MULTIPLE CHOICE QUESTIONS

GENERAL PHYSICS I

WITH ANSWERS

These are practice, study and review questions and problems. Work only on questions related to upcoming exams and previous questions. It is not necessarily good to get ahead of the class. Take the time to work out each question. Questions you get wrong need to be reworked until you can solve them correctly. Questions you can’t solve after reasonable effort and checking the correct answers should be brought up in class during review.

As a guide, until you can answers questions like these correctly, you aren’t prepared for exams
01 - INTRODUCTION

1. The ratio \( \frac{M}{m} \) of the prefixes M and m has what value?
   A. \( 10^3 \)  
   B. \( 10^6 \)  
   C. \( 10^9 \)  
   D. \( 10^{18} \)  
   E. \( 10^7 \)

2. One year is about ____ seconds while one day is exactly ____ seconds.
   A. \( 3.16 \times 10^7 \), 86 400  
   B. \( 5.26 \times 10^5 \), 86 400  
   C. \( 3.16 \times 10^7 \), 8 640

3. Suppose an equation relating position, \( x \), to time, \( t \), is given by \( x = b t^3 + c t^4 \), where \( b \) and \( c \) are constants. The dimensions of \( b \) and \( c \) are respectively:
   A. \( T^3 \), \( T^4 \)  
   B. \( 1/T^3 \), \( 1/T^4 \)  
   C. \( L/T^3 \), \( L/T^4 \)

4. The number 0.00017 has how many significant figures?
   A. 2  
   B. 3  
   C. 5

5. Multiplying a 2 significant figure number by a 3 significant figure number and then dividing the product by a six significant figure number yields a number with how many significant figures?
   A. 5/6  
   B. 1  
   C. 2

6. On planet Z, the standard unit of length is the foose. Ann the Astronaut is 5.90 feet tall on earth. She lands on planet Z and is measured to be 94 foosi tall. Her partner Rachael is 88 foosi tall. How tall is Rachael on Earth?
   A. 5.2 feet  
   B. 5.5 feet  
   C. 5.8 feet  
   D. 6.3 feet  
   E. 5.1 feet

7. A furlong is a distance of 220 yards. A fortnight is a time period of two weeks. A race horse is running at a speed of 5.00 yards per second. What is his speed in furlongs per fortnight?
   A. 27 500 furlongs/fortnight  
   B. 13 700 furlongs/fortnight  
   C. 6 220 furlongs/fortnight  
   D. 2 750 furlongs/fortnight  
   E. 1 150 furlongs/fortnight
8. The distance to the Andromeda Galaxy is estimated at about $2 \times 10^6$ light years. A light year is the distance traveled by light in one year; if the speed of light is $3 \times 10^8$ m/s, about how far is it from our galaxy to Andromeda? (1 year = $3.15 \times 10^7$ s)

A. $10 \times 10^{15}$ m  
B. $1 \times 10^{18}$ m  
C. $2 \times 10^{22}$ m  
D. $6 \times 10^{12}$ m  
E. $8 \times 10^{20}$ m

9. Water flows into a swimming pool at the rate of 8.0 gal/min. The pool is 16 ft wide, 32 ft long and 8.0 ft deep. How long does it take to fill? (1 U.S. gallon = 231 cubic inches)

A. 32 hours  
B. 64 hours  
C. 48 hours  
D. 24 hours  
E. 16 hours

10. When NASA was communicating with astronauts on the moon, the time from sending on the Earth to receiving on the moon was 1.28 s. Find the distance from Earth to the moon. (The speed of radio waves is $3.00 \times 10^8$ m/s.)

A. 240 000 km  
B. 384 000 km  
C. 480 000 km  
D. 768 000 km  
E. 576 000 km

11. The mass of the sun is $2.0 \times 10^{30}$ kg, and the mass of a hydrogen atom is $1.67 \times 10^{-27}$ kg. If we assume that the sun is mostly composed of hydrogen, how many atoms are there in the sun?

A. $1.2 \times 10^{56}$ atoms  
B. $3.4 \times 10^{56}$ atoms  
C. $1.2 \times 10^{57}$ atoms  
D. $2.4 \times 10^{57}$ atoms  
E. $3.2 \times 10^{57}$ atoms

12. The information on a one-gallon paint can is that the coverage, when properly applied, is 450 ft$^2$. One gallon is 231 in$^3$. What is the average thickness of the paint in such an application?

A. 0.003 6 in  
B. 0.009 0 in  
C. 0.043 in  
D. 0.051 in  
E. 0.059 in

13. Assume everyone in the United States consumes one soft drink in an aluminum can every two days. If there are 270 million Americans, how many tons of aluminum need to be recycled each year if each can weighs 1/16 pound and one ton = 2000 pounds?

A. 750 000 tons  
B. 1.5 million tons  
C. 1.75 million tons  
D. 3 million tons  
E. 3.5 million tons

14. A physics class in a large lecture hall has 150 students. The total mass of the students is about kg.

A. $10^2$  
B. $10^3$  
C. $10^4$  
D. $10^5$  
E. $10^6$
15. An apartment has 1100 ft\(^2\) of floor space. What is the approximate volume of the apartment?
A. \(10^3\) ft\(^3\)
B. \(10^4\) ft\(^3\)
C. \(10^5\) ft\(^3\)
D. \(10^6\) ft\(^3\)
E. \(10^7\) ft\(^3\)

16. Which point is nearest the x axis?
A. (-3, 4)
B. (4, 5)
C. (-5, 3)
D. (5, -2)
E. (-4, 4)

17. Each edge of a cube has a length of 25.4 cm. What is the length of a diagonal of the cube going through the center of the cube? [OMIT]
A. 25.4 in
B. 44.0 in
C. 14.4 in
D. 10.0 in
E. 18.0 in

18. If point A is located at coordinates (5, 3) and point B is located at coordinates (-3, 9), what is the distance from A to B if the units of the coordinated system are meters?
A. 14 m
B. 10 m
C. 8 m
D. 17 m
E. 15 m

19. If \(\phi = 90^\circ - \theta\), what is the value of \(\sin^2\phi + \sin^2\theta\) ?
A. 0
B. 1
C. -1
D. \(\frac{1}{2}\)
E. The answer depends on \(\theta\).

