost moon of Jupiter orbits the planet with a radius of 422×10^3 km and a period of 1.77 days. What is the mass of Jupiter? 3) _____

4) An object moves in a circular path at a constant speed. Compare the direction of the object's velocity and acceleration vectors. 4) _____

5) A 175-kg ball on the end of a string is revolving uniformly in a horizontal circle of radius 0.500 m. The ball makes 2.00 revolutions in a second. 5) _____
   (a) Determine the speed of the ball.
   (b) Determine the ball's centripetal acceleration.
   (c) Determine the force a person must exert on opposite end of the string.

6) The gravitational force between two objects is inversely proportional to 6) _____

7) The mass of the Moon is 7.4×10^{22} kg and its mean radius is 1.75×10^3 km. What is the acceleration due to gravity at the surface of the Moon? 7) _____

8) A 0.50-kg mass is attached to the end of a 1.0-m string. The system is whirled in a horizontal circular path. If the maximum tension that the string can withstand is 350 N. What is the maximum speed of the mass if the string is not to break? 8) _____

9) A car is negotiating a flat curve of radius 50 m with a speed of 20 m/s. The centripetal force provided by friction is 1.2×10^4 N. What is the mass of the car? 9) _____

10) When an object experiences uniform circular motion, the direction of the net force is 10) _____

11) As a rocket moves away from the Earth's surface, the rocket's weight 11) _____

12) Compared to its mass on the Earth, the mass of an object on the Moon is 12) _____

13) A satellite is in a low circular orbit about the Earth (i.e., it just skims the surface of the Earth). How long does it take to make one revolution around the Earth? (The mean radius of the Earth is 6.38×10^6 m.) 13) _____

14) A roller coaster car is on a track that forms a circular loop in the vertical plane. If the car is to just maintain contact with track at the top of the loop, what is the minimum value for its centripetal acceleration at this point? 14) _____

15) A frictionless curve of radius 100 m, banked at an angle of 45°, may be safely negotiated at a speed of 15) _____

16) The gravitational attractive force between two masses is F. If the masses are moved tohalf of their initial distance, what is the gravitational attractive force? 16) _____

17) The acceleration of gravity on the Moon is one-sixth what it is on Earth. An object of mass 72 kg is taken to the Moon. What is its mass there? 17) _____

18) A curve of radius 80 m is banked at 45°. Suppose that an ice storm hits, and the curve is effectively frictionless. What is the safe speed with which to take the curve without either sliding up or down? 18) _____

19) By how many newtons does the weight of a 100-kg person change when he goes from sea level to an altitude of 5000 m? (The mean radius of the Earth is 6.38×10^6 m.) 19) _____

20) Two objects, with masses m_1 and m_2, are originally a distance r apart. The gravitational force between them has magnitude F. The second object has its mass changed to $2m_2$, and the distance is changed to r/4. What is the magnitude of the new gravitational force? 20) _____

21) A jet plane flying 600 m/s experiences an acceleration of 4g when pulling out of the dive What is the radius of curvature of the loop in which the plane is flying? 21) _____

22) Two objects, with masses m_1 and m_2, are originally a distance r apart. The magnitude of the gravitational force between them is F. The masses are changed to $2m_1$ and $2m_2$, and the distance is changed to 4r. What is the magnitude of the new gravitational force? 22) _____

23) The maximum force a pilot can stand is about seven times his weight. What is the minimum radius of curvature that a jet plane's pilot, pulling out of a vertical dive, can tolerate at a speed of 250 m/s? 23) _____

24) A pilot executes a vertical dive then follows a semi-circular arc until it is going straight up. Just as the plane is at its lowest point, the force on him is 24) _____

25) Two planets have the same surface gravity, but planet B has twice the radius of planet A If planet A has mass m, what is the mass of planet B? 25) _____

26) A car of mass m goes around a banked curve of radius r with speed v. If the road is frictionless due to ice, the car can still negotiate the curve if the horizontal component of the normal force on the car from the road is equal in magnitude to 26) _____

27) What type of acceleration does an object moving with constant speed in a circular path experience? 27) _____

28) A car goes around a curve of radius r at a constant speed v. Then it goes around the same curve at half of the original speed. What is the centripetal force on the car as it goes around the curve for the second time, compared to the first time? 28) _____

