JP's Physics 101 Test Bank 2

Multiple Choice

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

____ 1. The total momentum before a collision is equal to the total momentum after the collision.
A. This is true only for collisions between objects moving in the same direction.
B. This is true for elastic collisions but not for inelastic collisions.
C. This is true for any collision.
D. This is not true for any collisions.
E. This is true for inelastic collisions but not for elastic collisions.

____ 2. An elastic collision is one in which
A. no lasting deformation of either object occurs.
B. both of the two colliding objects are made of a rubbery material.
C. lasting deformation occurs for both of the colliding objects.
D. lasting deformation occurs for one of the two colliding objects.
E. one of the two colliding objects is made of a rubbery material.

____ 3. An inelastic collision is one in which
A. both of the two colliding objects are made of a very rigid material.
B. both of the two colliding objects are made of a rubbery material.
C. the two colliding objects deform, generate heat, or stick together.
D. no lasting deformation of either object occurs.
E. one of the two colliding objects is made of a rubbery material.

____ 4. Which of these is the most accurate statement about momentum in a collision between two objects?
A. Momentum is only conserved if the colliding objects bounce apart.
B. Momentum is only conserved if the collision is elastic.
C. Momentum is never conserved.
D. Momentum is always conserved.
E. Momentum is only conserved if the collision is inelastic.

____ 5. A freight car moving at 20 m/s to the right strikes a stationary freight car of the same mass. If the collision is inelastic,
A. the first car will move left and the second car will move right, both at 20 m/s.
B. the first car will stop and the second car will move away at 20 m/s to the right.
C. the first car will move left and the second car will move right, both at 10 m/s.
D. both cars will move together to the right at 20 m/s.
E. both cars will move together to the right at 10 m/s.

____ 6. A freight car moving at 20 m/s to the right strikes a stationary freight car of the same mass. If the collision is elastic,
A. the first car will move left and the second car will move right, both at 10 m/s.
B. the first car will stop and the second car will move away at 20 m/s to the right.
C. both cars will move together to the right at 10 m/s.
D. both cars will move together to the right at 20 m/s.
E. the first car will move left and the second car will move right, both at 20 m/s.

____ 7. A green ball moving to the right at 3 m/s strikes a yellow ball moving to the left at 2 m/s. If the balls are equally massive and the collision is elastic,
A. the green ball will move to the left at 2 m/s while the yellow ball moves right at 3 m/s.
B. Both balls will stick together and move to the right at 1 m/s.
C. The yellow ball will stop while the green ball moves left at 3 m/s.
D. the green ball will move to the left at 3 m/s while the yellow ball moves right at 2 m/s.
E. The green ball will stop while the yellow ball moves right at 2 m/s.

____ 8. A green ball moving to the right at 3 m/s strikes a yellow ball moving to the left at 2 m/s. If the balls are equally massive and the collision is inelastic,
A. Both balls will stick together and move to the right at 1 m/s.
B. The yellow ball will stop while the green ball moves left at 3 m/s.
C. The green ball will stop while the yellow ball moves right at 2 m/s.
D. the green ball will move to the left at 2 m/s while the yellow ball moves right at 3 m/s.
E. the green ball will move to the left at 3 m/s while the yellow ball moves right at 2 m/s.

____ 9. A freight car moving at 30 m/s to the right strikes a stationary freight car of the same mass. If the two cars couple together, what will be their velocity after the collision?
A. 30 m/s to the right
B. 15 m/s to the left
C. 15 m/s to the right
D. 30 m/s to the left
E. 0 m/s

____ 10. A green ball moving to the right at 2 m/s strikes a yellow ball moving to the left at 3 m/s. If the balls are equally massive and the collision is elastic,
A. the green ball will move to the left at 2 m/s while the yellow ball moves right at 3 m/s.
B. The yellow ball will stop while the green ball moves left at 1 m/s.
C. the green ball will move to the left at 3 m/s while the yellow ball moves right at 2 m/s.
D. The yellow ball will stop while the green ball moves left at 3 m/s.
E. The green ball will stop while the yellow ball moves right at 2 m/s.

____ 11. Impulse is the product of
A. force and velocity.
B. velocity and acceleration.
C. mass and acceleration.
D. force and time.
E. force and inertia.

____ 12. Impulse is equal to the change in ____ of the object on which the impulse acts.
A. force.
B. acceleration.
C. velocity.
D. momentum.
E. mass.

____ 13. In order to minimize the force acting on your bare hand when you catch a baseball, you should
A. move your hand toward the ball as you catch it.
B. think happy thoughts while you catch the ball.
C. keep your hand as motionless as possible as you catch the ball.
D. let the ball bounce off your hand as you catch it.
E. move your hand away from the ball as you catch it.

____ 14. Impulse has the same units as
A. time.
B. force.
C. momentum.
D. acceleration.
E. mass.

____ 15. An impulse of 100 N-s is applied to an object. If this same impulse is delivered over a longer time interval,
A. the acceleration involved will be increased.
B. the force involved will be decreased.
C. the momentum transferred will be decreased.
D. the momentum transferred will be increased.
E. the force involved will be increased.

____ 16. An impulse of 100 N-s is applied to an object. If this same impulse is delivered over a shorter time interval,
A. the acceleration involved will be decreased.
B. the force involved will be increased.
C. the momentum transferred will be increased.
D. the momentum transferred will be decreased.
E. the force involved will be decreased.

____ 17. Whether you slam on the brakes or apply a steady, moderate pressure to the brake pedal, the ____ required to bring your car to a stop will be the same.
A. time.
B. impulse.
C. distance.
D. force.
E. acceleration.