20. A high fountain of water is in the center of a circular pool of water. You walk the circumference of the pool and measure it to be 150 meters. You then stand at the edge of the pool and use a protractor to gauge the angle of elevation of the top of the fountain. It is 55\(^\circ\). How high is the fountain?
A. 17 m
B. 23 m
C. 29 m
D. 34 m
E. 39 m

21. A right triangle has sides 5.0 m, 12 m, and 13 m. The smallest angle of this triangle is nearest:
A. 21\(^\circ\).
B. 23\(^\circ\).
C. 43\(^\circ\).
D. 55\(^\circ\).
E. Not attainable since this is not a right triangle.

22. A triangle has sides of length 7.0 cm and 25 cm. If the triangle is a right triangle, which of the following could be the length of the third side?
A. 18 cm
B. 24 cm
C. 27 cm
D. 32 cm
E. 20 cm
23. A train slowly climbs a 500-m mountain track which is at an angle of 10.0° with respect to the horizontal. How much altitude does it gain?
A. 86.8 m      D. 492 m
B. 88.2 m      E. 99.8 m
C. 341 m

24. The basic function of an automobile's carburetor is to atomize the gasoline and mix it with air to promote rapid combustion. Assume that 30 cm³ of gasoline is atomized into N spherical droplets. Each droplet has a radius of 2.0 \times 10^{-5} m. Find the total surface area of these N spherical droplets.
A. 2 100 cm²      D. 45 000 cm²
B. 15 000 cm²      E. 51 000 cm²
C. 18 000 cm²

25. A circle has an area of 2.0 m². A second circle has double the radius of the first. The area of the second circle is ____ times that of the first.
A. 0.50      D. 8.0
B. 2.0      E. 16
C. 4.0
02 - MOTION IN ONE DIMENSION

___ 1. A change in a physical quantity \( w \) having initial value \( w_i \) and final value \( w_f \) is given by which of the following?
   A. \( w_i - w_f \)  
   B. \( w_f - w_i \)  
   C. \( \frac{w_f + w_i}{2} \)  
   D. \( \frac{w_f - w_i}{2} \)  
   E. none of the above

___ 2. Displacement is which of the following types of quantities?
   A. vector  
   B. scalar  
   C. magnitude  
   D. dimensional

___ 3. Which of the following is not a vector quantity?
   A. temperature  
   B. velocity  
   C. acceleration  
   D. displacement  
   E. force

___ 4. In one-dimensional motion, the average speed of an object that moves from one place to another and then back to its original place has which of the following properties?
   A. It is positive.  
   B. It is negative.  
   C. It is zero.  
   D. It can be positive, negative, or zero.  
   E. It can be positive or negative but not zero.

___ 5. In one-dimensional motion where the direction is indicated by a plus or minus sign, the average velocity of an object has which of the following properties?
   A. It is positive.  
   B. It is negative.  
   C. It is zero.  
   D. It can be positive, negative, or zero.  
   E. It isn't zero.

___ 6. An object moves 20 m east in 30 s and then returns to its starting point taking an additional 50 s. If west is chosen as the positive direction, what is the sign associated with the average velocity of the object?
   A. +  
   B. -  
   C. 0 (no sign)  
   D. any of the above  
   E. It isn't zero.

___ 7. A bird, accelerating from rest at a constant rate, experiences a displacement of 28 m in 11 s. What is the average velocity?
   A. 1.7 m/s  
   B. 2.5 m/s  
   C. 3.4 m/s  
   D. 4.2 m/s  
   E. zero

___ 8. Jeff throws a ball straight up. For which situation is the vertical velocity zero?
   A. on the way up  
   B. at the top  
   C. on the way back down  
   D. both a and c are correct  
   E. none of the above

___ 9. Changing the positive direction in a reference frame to the opposite direction does not change
the sign of which of the following quantities?
A. velocity  
B. average velocity  
C. speed  
D. displacement  
E. acceleration

10. On a position versus time graph, the slope of the straight line joining two points on the plotted curve that are separated in time by the interval \( \Delta t \), is which of the following quantities?
A. average steepness  
B. average velocity  
C. instantaneous velocity  
D. average acceleration  
E. instantaneous acceleration

11. An \( x \) vs. \( t \) graph is drawn for a ball moving in one direction. The graph starts at the origin and at \( t = 5 \) s the velocity of the ball is zero. We can be positive that at \( t = 5 \) s,
A. the slope of the curve is non-zero.  
B. the ball has stopped.  
C. the acceleration is constant.  
D. the curve is at \( x = 0 \), \( t = 0 \).  
E. the slope of the curve is zero.

12. A \( v \) vs. \( t \) graph is drawn for a ball moving in one direction. The graph starts at the origin and at \( t = 5 \) s the acceleration of the ball is zero. We know that at \( t = 5 \) s,
A. the slope of the curve is non-zero.  
B. the velocity of the ball is not changing.  
C. the curve is not crossing the time axis.  
D. the curve is at \( v = 0 \), \( t = 0 \).  
E. the velocity of the ball is zero.

13. The value of an object's acceleration may be characterized in equivalent words by which of the following?
A. displacement  
B. rate of change of displacement  
C. velocity  
D. rate of change of velocity  
E. the change of velocity

14. In the case of constant acceleration, the average velocity equals the instantaneous velocity:
A. at the beginning of the time interval.  
B. at the end of the time interval.  
C. half-way through the time interval.  
D. three-fourths of the way through the time interval.  
E. one-fourth of the way through the time interval.

15. Two objects of different mass are released simultaneously from the top of a 20-m tower and fall to the ground. If air resistance is negligible, which statement best applies?
A. The greater mass hits the ground first.  
B. Both objects hit the ground together.  
C. The smaller mass hits the ground first.  
D. No conclusion can be made with the information given.

16. A baseball catcher throws a ball vertically upward and catches it in the same spot when it
returns to his mitt. At what point in the ball's path does it experience zero velocity and non-zero acceleration at the same time?
A. midway on the way up
B. at the top of its trajectory
C. the instant it leaves the catcher's hand
D. the instant before it arrives in the catcher's mitt
E. midway on the way down
03 - VECTORS AND TWO-DIMENSIONAL MOTION

1. Which type of quantity is characterized by both magnitude and direction?
   A. scalar  D. algebraic variable
   B. vector  E. dimensional
   C. trigonometric

2. Which of the following is an example of a vector quantity?
   A. velocity  D. mass
   B. temperature  E. length
   C. volume

3. When we subtract a velocity vector from another velocity vector, the result is:
   A. another velocity.  D. a scalar.
   B. an acceleration.  E. none of the above.
   C. a displacement.

4. When we add a displacement vector to another displacement vector, the result is:
   A. a velocity.  D. a scalar.
   B. an acceleration.  E. none of the above.
   C. another displacement.

