AP PHYSICS

Name: _____

Period: _____ Date: _____

Points: **58** Score: _____ IB Curve: _____

DEVIL PHYSICS

BADDEST CLASS ON CAMPUS

AP EXAM		CHAPTER TEST	
50 Multiple Choice • 45 Single Response • 5 Multi-Response	90 min, 1 point each	25 Multiple Choice • 22 Single Response • 3 Multi-Response	45 min
Free Response • 3 Short Free Response • 2 Long Free Response	90 min • 13 min ea, 7 pts ea • 25 min ea, 12 pts ea	Free Response • 2 Short Free Response • 1 Long Free Response	45 min • 12 min ea, 7 pts ea • 20 min ea, 12 pts ea

CHAPTER 5 TEST REVIEW

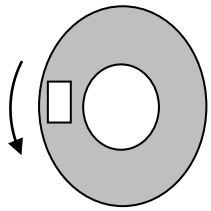
MULTIPLE CHOICE

1. (__/1) If the string were suddenly cut when the ball is at the position shown in answer (E) *of problem #6*, the subsequent motion of the ball would be,
   a. to the right
   b. to the left
   c. to the top of the page
   d. down and to the right
   e. down and to the left

Questions 2-4 are related to each other. A 40 kg child sits on the edge of a carnival ride at a radius of 4 m. The ride makes 3 revolutions in 6 s.

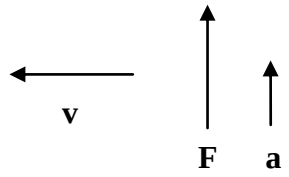
2. (__/1) The period for this ride is,
   a. ½ rev/s
   b. ½ s
   c. 2 rev/s
   d. 2 s
   e. 4 s
3. (__/1) The speed of the child is most nearly,
   a. 4 m/s
   b. 12 m/s
   c. 24 m/s
   d. 120 m/s
   e. 360 m/s
4. (__/1) The force which is holding the child in place on the ride is most nearly,
   a. 30 N
   b. 160 N
   c. 320 N
   d. 1440 N
   e. 2880 N

Questions 5 and 7 are related to each other. The figure below shows the top view of a car going around a horizontal circular track at a constant speed in the counterclockwise direction. Assume the frictional force between the tires and the road is at its maximum value.

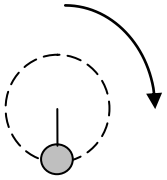


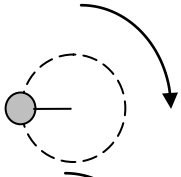
5. (__/1) Which of the following vectors represents the frictional force acting on the tires of the car?
   a. ←
   b. →
   c. ↑
   d. ↓
   e. ↙

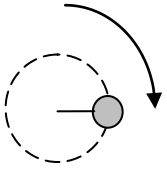
6. (__/1) A ball on the end of a string is swung in a horizontal circle, rotating clockwise as shown. When the ball is at a particular point in the circle, the direction of the velocity, centripetal force, and centripetal acceleration vectors respectively are shown below:

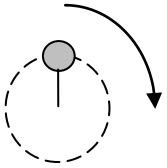


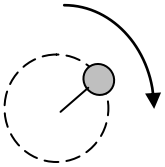
Which of the following best represents the position of the ball as it rotates clockwise?

a. 

b. 

c. 

d. 

e. 

7. (__/1) This car has a mass *m* and a speed *v* as it moves around the track of radius *R*. Which of the following expressions can be used to find the value of the coefficient of friction between the tires and the road?

a. $\mu = \frac{gR}{v}$

b. $\mu = \frac{gv}{R}$

c. $\mu = vgR$

d. $\mu = \frac{v^2}{gR}$

e. $\mu = \frac{mv^2}{R}$

8. (__/1) The acceleration due to gravity *g* at a distance r from the center of a planet of mass *M* is 9 m/s^2. In terms of the orbital distance *r*, what would the speed of this satellite have to be to remain in a circular orbit around this planet at this distance?