____ 18. ____ is equal to the change in momentum of the object on which it acts.
A. Mass
B. Velocity
C. Acceleration
D. Impulse
E. Force

____ 19. When a bullet is fired from a rifle,
A. the rifle exerts a lesser impulse on the bullet than the bullet exerts on the rifle.
B. the rifle exerts a lesser force on the bullet than the bullet exerts on the rifle.
C. the rifle and the bullet exert impulses of equal magnitude on each other.
D. the rifle exerts a greater force on the bullet than the bullet exerts on the rifle.
E. the rifle exerts a greater impulse on the bullet than the bullet exerts on the rifle.

____ 20. Case 1: A net force of 10 N acts on a mass of 2 kg for a time of 0.1 s.
Case 2: A net force of 10 N acts on a mass of 2 kg for a time of 0.2 s.
Both cases result in acceleration of the mass. In comparison, Case 1 and Case 2 will
A. involve the same impulse and produce different accelerations.
B. involve different impulses and produce the same acceleration.
C. produce the same change of momentum.
D. involve different impulses and produce different accelerations.
E. involve the same impulse and produce the same acceleration.

____ 21. Case 1: A net force of 10 N acts on a mass of 1 kg for a time of 0.2 s.
Case 2: A net force of 10 N acts on a mass of 2 kg for a time of 0.2 s.
Both cases result in acceleration of the mass. In comparison, Case 1 and Case 2 will
A. involve different impulses and produce different accelerations.
B. involve different impulses and produce the same acceleration.
C. involve the same impulse and produce different accelerations.
D. produce different changes of momentum.
E. involve the same impulse and produce the same acceleration.

____ 22. Case 1: A net force of 10 N acts on a mass of 1 kg for a time of 0.2 s.
Case 2: A net force of 20 N acts on a mass of 1 kg for a time of 0.2 s.
Both cases result in acceleration of the mass. In comparison, Case 1 and Case 2 will
A. produce the same change of momentum.
B. involve different impulses and produce different accelerations.
C. involve the same impulse and produce different accelerations.
D. involve different impulses and produce the same acceleration.
E. involve the same impulse and produce the same acceleration.

____ 23. Case 1: A net force of 10 N acts on a mass of 1 kg for a time of 0.2 s.
Case 2: A net force of 20 N acts on a mass of 2 kg for a time of 0.1 s.
Both cases result in acceleration of the mass. In comparison, Case 1 and Case 2 will
A. involve the same impulse and produce different accelerations.
B. involve different impulses and produce the same acceleration.
C. involve different impulses and produce different accelerations.
D. produce different changes of momentum.
E. involve the same impulse and produce the same acceleration.

____ 24. Case 1: A net force of 10 N acts on a mass of 1 kg for a time of 0.2 s.
Case 2: A net force of 20 N acts on a mass of 1 kg for a time of 0.1 s.
Both cases result in acceleration of the mass. In comparison, Case 1 and Case 2 will
A. involve different impulses and produce the same acceleration.
B. involve the same impulse and produce the same acceleration.
C. involve the same impulse and produce different accelerations.
D. produce different changes of momentum.
E. involve different impulses and produce different accelerations.

____ 25. Case 1: A net force of 10 N acts on a mass of 1 kg for a time of 0.1 s.
Case 2: A net force of 20 N acts on a mass of 2 kg for a time of 0.1 s.
Both cases result in acceleration of the mass. In comparison, Case 1 and Case 2 will
A. involve different impulses and produce different accelerations.
B. involve different impulses and produce the same acceleration.
C. involve the same impulse and produce different accelerations.
D. involve the same impulse and produce the same acceleration.
E. produce different changes of momentum.

____ 26. Momentum is the product of
A. force and velocity.
B. force and inertia.
C. velocity and acceleration.
D. mass and velocity.
E. mass and acceleration.

____ 27. If two speeding trucks have the same momentum,
A. they must have the same velocity.
B. the more massive truck must have a greater speed.
C. they must have the same acceleration.
D. they must have the same mass.
E. the more massive truck must have a lower speed.

____ 28. When a bullet is fired from a rifle,
A. the momentum of the bullet is zero.
B. the momentum of the rifle is equal and opposite to the momentum of the bullet.
C. the momentum of the bullet is greater than the momentum of the rifle.
D. the momentum of the rifle is zero.
E. the momentum of the rifle is greater than the momentum of the bullet.

____ 29. When a bullet is fired from a rifle,
A. the velocity of the rifle is zero.
B. the velocity of the rifle is greater than the velocity of the bullet.
C. the velocity of the bullet is zero.
D. the velocity of the rifle is equal and opposite to the velocity of the bullet.
E. the velocity of the bullet is greater than the velocity of the rifle.

____ 30. If two speeding trucks have the same momentum,
A. the less massive truck must have a lower speed.
B. the less massive truck must have a greater speed.
C. they must have the same mass.
D. they must have the same acceleration.
E. they must have the same velocity.

____ 31. When a bullet is fired from a rifle, the rifle and the bullet have
A. the same momentum, but the bullet has a greater inertia.
B. the same inertia and the same momentum.
C. the same inertia, but the rifle has a greater momentum.
D. the same inertia, but the bullet has a greater momentum.
E. the same momentum, but the rifle has a greater inertia.