5. A student adds two vectors with magnitudes of 200 and 40. Which one of the following is the only possible choice for the magnitude of the resultant?
   A. 100  D. 40
   B. 200  E. 150
   C. 260

6. Vector \( \vec{A} \) points north and vector \( \vec{B} \) points east. If \( \vec{C} = \vec{A} - \vec{B} \), then vector \( \vec{C} \) points:
   A. north of east.
   B. south of east.
   C. north of west.
   D. south of west.
   E. No conclusion can be made with the information given.

7. The first displacement is 6 m and the second displacement is 3 m. They cannot add together to give a total displacement of:
   A. 2 m.  D. 5 m.
   B. 3 m.  E. 9 m.
   C. 6 m.

8. Vector \( \vec{A} \) is 3 m long and vector \( \vec{B} \) is 4 m long. The length of the sum of the vectors must be:
   A. 5 m.  D. some value from 1 m to 7 m.
   B. 7 m.  E. some value from 3 m to 4 m.
   C. 12 m.
9. An object, initially moving in the negative x-direction, is subjected to a change in velocity in the positive y-direction. If the resulting velocity vector is drawn from the origin, into which quadrant does this vector point?
   A. 1st
   B. 2nd
   C. 3rd
   D. 4th
   E. None, since the object is now moving in the y-direction.

10. A car is initially moving at 20 m/s east and a little while later it is moving at 10 m/s north. Which of the following best describes the orientation of the average acceleration during this time interval?
   A. northeast
   B. northwest
   C. west
   D. north of west
   E. east

11. A hiker walks 200 m west and then walks 100 m north. In what direction is her resulting displacement?
   A. north
   B. west
   C. northwest
   D. east
   E. None of the answers is correct.

12. An object moves at a constant velocity of 11 m/s to the southwest for an interval of 20 s. Halfway through this interval, what is the magnitude of its instantaneous velocity?
   A. It can be any value from 0 to 22 m/s.
   B. 11 m/s
   C. 5.5 m/s
   D. 1.1 m/s
   E. More information is needed.

13. In a 2-dimensional Cartesian coordinate system the x-component of a given vector is equal to that vector's magnitude multiplied by which trigonometric function, with respect to the angle between vector and x-axis?
   A. sine
   B. cosine
   C. tangent
   D. cotangent
   E. none of the above.

14. In a 2-dimensional Cartesian coordinate system the y-component of a given vector is equal to that vector's magnitude multiplied by which trigonometric function, with respect to the angle between vector and y-axis?
   A. sine
   B. cosine
   C. tangent
   D. cotangent
   E. none of the above
15. A jogger runs halfway around a circular path with a radius of 60 m. What, respectively, are the magnitude of the displacement and the distance jogged?
A. 60 m, 188 m       D. 120 m, 377 m
B. 120 m, 188 m       E. 60 m, 377 m
C. 0 m, 377 m

16. A baseball is thrown by the center fielder (from shoulder level) to home plate where it is caught (on the fly at an equal shoulder level) by the catcher. At what point is the ball's speed at a minimum? (air resistance is negligible)
A. just after leaving the center fielder's hand
B. just before arriving at the catcher's mitt
C. at the top of the trajectory
D. speed is constant during entire trajectory
E. both a and b are correct

17. A baseball is thrown by the center fielder (from shoulder level) to home plate where it is caught (on the fly at shoulder level) by the catcher. At what point is the magnitude of the acceleration at a minimum? (air resistance is negligible)
A. just after leaving the center fielder's hand
B. just before arriving at the catcher's mitt
C. at the top of the trajectory
D. acceleration is constant during entire trajectory
E. both a and b are correct

18. A baseball is thrown by the center fielder (from shoulder level) to home plate where it is caught (on the fly at shoulder level) by the catcher. At what point does the magnitude of the vertical component of velocity have its minimum value? (air resistance is negligible)
A. just after leaving the center fielder's hand
B. just before arriving at the catcher's mitt
C. at the top of the trajectory
D. magnitude of vertical component of velocity is constant
E. both a and b are correct

19. A boat moves through the water in a river at a speed of 8 m/s relative to the water. The boat makes a trip downstream and then makes a return trip upstream to the original starting place. Which trip takes longer?
A. the downstream trip
B. the upstream trip
C. Both trips take the same amount of time.
D. The answer cannot be figured without knowing the speed of the river flow.

04 - THE LAWS OF MOTION
1. Which of the following is an example of the type of force that acts at a distance?
   A. gravitational  
   B. magnetic  
   C. electrical  
   D. all of the above  
   E. both a and b are correct

2. If we know an object is moving at constant velocity, we may assume:
   A. the net force acting on the object is zero.  
   B. there are no forces acting on the object.  
   C. the object is accelerating.  
   D. the object is losing mass.  
   E. the net force acting on the object isn't zero.

3. Which of the following expresses a principle, which was initially stated by Galileo and was later incorporated into Newton's laws of motion?
   A. An object's acceleration is inversely proportional to its mass.  
   B. For every action there is an equal but opposite reaction.  
   C. The natural condition for a moving object is to remain in motion.  
   D. The natural condition for a moving object is to come to rest.  
   E. Forces in nature always exist in pairs.

4. What condition must apply to a system's state of motion for it to be regarded as an inertial frame of reference?
   A. in decreasing velocity  
   B. in constant velocity  
   C. in constant acceleration  
   D. in increasing acceleration  
   E. in increasing velocity

5. A 7.0-kg bowling ball experiences a net force of 5.0 N. What will be its acceleration?
   A. 35 m/s^2  
   B. 7.0 m/s^2  
   C. 5.0 m/s^2  
   D. 0.71 m/s^2  
   E. 0.52 m/s^2

6. An astronaut applies a force of 500 N to an asteroid, and it accelerates at 7.00 m/s^2. What is the asteroid's mass?
   A. 71 kg  
   B. 135 kg  
   C. 441 kg  
   D. 3 500 kg  
   E. 3.600 kg

7. The acceleration due to gravity on the Moon's surface is one-sixth that on Earth. An astronaut's life support backpack weighs 300 lbs on Earth. What does it weigh on the Moon?
   A. 1 800 lb  
   B. 300 lb  
   C. 135 lb  
   D. 50 lb  
   E. 40 lb

8. If we know that a nonzero net force is acting on an object, which of the following must we assume regarding the object's condition? The object is:
A. at rest.  D. losing mass.
B. moving with a constant velocity.  E. both a and b are correct.
C. being accelerated.