29) A hypothetical planet has a mass of half that of the Earth and a radius of twice that of the Earth. What is the acceleration due to gravity on the planet in terms of g, the acceleration due to gravity at the Earth? 29) _____

30) What minimum banking angle is required for an Olympic bobsled to negotiate a 100-m radius turn at 35 m/s without skidding? (Ignore friction.) 30) _____

31) A spaceship is traveling to the Moon. At what point is it beyond the pull of Earth's gravity? 31) _____

32) When an object experiences uniform circular motion, the direction of the acceleration is 32) _____

33) What force is needed to make an object move in a circle? 33) _____

34) A car goes around a curve of radius r at a constant speed v. What is the direction of the ne force on the car? 34) _____

35) A satellite is in a low circular orbit about the Earth (i.e., it just skims the surface of the Earth). What is the speed of the satellite? (The mean radius of the Earth is 6.38×10^6 m.) 35) _____

36) A car goes around a curve of radius r at a constant speed v. Then it goes around a curve o radius 2r at speed 2v. What is the centripetal force on the car as it goes around the second curve, compared to the first? 36) _____

37) The maximum speed around a level curve is 30.0 km/h. What is the maximum speed around a curve with twice the radius? (Assume all other factors remain unchanged.) 37) _____

38) A person is standing on a scale in an elevator accelerating downward. Compare the reading on the scale to the person's true weight. 38) _____

39) An object moves with a constant speed of 30 m/s on a circular track of radius 150 m. What is the acceleration of the object? 39) _____

40) Europa, a moon of Jupiter, has an orbital diameter of 1.34×10^9 m, and a period of 3.55 days. What is the mass of Jupiter? 40) _____

41) A car goes around a flat curve of radius 50 m at a speed of 14 m/s. What must be the minimum coefficient of friction between the tires and the road for the car to make the turn? 41) _____

42) A motorcycle has a mass of 250 kg. It goes around a 13.7 m radius turn at 96.5 km/h. Wha is the centripetal force on the motorcycle? 42) _____

43) Suppose a satellite were orbiting the Earth just above the surface. What is its centripeta acceleration? 43) _____

44) Two objects attract each other gravitationally. If the distance between their centers is cut in half, the gravitational force 44) _____

45) What is the gravitational force on a 70-kg person standing on the Earth, due to the Moon? The mass of the Moon is 7.36×10^{22} kg and the distance to the Moon is 3.82×10^{8} m. 45) _____

46) An object weighs 432 N on the surface of the Earth. The Earth has radius r. If the object is raised to a height of 3r above the Earth's surface, what is its weight? 46) _____

47) How many revolutions per minute must a circular, rotating space station of radius 1000 m rotate to produce an artificial gravity of 9.80 m/s^2? 47) _____

48) What is the centripetal acceleration of a point on the perimeter of a bicycle wheel of diameter 70 cm when the bike is moving 8.0 m/s? 48) _____

1) 198 m/s^2
2) 40 m/s
3) 1.9×10^{27} kg
4) The vectors are perpendicular.
5) (a) 6.28 m/s
   (b) 79.0 m/s^2
   (c) 13.8 N
6) the square of the distance between the two objects
7) 1.6 m/s^2
8) 26 m/s
9) 1500 kg
10) is directed toward the center of the circular path.
11) decreases.
12) the same.
13) 85 min
14) g downward
15) 31 m/s.
16) 4F
17) 72 kg
18) 28 m/s
19) 1.6 N
20) 32F
21) 9200 m
22) F/4
23) 1060 m
24) more than mg, and pointing up.
25) 4m
26) mv^2/r.
27) centripetal acceleration
28) one-fourth as big
29) g/8
30) 51°
31) It is never beyond the pull of Earth's gravity.
32) is directed toward the center of the circular path.
33) centripetal force
34) toward the curve's center
35) 7.9 km/s
36) twice as big
37) 42.4 km/h
38) less than their true weight
39) 6.0 m/s^2
40) 1.89×10^{27} kg
41) 0.40
42) 1.31×10^4 N
43) equal to g
44) quadruples
45) 0.0024 N
46) 27 N
47) 0.95 rpm

48) 1.8×10^2 m/s^2