____ 32. The product of mass and velocity is called _____ .
A. kinetic energy
B. force
C. impulse
D. momentum
E. collision

____ 33. If a moving object doubles its speed, how much momentum will it have?
A. the same amount as before
B. four times as much as before
C. twice as much as before
D. one half as much as before
E. six times as much as before

____ 34. If a moving object triples its speed, how much momentum will it have?
A. six times as much as before
B. one third as much as before
C. the same amount as before
D. nine times as much as before
E. three times as much as before

____ 35. If a moving object cuts its speed in half, how much momentum will it have?
A. four times as much as before
B. one fourth as much as before
C. the same amount as before
D. one half as much as before
E. twice as much as before

____ 36. A 1-kg ball moving horizontally to the right at 3 m/s strikes a wall and rebounds, moving horizontally to the left at the same speed. What is the magnitude of the change in momentum of the ball?
A. 4 kg-m/s
B. 6 kg-m/s
C. 0 kg-m/s
D. 2 kg-m/s
E. 3 kg-m/s

____ 37. A 2-kg ball moving horizontally to the right at 3 m/s strikes a wall and rebounds, moving horizontally to the left at the same speed. What is the magnitude of the change in momentum of the ball?
A. 12 kg-m/s
B. 0 kg-m/s
C. 4 kg-m/s
D. 6 kg-m/s
E. 18 kg-m/s

____ 38. A mass of 12 kg moving to the right with a speed of 4 m/s would have a momentum of ____ kg-m/s.
A. 8
B. 16
C. 1/3
D. 48
E. 3

____ 39. A mass of 2 kg moving to the right with a speed of 6 m/s would have a momentum of ____ kg-m/s.
A. 4
B. 12
C. 1/3
D. 8
E. 3

____ 40. A mass of 2 kg moving to the right with a momentum of 6 kg-m/s would have a speed of ____ m/s.
A. 4
B. 1/3
C. 12
D. 3
E. 8

____ 41. A mass of 3 kg moving to the right with a momentum of 12 kg-m/s would have a speed of ____ m/s.
A. 36
B. 15
C. 4
D. 9
E. 1/4

____ 42. A mass of 2 kg moving to the right with a momentum of 8 kg-m/s would have a speed of ____ m/s.
A. 10
B. 4
C. 16
D. 2
E. 8

____ 43. A mass of 4 kg moving to the right with a momentum of 12 kg-m/s would have a speed of ____ m/s.
A. 12
B. 4
C. 48
D. 8
E. 3

____ 44. Which of these is the most accurate statement about kinetic energy in a collision between two objects?
A. Kinetic energy is only conserved if the colliding objects stick together.
B. Kinetic energy is only conserved if the collision is inelastic.
C. Kinetic energy is only conserved if the collision is elastic.
D. Kinetic energy is always conserved.
E. Kinetic energy is never conserved.

____ 45. Which of these is the most accurate statement about kinetic energy in a collision between two objects?
A. Kinetic energy is only conserved if the collision is inelastic.
B. Kinetic energy is always conserved.
C. Kinetic energy is never conserved.
D. Kinetic energy is only conserved if the colliding objects bounce apart.
E. Kinetic energy is only conserved if the colliding objects stick together.

____ 46. If a collision between two bodies is elastic,
A. the total momentum will be unchanged, but the total kinetic energy will be reduced.
B. the total kinetic energy will be unchanged, but the total momentum will be reduced.
C. both the total momentum and the total kinetic energy will be unchanged.
D. each body will retain its original momentum after the collision.
E. each body will retain its original kinetic energy after the collision.

____ 47. Potential energy is the energy possessed by an object due to its
A. acceleration.
B. momentum.
C. velocity.
D. shape.
E. position.

____ 48. Gravitational potential energy is the product of
A. mass and acceleration.
B. power and time.
C. weight and height.
D. force and distance.
E. momentum and impulse.

____ 49. The formula for kinetic energy is KE = ____ .
A. mv
B. $(1/2)\ mv^2$
C. ma
D. Fd
E. mgh

____ 50. The formula for gravitational potential energy is PE = ____ .
A. mgh
B. ma
C. mv
D. $(1/2)\ mv^2$
E. Fd

____ 51. Which of the following is true?
A. A body with zero velocity cannot have any potential energy.
B. A body with zero acceleration cannot have any kinetic energy.
C. A body with zero potential energy cannot have any velocity.
D. A body with zero acceleration cannot have any potential energy.
E. A body with zero velocity cannot have any kinetic energy.

____ 52. The unit of energy is the joule, which is equal to a
A. kg-m.
B. kg/s.
C. N/s.
D. N-m/s.
E. N-m.

____ 53. The kinetic energy of a body depends on its
A. mass and volume.
B. shape and acceleration.
C. shape and speed.
D. acceleration and volume.
E. mass and speed.

____ 54. The gravitational potential energy of a body depends on its
A. speed and position.
B. mass and volume.
C. weight and position.
D. speed and mass.
E. weight and volume.

____ 55. A skydiver weighing 500 newtons jumps from an airplane at a height of 2000 meters. If there is no air resistance, the skydiver's kinetic energy will equal his potential energy relative to the ground when he is at a height of ____ meters.
A. 1000
B. 500
C. 1
D. 2000
E. 1500

____ 56. A skydiver weighing 500 newtons jumps from an airplane at a height of 2000 meters. At the start of the jump, the skydiver's kinetic energy is ____ joules.
A. 1500
B. 2500
C. 0
D. 100,000
E. 1,000,000

____ 57. If a moving object doubles its speed, how much kinetic energy will it have?
A. one half as much as before
B. the same amount as before
C. four times as much as before
D. twice as much as before
E. six times as much as before

____ 58. If a moving object triples its speed, how much kinetic energy will it have?
A. six times as much as before
B. three times as much as before
C. the same amount as before
D. one third as much as before
E. nine times as much as before

____ 59. If a moving object cuts its speed in half, how much kinetic energy will it have?
A. the same amount as before
B. twice as much as before
C. one fourth as much as before
D. four times as much as before
E. one half as much as before