9. A cart of weight 20 N is accelerated across a level surface at 0.15 m/s². What net force acts on the wagon? (g = 9.8 m/s²)
   A. 0.92 N  D. 4.5 N
   B. 0.31 N  E. 5.2 N
   C. 3.0 N

10. Rita accelerates a 0.40-kg ball from rest to 9.0 m/s during the 0.15 s in which her foot is in contact with the ball. What average force does she apply to the ball during the kick?
    A. 48 N  D. 60 N
    B. 72 N  E. 76 N
    C. 24 N

11. A 70.0-kg man jumps 1.00 m down onto a concrete walkway. His downward motion stops in 0.0200 seconds. If he forgets to bend his knees, what force is transmitted to his leg bones?
    A. 15 500 N  D. 3 500 N
    B. 7 010 N  E. 2.600 N
    C. 4 900 N

12. The accelerating force of the wind on a small 200-kg sailboat is 707 N northeast. If the drag of the keel is 500 N acting west, what is the acceleration of the boat?
    A. 1.5 m/s² due east  D. 2.0 m/s² north by northwest
    B. 2.5 m/s² due north  E. 1.5 m/s² due west
    C. 3.0 m/s² northeast

13. In the terminology a 500-N block, the 500-N refers to the block's:
    A. mass.  D. None of the above.
    B. force.  E. Both a and c are correct.
    C. weight.

14. The statement by Newton that "for every action there is an opposite but equal reaction" is regarded as which of his laws of motion?
    A. first  D. fourth
    B. second  E. None of the above.
    C. third

15. A thrown stone hits a window, but doesn't break it. Instead it reverses direction and ends up on the ground below the window. In this case, we know:
    A. the force of the stone on the glass > the force of the glass on the stone.
B. the force of the stone on the glass = the force of the glass on the stone.
C. the force of the stone on the glass < the force of the glass on the stone.
D. the stone didn't slow down as it broke the glass.
E. No conclusion can be made with the information given.

16. Two blocks, joined by a string, have masses of 6.0 and 9.0 kg. They rest on a frictionless horizontal surface. A 2nd string, attached only to the 9-kg block, has horizontal force = 30 N applied to it. Both blocks accelerate. Find the tension in the string between the blocks.
A. 18 N
B. 28 N
C. 12 N
D. 15 N
E. 16 N

17. An elevator weighing 20 000 N is supported by a steel cable. What is the tension in the cable when the elevator is being accelerated upward at a rate of 3.00 m/s²? (g = 9.80 m/s²)
A. 13 900 N
B. 23 100 N
C. 20 000 N
D. 26 100 N
E. 17.800 N

18. As I slide a box at constant speed up a frictionless slope, pulling parallel to the slope, the tension in the rope will be:
A. greater than the tension would be if the box were stationary.
B. greater than the weight of the box.
C. equal to the weight of the box.
D. less than the weight of the box.
E. less than the tension would be if the box were stationary.

19. A 500-N tightrope walker stands at the center of the rope. If the rope can withstand a tension of 1 800 N without breaking, what is the minimum angle the rope can make with the horizontal?
A. 4°
B. 8°
C. 10°
D. 15°
E. 18°

20. It is late and Carlos is sliding down a rope from his third floor window to meet his friend Juan. As he slides down the rope faster and faster, he becomes frightened and grabs harder on the rope, increasing the tension in the rope. As soon as the upward tension in the rope becomes equal to his weight:
A. Carlos will stop.
B. Carlos will slow down.
C. Carlos will continue down at a constant velocity.
D. the rope must break.
E. Carlos will accelerate.

21. As a car skids with its wheels locked trying to stop on a road covered with ice and snow, the force of friction between the icy road and the tires will usually be:
A. greater than the normal force of the road times the coefficient of static friction.
B. equal to the normal force of the road times the coefficient of static friction.
C. less than the normal force of the road times the coefficient of static friction.
D. greater than the normal force of the road times the coefficient of kinetic friction.
E. less than the normal force of the road times the coefficient of kinetic friction.

___ 22. A hockey puck moving at 7.0 m/s coasts to a halt in 75 m on a smooth ice surface. What is the coefficient of friction between the ice and the puck?
A. $\mu = 0.025$  
B. $\mu = 0.033$  
C. $\mu = 0.12$
D. $\mu = 0.25$  
E. $\mu = 0.31$

___ 23. A 100-N block, on a 30° incline, is being held motionless by friction. The coefficient of static friction between the block and the plane is 0.60. The force due to friction is:
A. 0 N.  
B. 30 N.  
C. 50 N.  
D. 52 N.  
E. 61 N.
05 - ENERGY

1. The unit of work, joule, is dimensionally the same as:
   A. newton/second.  D. newton-meter.
   B. newton/kilogram  E. newton/meter.
   C. newton-second.

2. Rupel pushes a box 5.00 m by applying a 25.0-N horizontal force. What work does she do?
   A. 10.0 J  D. 550 J
   B. 25.0 J  E. 750 J
   C. 125 J

3. A horizontal force of 100 N is applied to move a 45-kg cart across a 9.0-m level surface. What work is done by the 100-N force?
   A. 405 J  D. 4500 J
   B. 500 J  E. 5600 J
   C. 900 J

4. Which of the following is an example of a non-conservative force?
   A. gravity  D. Both choices A and B are valid.
   B. magnetism  E. Both choices A and C are valid.
   C. friction

5. Which of the following is that form of energy associated with an object's motion?
   A. potential  D. kinetic
   B. thermal  E. nuclear
   C. bio-chemical

6. Which of the following is that form of energy associated with an object's location in a conservative force field?
   A. potential  D. kinetic
   B. thermal  E. nuclear
   C. bio-chemical

7. What is the kinetic energy of a 0.135-kg baseball thrown at 40.0 m/s (90.0 mph)?
   A. 54.0 J  D. 216 J
   B. 87.0 J  E. 256 J
   C. 108 J

8. If both mass and velocity of a ball are tripled, the kinetic energy is increased by a factor of:
   C. 9.
9. If during a given physical process the only force acting on an object is friction, which of the following must be assumed in regard to the object's kinetic energy?
   A. decreases
   B. increases
   C. remains constant
   D. cannot tell from the information given
   E. increases up to the maximum and then remains constant

10. A very light cart holding a 300-N box is moved at constant velocity across a 15-m level surface. What is the net work done in the process?
   A. zero
   B. 1/20 J
   C. 20 J
   D. 2000 J
   E. 4500 J

11. A 7.00-kg bowling ball falls from a 2.00-m shelf. Just before hitting the floor, what will be its kinetic energy? \((g = 9.80 \text{ m/s}^2\) and assume air resistance is negligible)
   A. 14.0 J
   B. 19.6 J
   C. 29.4 J
   D. 137 J
   E. 156 J

12. As an object is lowered into a deep hole in the surface of the earth, which of the following must be assumed in regard to its potential energy?
   A. increase
   B. decrease
   C. remain constant
   D. cannot tell from the information given
   E. increases up to the maximum and then remains constant

13. When an object is dropped from a tower, what is the effect of the air resistance as it falls?
   A. does positive work
   B. increases the object's kinetic energy
   C. increases the object's potential energy
   D. increases the total energy of the object
   E. None of the above choices are valid.