a. $v = 3\sqrt{r}$

b. $v = 3r$

c. $v = 9\sqrt{r}$

d. $v = 9r$

e. $v = 3\sqrt[3]{r}$

9. (__/1) In general,

a. the smaller the orbital radius of a satellite, the longer its orbital period

b. the larger the orbital radius of a satellite, the shorter its orbital period

c. the larger the orbital radius of a satellite, the longer its orbital period

d. the smaller the orbital radius of a satellite, the smaller its acceleration

e. the larger the orbital radius of a satellite, the greater the gravitational forces acting on it

10. (__/1) If the distance between two point particles is doubled, then the gravitational force between them,

a. decreases by a factor of 4

b. decreases by a factor of 2

c. increases by a factor of 2

d. increases by a factor of 4

e. cannot be determined without knowing the masses

11. (__/1) At the surface of the earth, an object of mass *m* has weight *w*. If this object is transported to an altitude above the earth's surface that is equal to twice the radius of the earth, at the new location

a. its mass is *m*/2 and its weight is *w*/2

b. its mass is *m* and its weight is *w*/2

c. its mass is *m*/2 and its weight is *w*/4

d. its mass is *m* and its weight is *w*/4

e. its mass is *m* and its weight is *w*/9

12. (__/1) A moon of mass *m* orbits a planet of mass 100*m*. Let the strength of the gravitational force exerted by the planet on the moon be denoted by F_1, and let the strength of the gravitational force exerted by the moon on the planet be F_2. Which of the following is true?
    a. $F_1 = 100\ F_2$
    b. $F_1 = 10\ F_2$
    c. $F_1 = F_2$
    d. $F_2 = 10\ F_1$
    e. $F_2 = 100\ F_1$
13. (__/1) The dwarf planet Pluto has 1/500 the mass and 1/15 the radius of the Earth. What is the value of g in m/s^2 on the surface of Pluto? (use $1g = 10\ m/s^2$)
    a. 50/225
    b. 50/15
    c. 15/50
    d. 225/50
    e. 225/500
14. (__/1) A moon of Jupiter has a nearly circular orbit of radius *R* and an orbit period of *T*. Which of the following expressions gives the mass of Jupiter?
    a. $\frac{2\pi R}{T}$
    b. $\frac{4\pi^2 R}{T^2}$
    c. $\frac{2\pi R^3}{GT^2}$
    d. $\frac{4\pi R^2}{GT^2}$
    e. $\frac{4\pi^2 R^3}{GT^2}$
15. (__/1) Two large bodies, Body A of mass m and Body B of mass 4m, are separated by a distance R. At what distance from Body A, along the line joining the bodies, would the gravitational force on a third body, Body C, be equal to zero? (Ignore the presence of any other bodies).
    a. $\frac{R}{16}$
    b. $\frac{R}{8}$
    c. $\frac{R}{5}$
    d. $\frac{R}{4}$
    e. $\frac{R}{3}$
16. (__/1) When an object experiences uniform circular motion, the direction of the acceleration is,
    a. in the same direction as the velocity vector
    b. in the opposite direction of the velocity vector
    c. is directed toward the center of the circular path
    d. is directed away from the center of the circular path
    e. in a direction tangent to the circular path
17. (__/1) A car goes around a curve of radius *r* at a constant speed *v*. Then it goes around a curve of radius 2*r* at speed 2*v*. What is the centripetal force on the car as it goes around the second curve, compared to the first?
    a. four times as big
    b. twice as big
    c. one-half as big
    d. one-fourth as big
    e. the same
18. (__/1) Is it possible for an object moving around a circular path to have both centripetal and tangential acceleration?
    a. No, because then the path would not be a circle
    b. No, an object can only have one or the other at any given time
    c. Yes, this is possible if the speed is constant
    d. Yes, this is possible if the acceleration is constant
    e. Yes, this is possible if the speed is changing
19. (__/1) 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 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?
    a. 32F
    b. 16F
    c. F
    d. F/16
    e. F/32