____ 60. A car traveling 90 km/hr has ___ times the kinetic energy of the same car traveling 30 km/hr.
A. 30
B. 3
C. 9
D. 15
E. 6

____ 61. A car traveling 80 km/hr has ___ times the kinetic energy of the same car traveling 20 km/hr.
A. 2
B. 16
C. 6
D. 4
E. 8

____ 62. A skydiver weighing 500 newtons jumps from an airplane at a height of 2000 meters. At the start of the jump, the skydiver's potential energy is ____ joules relative to the ground.
A. 100,000
B. 4
C. 2500
D. 1,000,000
E. 1500

____ 63. A swinging pendulum has ____ at the bottom (middle) of its arc.
A. maximum total energy
B. maximum potential energy
C. minimum kinetic energy
D. minimum potential energy
E. minimum total energy

____ 64. A swinging pendulum has ____ at the bottom (middle) of its arc.
A. maximum potential energy
B. maximum total energy
C. minimum total energy
D. minimum kinetic energy
E. maximum kinetic energy

____ 65. A swinging pendulum has ____ at the top (end) of its arc.
A. maximum kinetic energy
B. minimum kinetic energy
C. minimum total energy
D. maximum total energy
E. minimum potential energy

____ 66. A swinging pendulum has ____ at the top (end) of its arc.
A. maximum potential energy
B. minimum total energy
C. minimum potential energy
D. maximum kinetic energy
E. maximum total energy

____ 67. If a swinging pendulum has 4 joules of kinetic energy at the bottom (middle) of its arc, its potential energy at the top (end) of its arc will be ____ its potential energy at the bottom (middle) of the arc.
A. 4 joules more than
B. the same as
C. 2 joules more than
D. 2 joules less than
E. 4 joules less than

____ 68. If a swinging pendulum has 4 joules of kinetic energy at the bottom (middle) of its arc, its total energy at the top (end) of its arc will be ____ its total energy at the bottom (middle) of the arc.
A. 2 joules less than
B. 4 joules more than
C. 4 joules less than
D. 2 joules more than
E. the same as

____ 69. If a swinging pendulum has 2 joules of kinetic energy at the bottom (middle) of its arc, its potential energy at the top (end) of its arc will be ____ its potential energy at the bottom (middle) of the arc.
A. the same as
B. 4 joules more than
C. 2 joules less than
D. 4 joules less than
E. 2 joules more than

____ 70. If a swinging pendulum has 2 joules of kinetic energy at the bottom (middle) of its arc, its total energy at the top (end) of its arc will be ____ its total energy at the bottom (middle) of the arc.
A. 4 joules less than
B. 2 joules more than
C. 2 joules less than
D. the same as
E. 4 joules more than

____ 71. Two identical balls of clay rolling in opposite directions collide, stick together, and stop. In this collision
A. neither momentum nor kinetic energy were conserved.
B. momentum and kinetic energy were both conserved.
C. momentum was conserved, but kinetic energy was not.
D. kinetic energy was conserved, but momentum was not.
E. none of the above are true.

____ 72. If two objects of different mass have the same non-zero momentum,
A. the one with less mass will have the greater kinetic energy.
B. the one with more mass will have the greater kinetic energy.
C. they will have the same kinetic energy.
D. the one with the lower speed will have the greater kinetic energy.
E. the one with the higher speed will have the greater mass.

____ 73. If two objects of different mass have the same non-zero momentum,
A. the one with the higher speed will have the greater mass.
B. the one with less mass will have less kinetic energy.
C. they will have the same kinetic energy.
D. the one with the lower speed will have the greater kinetic energy.
E. the one with more mass will have less kinetic energy.

____ 74. A car traveling at 60 km/hr passes a truck going 30 km/hr. If the truck has twice the mass of the car, which of the following is true?
A. The car has the same momentum and four times as much kinetic energy as the truck.
B. The car has the same kinetic energy and twice as much momentum as the truck.
C. The car and the truck have the same momentum and the same kinetic energy.
D. The car has the same kinetic energy and half as much momentum as the truck.
E. The car has the same momentum and twice as much kinetic energy as the truck.

____ 75. A car traveling at 60 km/hr passes a truck going 30 km/hr that has four times the mass of the car. Which of the following is true?
A. The car and the truck have the same momentum and the same kinetic energy.
B. The car has the same kinetic energy and twice as much momentum as the truck.
C. The car has the same momentum and twice as much kinetic energy as the truck.
D. The car has the same kinetic energy and half as much momentum as the truck.
E. The car has the same momentum and four times as much kinetic energy as the truck.

____ 76. If two objects of different mass have the same non-zero kinetic energy,
A. the one with more mass will have the greater momentum.
B. they will have the same momentum.
C. the one with the higher speed will have the greater mass.
D. the one with the higher speed will have the greater momentum.
E. the one with less mass will have the greater momentum.

____ 77. A car traveling at 60 km/hr passes a truck going 30 km/hr that has twice the mass of the car. Which of the following is true?
A. The car has the same momentum and four times as much kinetic energy as the truck.
B. The car and the truck have the same momentum and the same kinetic energy.
C. The car has the same kinetic energy and twice as much momentum as the truck.
D. The car has the same momentum and twice as much kinetic energy as the truck.
E. The car has the same kinetic energy and half as much momentum as the truck.