14. Samantha pushes a 50-N crate up a ramp 25.0 m in length and inclined at 10° with the horizontal. What potential energy change does the crate experience?
   A. 13 J
   B. 55 J
   C. 120 J
   D. 220 J
   E. 280 J

15. A hill is 100 m long and makes an angle of 12° with the horizontal. As a 50-kg jogger runs up the hill, how much work does gravity do on the jogger?
   A. 49 000 J
   B. 10 000 J
   C. −10 000 J
   D. zero
   E. −49 000 J

16. A 2.00-kg ball has zero kinetic and potential energy. Ernie drops the ball into a 10.0-m-deep
well. Just before the ball hits the bottom, the sum of its kinetic and potential energy is:
A. zero.  
B. 196 J.  
C. \(-196 \text{ J.}\)  
D. 392 J.  
E. \(-392 \text{ J.}\)

17. Two blocks are released from the top of a building. One falls straight down while the other slides down a smooth ramp. If all friction is ignored, which one is moving faster when it reaches the bottom?
A. The block that went straight down.  
B. The block that went down the ramp.  
C. They both will have the same speed.  
D. Insufficient information to work the problem.

18. The quantity of work equal to one joule is also equivalent to which of the following?
A. watt  
B. watt \(/	ext{s}\)  
C. watt \(\cdot\) s

19. The rate at which work is done is equivalent to which of the following?
A. increase in potential energy  
B. thermal energy  
C. potential energy  
D. power  
E. kinetic energy

20. The unit of power, watt, is dimensionally the same as:
A. joule-second.  
B. joule/second.  
C. joule-meter.

21. A 200-hp engine can deliver, in SI units, an average power of ___. (1 hp = 746 W)
A. 200 W  
B. 74 600 W  
C. 149 000 W

22. The area under the force vs. displacement curve represents:
A. area.  
B. force.  
C. work.
1. A valid unit for momentum is which of the following?
   A. kg×m/s²
   B. kg/m²
   C. kg×m/s
   D. N×m
   E. N/m

2. The dimensional equivalent of the quantity impulse in terms of the fundamental quantities (mass, length, time) is which of the following? M: mass L: length T: time
   A. ML⁻¹T⁻¹
   B. ML²T⁻²
   C. MLT
   D. ML⁻²
   E. ML²T

3. The impulse experienced by a body is equivalent to its change in:
   A. velocity.
   B. kinetic energy.
   C. momentum.
   D. potential energy.
   E. None of the above choices are valid.

4. The dimensional equivalence of the quantity "momentum" in terms of the fundamental quantities (mass, length, time) is:
   A. ML⁻¹T⁻¹
   B. ML²T⁻²
   C. MLT
   D. ML⁻²
   E. ML²T

5. A ball with original momentum +4.0 kg×m/s hits a wall and bounces straight back without losing any kinetic energy. The change in momentum of the ball is:
   A. 0
   B. -4.0 kg×m/s.
   C. 8.0 kg×m/s.
   D. -8.0 kg×m/s.
   E. 4.0 kg×m/s.

6. The units of impulse are equivalent to:
   A. those of energy.
   B. N×m.
   C. kg×m/s.
   D. those of force.
   E. N/m.

7. The law of conservation of momentum is applicable to systems made up of objects described by which of the following?
   A. macroscopic
   B. microscopic
   C. interacting through friction
   D. All the above choices are valid.
   E. None of the above.

8. If the momentum of an object is tripled, its kinetic energy will change by what factor?
   A. zero
   B. one-third
   C. three
   D. nine
   E. None of the above.
9. The kinetic energy of an object is quadrupled. Its momentum will change by what factor?
   A. zero  D. four
   B. two  E. None of the above.
   C. eight

10. A moderate force will break an egg. However, an egg dropped on the road usually breaks, while one dropped on the grass usually doesn't break. This is because for the egg dropped on the grass:
   A. the change in momentum is greater.
   B. the change in momentum is less.
   C. the time interval for stopping is greater.
   D. the time interval for stopping is less.
   E. Both choices A and C are valid.

11. A billiard ball collides in an elastic head-on collision with a second stationary identical ball. After the collision which of the following conditions applies to the first ball?
   A. maintains the same velocity as before
   B. has one half its initial velocity
   C. comes to rest
   D. moves in the opposite direction
   E. Both choices B and D are valid.

12. A billiard ball collides in an elastic head-on collision with a second identical ball. What is the kinetic energy of the system after the collision compared to that before collision?
   A. the same as
   B. one fourth
   C. twice
   D. four times
   E. None of the above choices are valid.

13. In a two-body collision, if the momentum of the system is conserved, then which of the following best describes the kinetic energy after the collision?
   A. must be less
   B. must also be conserved
   C. may also be conserved
   D. is doubled in value
   E. is halved in value

14. In a two-body collision, if the kinetic energy of the system is conserved, then which of the following best describes the momentum after the collision?
   A. must be less
   B. must also be conserved
   C. may also be conserved
   D. is doubled in value
   E. is halved in value

15. If a two-body collision is not head-on, then we may always assume that:
   A. momentum is conserved.
   B. kinetic energy is conserved.
   C. neither momentum nor kinetic energy are conserved.
   D. both momentum and kinetic energy are conserved.
   E. none of the above choices are valid.
16. In a system with two moving objects, when a collision occurs between the objects:
A. the total kinetic energy is always conserved.
B. the total momentum is always conserved.
C. the total kinetic energy and total momentum are always conserved.
D. neither the kinetic energy nor the momentum is conserved.
E. none of the above choices are valid.

17. When a collision is perfectly inelastic, then:
A. all the kinetic energy is conserved.  D. the total momentum is zero.
B. all the kinetic energy is gone.  E. both choices A and C are valid.
C. the participants stick together.