20. (__/1) A point on a wheel rotating at 5.00 rev/s is located 0.200m from the axis. What is the centripetal acceleration?
    a. 0.050 m/s^2
    b. 0.310 m/s^2
    c. 1.35 m/s^2
    d. 48.0 m/s^2
    e. 198 m/s^2
21. (__/1) 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?
    a. 0.20
    b. 0.40
    c. 0.60
    d. 0.80
    e. cannot be determined without knowing the mass of the car
22. (__/1) A hydrogen atom consists of a proton of mass 1.67×10^{-27} kg and an orbiting electron of mass 9.11×10^{-31} kg. In one of its orbits, the electron is 5.3×10^{-11} m from the proton. What is the *gravitational* attraction between the electron and proton at this point?
    a. 3.6×10^{-27} N
    b. 1.8×10^{-47} N
    c. 3.6×10^{-47} N
    d. 5.4×10^{-47} N
    e. 1.9×10^{-57} N
23. (__/1) 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's above the Earth's surface, what is its weight?
    a. 432 N
    b. 48 N
    c. 27 N
    d. 0 N
    e. cannot be determined without knowing the object's mass
24. (__/1) A satellite is in a low circular orbit about the Earth (i.e. it just skims the surface of the earth order of magnitude-wise). How long does it take to make one revolution around the Earth? (Use 6.38×10^6 m as the mean radius of the Earth).
    a. 81 min
    b. 85 min
    c. 89 min
    d. 93 min
    e. 98 min
25. (__/1) Which of the following statements are true for a satellite in outer space orbiting the earth?

    I. There are no forces acting on the satellite

    II. The force of gravity is the only force acting on the satellite

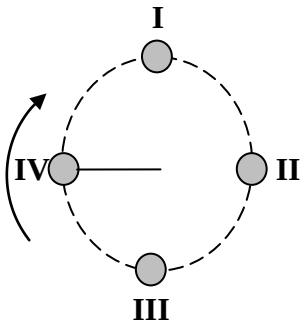
    III. The force of gravity is balanced by the outward force of the object.

    a. I only
    b. II only
    c. III only
    d. I and III are correct
    e. II and III are correct

FREE RESPONSE

26. (__/2) State Newton's law of universal gravitation.

27. A ball on the end of a string is swung in a vertical circle. The mass m of the ball is 0.25 kg and the radius of the circle R = 0.75 m. The position of the ball is marked every quarter of a revolution in the diagram below.



a. (__/2) On the diagram below, draw all of the forces acting on the ball when it is at position IV. Be sure to label each force

b. (__/3) When the ball is at position IV, the tension force in the string is twice as great as the weight of the ball. Determine the speed of the ball at position IV.

c. (__/2) On the diagrams below, draw and label the forces acting on the ball,

i. at the top of the circle (Position I) and

ii. at the bottom of the circle (Position III

Position I **Position III**

d. (__/3) The speed of the ball at Position III (the bottom of the circle) is 5 m/s. Determine the tension force in the string as the ball passes through Position III.

e. Suppose the string breaks just as the ball is at Position IV.

i. (__/2) Describe the subsequent motion of the ball

ii. (__/2) Use the speed you calculated in part (b) to determine the maximum height the ball reaches after the spring breaks.

28. A robot probe lands on a new uncharted planet. It has determined the diameter of the new planet to be $8x10^6$ m. The probe weighs a known mass of 1 kg and determines the weight to be 5 N on the new planet.

a. (__/3) Use Newton's Universal Law of Gravitation to determine the mass of the new planet.

b. (__/3) Use the value found in (a) above to determine the acceleration due to gravity on this planet. Express your answer in both m/s^2 and g's (where $1g = 10\ m/s^2$)

c. Bonus: What is the average density of this planet?

d. (__/3) This planet has a moon that orbits it at a distance of $6x10^9$ m from center to center. What is the moon's period in years?

29. The earth has a mass of $6x10^{24}$ kg and orbits the Sun in $3.15x10^7$ seconds at a constant circular distance of $1.5x10^{11}$ m.

a. (__/2) What is the centripetal acceleration around the Sun?

b. (__/3) What is the gravitational force acting between the Sun and Earth?

c. (__/3) What is the mass of the Sun?