____ 78. When using a simple lever to raise a heavy object, the ____ input must equal the ____ output if frictional forces are neglected.
A. work; work
B. momentum; momentum
C. impulse; impulse
D. force; force
E. acceleration; acceleration

____ 79. When using a jack as a lever to raise one end of a car off the ground, you are applying a relatively ____ force to raise the car a relatively ____ distance for each push of the jack handle.
A. large; large
B. small; small
C. small; large
D. large; small
E. None of the above -- a jack cannot be used as a lever.

____ 80. When using a jack as a lever to raise one end of a car off the ground, the relatively ____ force applied to the jack handle translates into a relatively ____ force on the car.
A. large; large
B. small; large
C. small; small
D. large; small
E. None of the above -- a jack cannot be used as a lever.

____ 81. When using a jack as a lever to raise one end of a car off the ground, the jack handle is moved a relatively ____ distance in order to lift the car a relatively ____ distance.
A. large; large
B. large; small
C. small; large
D. small; small
E. None of the above -- a jack cannot be used as a lever.

____ 82. Efficiency is the ratio of
A. useful energy output to total energy input.
B. useful energy input to total energy input.
C. total energy input to total energy output.
D. useful energy input to total energy output.
E. useful energy output to total energy output.

____ 83. Real machines are not 100% efficient because
A. that would require the work output to be 100 times the work input, which is impossible.
B. the energy input is always less than the energy output.
C. some of the energy input is always transformed into thermal energy.
D. some of the energy input is always transformed into gravitational potential energy.
E. that would require the work input to be 100 times the work output, which is impossible.

____ 84. A physicist does 100 joules of work on a simple machine that raises a box of books through a height of 0.4 meters. If the efficiency of the machine is 80%, how much work is converted to thermal energy by this process?
A. 20 joules
B. 60 joules
C. 40 joules
D. 80 joules
E. 100 joules

____ 85. A physicist does 100 joules of work on a simple machine that raises a box of books through a height of 0.6 meters. If the efficiency of the machine is 20%, how much work is converted to thermal energy by this process?
A. 60 joules
B. 80 joules
C. 100 joules
D. 20 joules
E. 40 joules

____ 86. A physicist does 100 joules of work on a simple machine that raises a box of books through a height of 0.8 meters. If the efficiency of the machine is 40%, how much work is converted to thermal energy by this process?
A. 60 joules
B. 80 joules
C. 20 joules
D. 100 joules
E. 40 joules

____ 87. A physicist does 100 joules of work on a simple machine that raises a box of books through a height of 0.2 meters. If the efficiency of the machine is 60%, how much work is converted to thermal energy by this process?
A. 60 joules
B. 20 joules
C. 40 joules
D. 100 joules
E. 80 joules

____ 88. Work is equal to the product of
A. velocity and time.
B. mass and velocity.
C. mass and acceleration.
D. force and time.
E. force and distance.

____ 89. _____ is the rate at which work is done.
A. Kinetic energy
B. Impulse
C. Power
D. Potential energy
E. Momentum

____ 90. When you run up two flights of stairs instead of walking up them, you feel more tired because
A. your power output is greater when you run than when you walk.
B. a running person has more inertia than a walking person.
C. you do more work when you run than when you walk.
D. the gravitational force is greater on a running person than on a walking person.
E. the gravitational acceleration is greater on a running person than on a walking person.

____ 91. The work required to move a bowling ball from the sidewalk to the top of a tall building is
A. equal to the weight of the ball times the height of the building.
B. equal to the mass of the ball times the acceleration of gravity.
C. equal to the mass of the ball times the speed at which it is moved to the top of the building.
D. equal to the impulse applied to the ball.
E. equal to the mass of the ball times the height of the building.

____ 92. ____ is the rate at which ____ is done.
A. Friction; power
B. Inertia; acceleration
C. Work; power
D. Energy; work
E. Power; work

____ 93. The work done against gravity in moving a box with a mass of 3 kilograms through a horizontal distance of 5 meters is
A. 15 joules.
B. 15 newtons.
C. 150 joules.
D. 0 joules.
E. 150 newtons.

____ 94. The work done against gravity in moving a box with a mass of 20 kilograms through a horizontal distance of 5 meters is
A. 1000 newtons.
B. 100 joules.
C. 0 joules.
D. 100 newtons.
E. 1000 joules.

____ 95. Max pushed on a heavy crate (mass = 250 kg) for 5 seconds with a force of 200 newtons, but the crate did not move at all. How much work did Max do on the crate?
A. 250,000 J
B. none
C. 1000 J
D. 1250 J
E. 200 J

____ 96. The work done against gravity in moving a box with a mass of 20 kilograms through a height of 5 meters is
A. 100 newtons.
B. 1000 joules.
C. 4 joules.
D. 1000 newtons.
E. 100 joules.

____ 97. The work done against gravity in moving a box with a weight of 20 newtons through a height of 5 meters is
A. 100 newtons.
B. 100 joules.
C. 1000 joules.
D. 4 joules.
E. 1000 newtons.

____ 98. The work done against gravity in moving a box with a weight of 5 newtons through a height of 3 meters is
A. 5/3 joules.
B. 15 joules.
C. 15 newtons.
D. 150 joules.
E. 150 newtons.

____ 99. The work done against gravity in moving a box with a mass of 3 kilograms through a height of 5 meters is
A. 15 joules.
B. 0.6 joules.
C. 150 newtons.
D. 150 joules.
E. 15 newtons.

____100. The work done against gravity in moving a box with a mass of 5 kilograms through a height of 3 meters is
A. 15 newtons.
B. 150 joules.
C. 150 newtons.
D. 5/3 joules.
E. 15 joules.

____101. The work done against gravity in moving a box with a weight of 3 newtons through a height of 5 meters is
A. 15 joules.
B. 15 newtons.
C. 150 joules.
D. 0.6 joules.
E. 150 newtons.