18. A 75-kg swimmer dives horizontally off a 500-kg raft. The diver's speed immediately after
leaving the raft is 4.0 m/s. A micro-sensor system attached to the edge of the raft measures the
time interval during which the diver applies an impulse to the raft just prior to leaving the raft
surface. If the time interval is read as 0.20 s, what is the magnitude of the average horizontal
force by diver on the raft?
A. 900 N  D. 1500 N
B. 450 N  E. 1700 N
C. 525 N

19. Alex throws a 0.15-kg rubber ball down onto the floor. The ball's speed just before impact is
6.5 m/s, and just after is 3.5 m/s. What is the change in the magnitude of the ball's momentum?
A. 0.09 kg×m/s  D. 5.7 kg×m/s
B. 1.5 kg×m/s  E. 126 kg×m/s
C. 4.3 kg×m/s

20. Jerome pitches a baseball of mass 0.20 kg. The ball arrives at home plate with a speed of 40
m/s and is batted straight back to Jerome with a return speed of 60 m/s. What is the magnitude
of change in the ball's momentum?
A. 4.0 kg×m/s  D. 20 kg×m/s
B. 8.0 kg×m/s  E. 24 kg×m/s
C. 18 kg×m/s

21. A 75-kg swimmer dives horizontally off a 500-kg raft. If the diver's speed immediately after
leaving the raft is 4 m/s, what is the corresponding raft speed?
A. 0.2 m/s  D. 4.0 m/s
B. 0.5 m/s  E. 5.0 m/s
C. 0.6 m/s
22. A 70-kg man is standing in a 20-kg boat. The man steps to the right thinking he is stepping out onto the dock. However, the following will actually happen (ignore the friction of the water or air on the boat or the man):
   A. The man only moves a short distance to the right while the boat moves a larger distance to the left.
   B. The man actually stays still while the boat moves toward the left.
   C. The boat doesn't move and the man moves to the right.
   D. The boat and the man don't move.
   E. None of the above.

23. Three satellites are launched into space connected together. Once in deep space, an explosive charge separates the three satellites and they move apart. The satellites each have different masses with \( m_1 < m_2 < m_3 \). Which of the following statements is always true?
   A. The one with mass \( m_1 \) receives the greatest impulse.
   B. The one with mass \( m_3 \) receives the greatest impulse.
   C. The all must receive equal impulses.
   D. Although one or more of the above statements could be true in special cases, they are not always true.
   E. All of the above statements are always false.

24. A 5-kg object is moving to the right at 4 m/s and collides with another object moving to the left at 5 m/s. The objects collide and stick together. After the collision, the combined object:
   A. is moving to the right.
   B. is moving to the left.
   C. is at rest.
   D. has less kinetic energy than the system had before the collision.
   E. has the same kinetic energy that the system had before the collision.
1. 2,600 rev/min is equivalent to which of the following?
   A. 2,600 rad/s  
   B. 43.3 rad/s  
   C. 273 rad/s
   D. 60 rad/s  
   E. 56 rad/s

2. A grindstone spinning at the rate of 8.3 rev/s has what approximate angular speed?
   A. 3.2 rad/s  
   B. 26 rad/s  
   C. 52 rad/s
   D. 81 rad/s  
   E. 97 rad/s

3. A 0.12-m-radius grinding wheel takes 5.5 s to speed up from 2.0 rad/s to 11.0 rad/s. What is the wheel's average angular acceleration?
   A. 9.6 rad/s²  
   B. 4.8 rad/s²  
   C. 1.6 rad/s²
   D. 0.33 rad/s²  
   E. 0.27 rad/s²

4. A 0.30-m-radius automobile tire rotates how many rad after starting from rest and accelerating at a constant 2.0 rad/s² over a 5.0-s interval?
   A. 12.5 rad  
   B. 25 rad  
   C. 2.0 rad
   D. 0.50 rad  
   E. 0.25 rad

5. Starting from rest, a wheel undergoes constant angular acceleration for a period of time T. At what time after the start of rotation does the wheel reach an angular speed equal to its average angular speed for this interval?
   A. 0.25 T  
   B. 0.50 T  
   C. 0.67 T
   D. 0.71 T  
   E. 0.82 T

6. Starting from rest, a wheel undergoes constant angular acceleration for a period of time T. At which of the following times does the average angular acceleration equal the instantaneous angular acceleration?
   A. 0.50 T  
   B. 0.67 T  
   C. 0.71 T
   D. all of the above  
   E. none of the above

7. A ventilation fan has blades 0.25 m in radius rotating at 20 rpm. What is the tangential speed of each blade tip?
   A. 0.02 m/s  
   B. 0.52 m/s  
   C. 5.0 m/s
   D. 20 m/s  
   E. 23 m/s
8. A 0.30-m-radius automobile tire accelerates from rest at a constant 2.0 rad/s² over a 5.0-s interval. What is the tangential component of acceleration for a point on the outer edge of the tire during the 5-s interval?
   A. 33 m/s²  
   B. 6.7 m/s²  
   C. 0.60 m/s²  
   D. 0.30 m/s²  
   E. 0.25 m/s²

9. Consider a point on a bicycle tire that is momentarily in contact with the ground as the bicycle rolls across the ground with constant speed. The direction for the acceleration for this point at that moment is:
   A. upward.  
   B. down toward the ground.  
   C. forward.  
   D. at that moment the acceleration is zero.  
   E. none of the above.

10. A wheel is rotated about a horizontal axle at a constant angular speed. Next it is rotated in the opposite direction with the same angular speed. The acceleration at a point on the top of the wheel in the second case as compared to the acceleration in the first case:
    A. is in the same direction.  
    B. is in the opposite direction.  
    C. is upward.  
    D. is tangential to the wheel.  
    E. none of the above.