____102. Angular momentum is the product of
A. mass and velocity.
B. acceleration and time.
C. linear momentum and angle.
D. rotational inertia and rotational velocity.
E. force and impulse.

____103. A moving bicycle is more stable against tipping than a non-moving bicycle
A. because of the kinetic energy of the bicycle and rider.
B. because of the linear momentum of the bicycle and rider.
C. because of the gravitational potential energy of the rider.
D. because of the friction of the bicycle tires with the ground.
E. because of the angular momentum of the spinning wheels.

____104. An unbalanced external torque acting on an object will cause a change in the object's
A. potential energy.
B. mass.
C. angular momentum.
D. linear momentum.
E. weight.

____105. A platform diver performing a somersault maneuver is changing her ____ but not her ____ .
A. angular momentum; gravitational potential energy
B. kinetic energy; linear momentum
C. linear momentum; rotational speed
D. gravitational potential energy; kinetic energy
E. rotational speed; angular momentum

____106. As a spinning ice skater pulls her arms in toward her body,
A. her angular momentum increases, due to conservation of rotational speed.
B. her rotational speed decreases, due to conservation of angular momentum.
C. her rotational speed remains constant, due to conservation of angular momentum.
D. her rotational speed increases, due to conservation of angular momentum.
E. her angular momentum decreases, due to conservation of rotational speed.

____107. As a spinning ice skater moves her arms out away from her body,
A. her angular momentum increases, due to conservation of rotational speed.
B. her rotational speed increases, due to conservation of angular momentum.
C. her angular momentum decreases, due to conservation of rotational speed.
D. her rotational speed decreases, due to conservation of angular momentum.
E. her rotational speed remains constant, due to conservation of angular momentum.

____108. When angular momentum is conserved, rotational speed
A. must be constant.
B. increases if the mass moves closer to the axis of rotation.
C. decreases if the mass moves closer to the axis of rotation.
D. may increase, but can never decrease.
E. may decrease, but can never increase.

____109. When angular momentum is conserved, rotational speed
A. may increase, but can never decrease.
B. decreases if the mass moves farther from the axis of rotation.
C. increases if the mass moves farther from the axis of rotation.
D. must be constant.
E. may decrease, but can never increase.

____110. The center of mass of an object
A. must always coincide with some of the object's mass.
B. must lie inside the object's surface.
C. is the average position of the object's mass.
D. is always at its midpoint.
E. always moves in a straight line when the object is thrown into the air.

____111. When you stand in equilibrium on only one foot,
A. your center of mass will be directly above the other foot.
B. your rotational inertia will be zero.
C. your center of mass will be directly above that foot.
D. you will always fall over.
E. your center of mass will be directly above a point equidistant between your two feet.

____112. The center of mass of a meter stick is approximately ___ centimeters from the end of the stick.
A. 0
B. 500
C. 100
D. 10
E. 50

____113. The center of mass of a meter stick is approximately ___ millimeters from the end of the stick.
A. 50
B. 0
C. 100
D. 500
E. 10

____114. A centrifugal force is an apparent force that is
A. against the direction of motion of an object.
B. directed toward the center of curvature of the path of a moving object.
C. directed toward the center of the Earth.
D. in the direction of motion of an object.
E. directed away from the center of curvature of the path of a moving object.

____115. When a car rounds a curve to the left at high speed, the passengers experience the illusion of being acted upon by
A. an upward-directed centrifugal force.
B. a centrifugal force directed to the left.
C. a centripetal force directed to the right.
D. a centrifugal force directed to the right.
E. an upward-directed centripetal force.

____116. A centrifugal force is
A. a real force caused by gravity.
B. an apparent force caused by rotational motion.
C. a real force caused by rotational motion.
D. a real force that is the reaction force to a centripetal force.
E. an apparent force caused by gravity.

____117. When a car rounds a curve to the right at high speed, the passengers experience the illusion of being acted upon by
A. a centrifugal force directed to the right.
B. a centrifugal force directed to the left.
C. an upward-directed centrifugal force.
D. an upward-directed centripetal force.
E. a centripetal force directed to the left.

____118. A centripetal force is one that is
A. against the direction of motion of an object.
B. directed toward the center of the Earth.
C. directed toward the center of curvature of the path of a moving object.
D. directed away from the center of curvature of the path of a moving object.
E. in the direction of motion of an object.

____119. When you whirl a rock tied to a string in a horizontal circle around your head,
A. the rock exerts a centripetal force on the string.
B. the string exerts a centripetal force on the rock.
C. the Earth exerts a centripetal force on the rock.
D. the string exerts a centripetal force on your hand.
E. there are no centripetal forces involved.

____120. When a car rounds a curve at high speed,
A. the road exerts a centripetal force on the tires.
B. the car body exerts a centripetal force on the tires.
C. there are no centripetal forces involved.
D. the car exerts a centripetal force on the road.
E. the tires exert a centripetal force on the road.

____121. When a car rounds a curve at high speed,
A. there are no centripetal forces involved.
B. the car exerts a centripetal force on the road.
C. the tires exert a centripetal force on the road.
D. the car exerts a centripetal force on the driver.
E. the car body exerts a centripetal force on the tires.

____122. As you whirl a rock tied to a string in a horizontal circle around your head, the string suddenly breaks; what happens?
A. The rock will move inward and strike you on the head.
B. The rock will move along a straight line tangent to the circle while curving toward the ground.
C. The rock will move outward directly away from your head while curving toward the ground.
D. The rock will continue to move in a circle about your head.
E. The rock will fall straight to the ground.

____123. On a spinning disk, points closer to the outer edge will have ____ points near the center.
A. the same tangential speed as and greater rotational speed than
B. the same rotational speed as and greater tangential speed than
C. lower rotational speed and higher tangential speed than
D. the same tangential speed as and lower rotational speed than
E. the same rotational speed as and lower tangential speed than

____124. On a spinning disk, points closer to the center will have ____ points near the outer edge.
A. the same tangential speed as and greater rotational speed than
B. the same tangential speed as and lower rotational speed than
C. the same rotational speed as and greater tangential speed than
D. lower rotational speed and higher tangential speed than
E. the same rotational speed as and lower tangential speed than

____125. On the rotating Earth, points that have the highest tangential speed will be located at
A. Mankato.
B. the Equator.
C. the South Pole.
D. the North Pole.
E. (None of these -- all points on the Earth have the *same* tangential speed.)

____126. On the rotating Earth, points that have the highest rotational speed will be located at
A. Mankato.
B. the Equator.
C. the North Pole.
D. the South Pole.
E. (None of these -- all points on the Earth have the *same* rotational speed.)

____127. An object moving in a circular path
A. must be slowing down.
B. must be moving at a constant velocity.
C. must be moving at a constant speed.
D. must be accelerating.
E. must be speeding up.

____128. A merry-go-round rotates 9 times each minute such that a point on its rim moves at a rate of 3 m/s. At a point 2/3 of the way out from the center to the rim, the rotational speed would be ____ .
A. 6 RPM
B. 9 RPM
C. 2 m/s
D. 3 RPM
E. 3 m/s

____129. A merry-go-round rotates 8 times each minute such that a point on its rim moves at a rate of 4 m/s. At a point halfway out from the center to the rim, the rotational speed would be ____ .
A. 2 RPM
B. 4 RPM
C. 2 m/s
D. 8 RPM
E. 4 m/s

____130. A merry-go-round rotates 9 times each minute such that a point on its rim moves at a rate of 3 m/s. At a point 1/3 of the way out from the center to the rim, the rotational speed would be ____ .
A. 9 RPM
B. 3 RPM
C. 6 RPM
D. 1 m/s
E. 3 m/s

____131. A merry-go-round rotates 8 times each minute such that a point on its rim moves at a rate of 4 m/s. At a point 3/4 of the way out from the center to the rim, the rotational speed would be ____ .
A. 6 RPM
B. 6 m/s
C. 3/4 RPM
D. 8 RPM
E. 3/4 m/s

____132. A merry-go-round rotates 9 times each minute such that a point on its rim moves at a rate of 3 m/s. At a point 2/3 of the way out from the center to the rim, the tangential speed would be ____ .
A. 3 m/s
B. 2 m/s
C. 3 RPM
D. 9 RPM
E. 6 RPM

____133. A merry-go-round rotates 8 times each minute such that a point on its rim moves at a rate of 4 m/s. At a point halfway out from the center to the rim, the tangential speed would be ____ .
A. 8 RPM
B. 2 RPM
C. 4 m/s
D. 2 m/s
E. 4 RPM

____134. A merry-go-round rotates 9 times each minute such that a point on its rim moves at a rate of 3 m/s. At a point 1/3 of the way out from the center to the rim, the tangential speed would be ____ .
A. 3 RPM
B. 1 m/s
C. 3 m/s
D. 2 m/s
E. 9 RPM

____135. A merry-go-round rotates 8 times each minute such that a point on its rim moves at a rate of 4 m/s. At a point 3/4 of the way out from the center to the rim, the tangential speed would be ____ .
A. 8 RPM
B. 6 m/s
C. 0.75 m/s
D. 3 m/s
E. 6 RPM

____136. The rotational inertia of an object depends on
A. the rotational speed of the object.
B. the volume of the object.
C. the weight of the object.
D. the mass of the object and its distribution with respect to the axis of rotation.
E. the color of the object.

____137. A tightrope walker carries a long pole because
A. the pole is filled with helium gas and tends to float in the air.
B. he can use it to break his fall if he loses his balance.
C. the pole decreases his rotational inertia.
D. the pole is made of a material that is not affected by gravity.
E. the pole increases his rotational inertia.

____138. An empty soup can and a full one are rolled side-by-side down an incline. If they start together, which one will reach the bottom first?
A. The empty can arrives first.
B. It depends on the diameters of the cans.
C. The full can arrives first.
D. They will arrive together.
E. It depends on the kind of soup.

____139. An empty soup can and a full one are rolled side-by-side down an incline. If they start together, which one will roll more slowly?
A. It depends on the diameters of the cans.
B. The empty can will be slower.
C. They will roll at the same rate.
D. It depends on the kind of soup.
E. The full can will be slower.

____140. A mass m is tied to a string and swung in a horizontal circle of radius r; the rotational inertia of this system is ____ .
A. mr^2
B. rm^2
C. m/r^2
D. m/r
E. mr

____141. The rotational inertia of a sphere of mass m and radius r is proportional to ____ .
A. m/r^2
B. mr^2
C. m/r
D. rm^2
E. mr

____142. A mass of 1 kilogram is tied to a string and swung in a horizontal circle of radius 1 meter; if the radius of the circle is then increased to 2 meters, the rotational inertia of this new system will be ____ as before.
A. the same
B. twice as much
C. four times as much
D. one fourth as much
E. one half as much

____143. A mass of 1 kilogram is tied to a string and swung in a horizontal circle of radius 1 meter; if the radius of the circle is then decreased to 0.5 meter, the rotational inertia of this new system will be ____ as before.
A. one fourth as much
B. the same
C. four times as much
D. twice as much
E. one half as much

____144. A mass of 1 kilogram is tied to a string and swung in a horizontal circle of radius 1 meter; if the mass is then decreased to 0.5 kilogram, the rotational inertia of this new system will be ____ as before.
A. one fourth as much
B. four times as much
C. twice as much
D. one half as much
E. the same

____145. A mass of 1 kilogram is tied to a string and swung in a horizontal circle of radius 1 meter; if the mass is then increased to 2 kilograms, the rotational inertia of this new system will be ____ as before.
A. twice as much
B. one half as much
C. the same
D. one fourth as much
E. four times as much

____146. Torque is the product of
A. mass and radius.
B. lever arm and force.
C. rotational inertia and velocity.
D. force and velocity.
E. lever arm and rotational inertia.