11. A ceiling fan is turned on and reaches an angular speed of 120 rev/min in 20 s. It is then turned off and coasts to a stop in an additional 40 s. The ratio of the average angular acceleration for the first 20 s to that for the last 40 s is which of the following?
    A. 2  
    B. 0.5  
    C. -0.5  
    D. -2  
    E. 1.5

12. A Ferris wheel starts at rest and builds up to a final angular speed of 0.70 rad/s while rotating through an angular displacement of 4.9 rad. What is its average angular acceleration?
    A. 0.10 rad/s²  
    B. 0.05 rad/s²  
    C. 1.8 rad/s²  
    D. 0.60 rad/s²  
    E. 0.04 rad/s²

13. A bucket in an old well is hoisted upward by a rope which winds up on a cylinder having a radius of 0.050 m. How many rev/s must the cylinder turn if the bucket is raised at a speed of 0.15 m/s?
    A. 3.0 rev/s  
    B. 1.5 rev/s  
    C. 0.48 rev/s  
    D. 0.24 rev/s  
    E. 0.18 rev/s

14. A point on the rim of a 0.25-m-radius rotating wheel has a centripetal acceleration of 4.0 m/s². What is the angular speed of the wheel?
    A. 1.0 rad/s  
    B. 2.0 rad/s  
    C. 3.2 rad/s  
    D. 4.0 rad/s  
    E. 4.5 rad/s
15. At what speed will a car round a 52-m-radius curve, banked at a 45° angle, if no friction is required between the road and tires to prevent the car from slipping? (g = 9.8 m/s²)

A. 27 m/s  
B. 17 m/s  
C. 23 m/s  
D. 35 m/s  
E. 43 m/s
1. A vault is opened by applying a force of 300 N perpendicular to the plane of the door, 0.80 m from the hinges. Find the torque due to this force about an axis through the hinges.
   A. 120 N·m  
   B. 240 N·m  
   C. 300 N·m  
   D. 360 N·m  
   E. 420 N·m

2. A 3.0-m rod is pivoted about its left end. A force of 6.0 N is applied perpendicular to the rod at a distance of 1.2 m from the pivot causing a ccw torque, and a force of 5.2 N is applied at the end of the rod 3.0 m from the pivot. The 5.2 N is at an angle of 30° to the rod and causes a cw torque. What is the net torque about the pivot?
   A. 15 N·m  
   B. 0 N·m  
   C. -6.3 N·m  
   D. -0.6 N·m  
   E. 6.3 N·m

3. Two children seat themselves on a seesaw. The one on the left has a weight of 400 N while the one on the right weighs 300 N. The fulcrum is at the midpoint of the seesaw. If the child on the left is not at the end but is 1.50 m from the fulcrum and the seesaw is balanced, what is the torque provided by the weight of the child on the right?
   A. 600 N·m  
   B. 450 N·m  
   C. -600 N·m  
   D. -450 N·m  
   E. 0 N·m

4. A bucket filled with water has a mass of 23 kg and is attached to a rope, which in turn, is wound around a 0.050-m radius cylinder at the top of a well. What torque does the weight of water and bucket produce on the cylinder if the cylinder is not permitted to rotate? \( (g = 9.8 \text{ m/s}^2) \)
   A. 34 N·m  
   B. 17 N·m  
   C. 11 N·m  
   D. 23 N·m  
   E. 28 N·m

5. Masses are distributed in the \( x, y \)-plane as follows: 6.0 kg at \((0.0, 0.0)\) m, 4.0 kg at \((2.0, 0.0)\) m, and 5.0 kg at \((2.0, 3.0)\) m. What is the \( x \)-coordinate of the center of gravity of this system of masses?
   A. 18 m  
   B. 2.0 m  
   C. 1.2 m  
   D. 1.0 m  
   E. 0.96 m

6. A hoop of radius 1.0 m is placed in the first quadrant of an \( xy \)-coordinate system with its rim touching both the \( x \)-axis and the \( y \)-axis. What are the coordinates of its center of gravity?
   A. \((1.0, 1.0)\) m  
   B. \((0.7, 0.7)\) m  
   C. \((0.5, 0.5)\) m  
   D. Since there is nothing at the center of the hoop, it has no center of gravity.  
   E. None of the above.
7. An 80-kg man is one fourth of the way up a 10-m ladder that is resting against a smooth, frictionless wall. If the ladder has a mass of 20 kg and it makes an angle of 60° with the ground, find the force of friction of the ground on the foot of the ladder.
A. $7.8 \times 10^2$ N  
B. $2.0 \times 10^2$ N  
C. 50 N
D. $1.7 \times 10^2$ N  
E. 100 N

8. The quantity "moment of inertia" (in terms of the fundamental quantities of mass, length, and time) is equivalent to:
A. $ML^2T^{-2}$  
B. $ML$  
C. $ML^2$
D. $ML^{-1}T^{-2}$  
E. $ML^2$

9. A 4.0-kg mass is placed at (3.0, 4.0) m, and a 6.0-kg mass is placed at (3.0, -4.0) m. What is the moment of inertia of this system of masses about the x-axis?
A. 160 kg·m²  
B. 90 kg·m²  
C. 250 kg·m²
D. 32 kg·m²  
E. 180 kg·m²

10. If a net torque is applied to an object, that object will experience:
A. a constant angular speed.  
B. an angular acceleration.  
C. a constant moment of inertia.  
D. an increasing moment of inertia.  
E. none of the above.

11. According to Newton's second law, the angular acceleration experienced by an object is directly proportional to:
A. its moment of inertia.  
B. the net applied torque.  
C. the object's size.  
D. choices a and b above are both valid.  
E. none of the above.

12. A ventilation fan with a moment of inertia of 0.034 kg·m² has a net torque of 0.11 N·m applied to it. What angular acceleration does it experience?
A. 5.3 rad/s²  
B. 4.0 rad/s²  
C. 3.2 rad/s²
D. 0.31 rad/s²  
E. 0.25 rad/s²

13. A disk has a moment of inertia of $3.0 \times 10^4$ kg·m² and rotates with an angular speed of 3.5 rad/sec. What net torque must be applied to bring it to rest within 3 s?
A. $4.5 \times 10^3$ N·m  
B. $7.5 \times 10^4$ N·m  
C. $3.5 \times 10^4$ N·m
D. $5.0 \times 10^4$ N·m  
E. $2.5 \times 10^4$ N·m
14. The Earth moves about the Sun in an elliptical orbit. As the Earth moves closer to the Sun, which of the following best describes the Earth-Sun system's moment of inertia?
A. decreases  C. remains constant
B. increases  D. none of the above choices are valid

15. A bowling ball has a mass of 7.0 kg, a moment of inertia of $2.8 \times 10^{-2}$ kg\(\cdot\)m\(^2\) and a radius of 0.10 m. If it rolls down the lane without slipping at a linear speed of 4.0 m/s, what is its angular speed?
A. 0.80 rad/s  D. 40 rad/s
B. 10 rad/s  E. 4 rad/s
C. 0.050 rad/s