____147. A doorknob is normally placed near the edge of the door opposite the hinges. This is because
A. the door would look funny with the knob in any other position.
B. that is where the door's rotational inertia will be lowest.
C. a force at this position will produce a minimum torque.
D. a force at this position will produce a maximum torque.
E. that is where the door's center of mass is located.

____148. To obtain the maximum torque for a given force when using a wrench, the force should be applied at a ____ degree angle to the handle of the wrench.
A. 30
B. 90
C. 180
D. 60
E. 45

____149. A 60-kg grandfather and his 30-kg granddaughter are balanced on a seesaw. If the grandfather is sitting 1 meter from the pivot point, the granddaughter must be sitting ____ from it.
A. 2 meters
B. 1 meter
C. 3 meters
D. 6 meters
E. 0.5 meter

____150. A 75-kg grandfather and his 30-kg granddaughter are balanced on a seesaw. If the grandfather is sitting 1 meter from the pivot point, the granddaughter must be sitting ____ from it.
A. 2.5 meters
B. 0.5 meter
C. 7.5 meters
D. 5 meters
E. 1.5 meters

____151. A 60-kg grandfather and his 30-kg granddaughter are balanced on a seesaw. If the granddaughter is sitting 2 meters from the pivot point, the grandfather must be sitting ____ from it.
A. 2 meters
B. 1 meter
C. 0.5 meter
D. 3 meters
E. 4 meters

____152. A 75-kg grandfather and his 30-kg granddaughter are balanced on a seesaw. If the granddaughter is sitting 2 meters from the pivot point, the grandfather must be sitting ____ from it.
A. 2 meters
B. 0.5 meter
C. 5 meters
D. 0.8 meter
E. 2.5 meters

____153. A 60-kg grandfather and his 20-kg granddaughter are balanced on a seesaw. If the grandfather is sitting 1 meter from the pivot point, the granddaughter must be sitting ____ from it.
A. 3 meters
B. 1 meter
C. 2 meters
D. 20 meters
E. 6 meters

____154. A 60-kg grandfather and his 20-kg granddaughter are balanced on a seesaw. If the granddaughter is sitting 3 meters from the pivot point, the grandfather must be sitting ____ from it.
A. 18 meters
B. 9 meters
C. 1 meter
D. 20 meters
E. 3 meters

____155. A 60-kg grandfather and his 15-kg granddaughter are balanced on a seesaw. If the grandfather is sitting 0.5 meter from the pivot point, the granddaughter must be sitting ____ from it.
A. 7.5 meters
B. 4 meters
C. 15 meters
D. 1 meter
E. 2 meters

____156. A 60-kg grandfather and his 15-kg granddaughter are balanced on a seesaw. If the granddaughter is sitting 2 meters from the pivot point, the grandfather must be sitting ____ from it.
A. 4 meters
B. 1 meter
C. 0.5 meter
D. 15 meters
E. 30 meters

____157. A meter stick is balanced on a fulcrum positioned at the 50 cm mark. If a 100 gram weight is hung at the 20 cm mark, where should another 100 gram weight be hung to balance the stick?
A. at the 80 cm mark
B. at the 20 cm mark
C. at the 70 cm mark
D. at the 30 cm mark
E. at the 50 cm mark

____158. A meter stick is balanced on a fulcrum positioned at the 50 cm mark. If a 100 gram weight is hung at the 30 cm mark, where should another 100 gram weight be hung to balance the stick?
A. at the 70 cm mark
B. at the 50 cm mark
C. at the 30 cm mark
D. at the 80 cm mark
E. at the 20 cm mark

____159. A meter stick is balanced on a fulcrum positioned at the 50 cm mark. If a 100 gram weight is hung at the 70 cm mark, where should another 100 gram weight be hung to balance the stick?
A. at the 70 cm mark
B. at the 30 cm mark
C. at the 80 cm mark
D. at the 20 cm mark
E. at the 50 cm mark

____160. A meter stick is balanced on a fulcrum positioned at the 50 cm mark. If a 100 gram weight is hung at the 80 cm mark, where should another 100 gram weight be hung to balance the stick?
A. at the 50 cm mark
B. at the 30 cm mark
C. at the 20 cm mark
D. at the 80 cm mark
E. at the 70 cm mark

____161. A meter stick is balanced on a fulcrum positioned at the 50 cm mark. If a 100 gram weight is hung at the 70 cm mark, where should a 200 gram weight be hung to balance the stick?
A. at the 20 cm mark
B. at the 40 cm mark
C. at the 60 cm mark
D. at the 30 cm mark
E. at the 80 cm mark

____162. A meter stick is balanced on a fulcrum positioned at the 50 cm mark. If a 100 gram weight is hung at the 20 cm mark, where should a 300 gram weight be hung to balance the stick?
A. at the 70 cm mark
B. at the 10 cm mark
C. at the 80 cm mark
D. at the 60 cm mark
E. at the 30 cm mark