16. A bucket of water with total mass 23 kg is attached to a rope, which in turn is wound around a 0.050-m radius cylinder at the top of a well. The bucket is raised to the top of the well and released. The bucket is moving with a speed of 8.0 m/s upon hitting the water surface in the well. What is the angular speed of the cylinder at this instant?
A. 39 rad/s  D. 160 rad/s
B. 79 rad/s  E. 190 rad/s
C. 120 rad/s

17. A majorette takes two batons and fastens them together in the middle at right angles to make an "x" shape. Each baton was 0.80 m long and each ball on the end is 0.20 kg. (Ignore the mass of the rods.) What is the moment of inertia if the arrangement is spun around an axis through the center perpendicular to both rods?
A. 0.064 kg\(\cdot\)m\(^2\)  D. 0.32 kg\(\cdot\)m\(^2\)
B. 0.096 kg\(\cdot\)m\(^2\)  E. 0.46 kg\(\cdot\)m\(^2\)
C. 0.13 kg\(\cdot\)m\(^2\)

18. A 40-kg boy is standing on the edge of a stationary 30-kg platform that is free to rotate. The boy tries to walk around the platform in a counterclockwise direction. As he does:
A. the platform doesn't rotate.
B. the platform rotates in a clockwise direction just fast enough so that the boy remains stationary relative to the ground.
C. the platform rotates in a clockwise direction while the boy goes around in a counterclockwise direction relative to the ground.
D. both go around with equal angular velocities but in opposite directions.
E. none of the above.

19. The total kinetic energy of a baseball thrown with a spinning motion is a function of:
A. its linear speed but not rotational speed.
B. both linear and rotational speeds.
C. its rotational speed but not linear speed.
D. neither linear nor rotational speed.
E. none of the above.
20. A bowling ball has a mass of 7.0 kg, a moment of inertia of \(2.8 \times 10^{-2}\) kg\cdot m^2 and a radius of 0.10 m. If it rolls down the lane without slipping at a linear speed of 4.0 m/s, what is its total kinetic energy?

A. 45 J  
B. 32 J  
C. 11 J

21. A cylinder \((I = MR^2/2)\) is rolling along the ground at 7.0 m/s. It comes to a hill and starts going up. Assuming no losses to friction, how high does it get before it stops?

A. 1.2 m  
B. 3.7 m  
C. 4.2 m

22. The quantity "angular momentum" (in terms of the fundamental quantities of mass, length, and time) is equivalent to:

A. \(MLT^{-2}\)  
B. \(ML^2T^{-1}\)  
C. \(ML^{-2}T^{-3}\)  
D. \(ML^3T\)  
E. \(ML^2T^{-1}\)

23. A figure skater with arms initially extended starts spinning on the ice at 3 rad/s. She then pulls her arms in close to her body. Which of the following results?

A. a smaller rotational rate  
B. a greater rotational rate  
C. a greater angular momentum  
D. a smaller angular momentum  
E. both choices B and D are valid.

24. An ice skater spins at 2.5 rev/s when his arms are extended. He draws his arms in and spins at 6.0 rev/s. By what factor does his moment of inertia change in the process?

A. 2.4  
B. 1.0  
C. 0.42  
D. 0.12  
E. 0.10

25. A turntable has a moment of inertia of \(3.00 \times 10^{-2}\) kg\cdot m^2 and spins freely on a frictionless bearing at 25.0 rev/min. A 0.300-kg ball of putty is dropped vertically onto the turntable and sticks at a point 0.100 m from the center. What is the new rate of rotation of the system?

A. 40.8 rev/min  
B. 22.7 rev/min  
C. 33.3 rev/min  
D. 27.2 rev/min  
E. 20.5 rev/min
26. The Earth's gravity exerts no torque on a satellite orbiting the Earth in an elliptical orbit. Compare the motion of the satellite at the point nearest the Earth (perigee) to the motion at the point farthest from the Earth (apogee). At these two points:
A. the tangential velocities are the same.
B. the angular velocities are the same.
C. the angular momenta are the same.
D. the kinetic energies are the same.
E. none of the above.

27. An object with mass m and moment of inertia I is spinning with an angular momentum L. Its kinetic energy is:
A. 0.5 I^2/L.
B. 0.5 L^2/I.
C. 0.5 L^2/m.
D. 0.5 I^2/m.
E. 0.5 I^2/L^2.
09 - GRAVITY

___ 1. An Earth satellite is orbiting at a distance from the Earth's surface equal to one Earth radius (4,000 miles). At this location, the acceleration due to gravity is what factor times the value of g at the Earth's surface?
   A. There is no acceleration since the satellite is in orbit.
   B. 2
   C. 1/2
   D. 1/4
   E. 4

___ 2. A satellite is in a circular orbit about the Earth at a distance of one Earth radius above the surface. What is the speed of the satellite? (The radius of the Earth is 6.4 × 10^6 m, and G = 6.67 × 10^-11 N m^2/kg^2.)
   A. 2,800 m/s
   B. 4,200 m/s
   C. 5,600 m/s
   D. 16,800 m/s
   E. 19,500 m/s

___ 3. Doubling the mean distance from the Sun results in changing the orbital period of revolution by what factor?
   A. 2^{1/2}
   B. 2
   C. 2^{3/2}
   D. 2
   E. 2^4

___ 4. In order for a satellite to be geosynchronous, its orbit must:
   A. go over the North and South Poles.
   B. be over the equator.
   C. be over a single longitude.
   D. emit television signals.
   E. none of the above.

___ 5. According to Kepler's second law, Halley's Comet circles the Sun in an elliptical path with the Sun at one focus of the ellipse. What is at the other focus of the ellipse?
   A. nothing
   B. the Earth
   C. The comet itself passes through the other focus.
   D. The tail of the comet stays at the other ellipse.
   E. the Jupiter

___ 6. At what location does an artificial Earth satellite in elliptical orbit have its greatest speed?
   A. nearest the Earth
   B. farthest from the Earth
   C. between Earth and Moon
   D. between Earth and Sun
   E. nearest the Moon
___ 7. Which of the following best describes the property of the period of orbital revolution for an Earth satellite?
A. greater when the orbital radius is smaller
B. greater when the orbital radius is larger
C. independent of the orbital radius
D. determined mainly by the satellite's mass
E. none of the above

___ 8. Of the eight known planets in our solar system, the innermost is Mercury. When compared to the other planets in the system, Mercury has the:
A. greatest centripetal acceleration.  
B. greatest period of revolution.  
C. smallest angular velocity.  
D. smallest tangential velocity.  
E. both choices A and D are valid.
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