

**Mid Year Exam Review (Revised 12-30-2011)****Multiple Choice**

*Identify the letter of the choice that best completes the statement or answers the question.*

- \_\_\_\_\_ 1. A hypothesis is
- the long side of a right triangle.
  - an educated guess that has yet to be proven by experiment.
  - close agreement by competent observers of observations of the same phenomena.
  - a guess that has been tested over and over again and always found to be true.
  - a synthesis of a large collection of information that includes guesses.
- \_\_\_\_\_ 2. One possible unit of speed is
- miles per hour.
  - light years per century.
  - kilometers per hour.
  - all of the above.
  - none of the above.
- \_\_\_\_\_ 3. When you look at the speedometer in a moving car, you can see the car's
- average distance traveled.
  - instantaneous acceleration.
  - average speed.
  - instantaneous speed.
  - average acceleration.
- \_\_\_\_\_ 4. Acceleration is defined as the CHANGE in
- time it takes to move from one place to another place.
  - velocity of an object.
  - distance divided by the time interval.
  - velocity divided by the time interval.
  - time it takes to move from one speed to another speed.
- \_\_\_\_\_ 5. Suppose you are in a car that is going around a curve. The speedometer reads a constant 30 miles per hour. Which of the following is NOT true?
- You and the car are accelerating.
  - Your acceleration is constantly changing.
  - Your velocity is constant.
  - Your direction is constantly changing.
  - Your speed is constant.
- \_\_\_\_\_ 6. A train travels 6 meters in the first second of travel, 6 meters again during the second second of travel, and 6 meters again during the third second. Its acceleration is
- $0 \text{ m/s}^2$ .
  - $6 \text{ m/s}^2$ .
  - $12 \text{ m/s}^2$ .
  - $18 \text{ m/s}^2$ .
  - none of the above

- \_\_\_\_\_ 7. A car starts from rest and after 7 seconds it is moving at 42 m/s. What is the car's average acceleration?
- 0.17 m/s<sup>2</sup>
  - 1.67 m/s<sup>2</sup>
  - 6 m/s<sup>2</sup>
  - 7 m/s<sup>2</sup>
  - none of the above
- \_\_\_\_\_ 8. As an object falls freely in a vacuum, its
- velocity increases.
  - acceleration increases.
  - both A and B.
  - none of the above.
- \_\_\_\_\_ 9. Suppose an object is in free fall. Each second the object falls
- the same distance as in the second before.
  - a larger distance than in the second before.
  - with the same instantaneous speed.
  - with the same average speed.
  - none of the above
- \_\_\_\_\_ 10. If you drop a feather and a coin at the same time in a tube filled with air, which will reach the bottom of the tube first?
- The feather
  - Neither—they will both reach the bottom at the same time.
  - The coin
- \_\_\_\_\_ 11. Consider drops of water leaking from a water faucet. As the drops fall they
- remain at a relatively fixed distance from each other.
  - get farther apart.
  - get closer together.
- \_\_\_\_\_ 12. A ball tossed vertically upward rises, reaches its highest point, and then falls back to its starting point. During this time the acceleration of the ball is always
- in the direction of motion.
  - opposite its velocity.
  - directed downward.
  - directed upward.
- \_\_\_\_\_ 13. The hang time (time one's feet are off the ground in a jump) for most athletes is
- less than 1 second.
  - considerably more than 1 second.
  - about 1 second.
  - slightly more than 1 second.
- \_\_\_\_\_ 14. When a basketball player jumps to make a shot, once the feet are off the floor, the jumper's acceleration
- varies with body orientation.
  - depends on launch speed.
  - is usually greater for taller players (but not always).
  - depends on all the above.
  - is  $g$ ; no more, no less.

- \_\_\_\_\_ 15. Suppose you take a trip that covers 180 km and takes 3 hours to make. Your average speed is
- 30 km/h.
  - 60 km/h.
  - 180 km/h.
  - 360 km/h.
  - 540 km/h.
- \_\_\_\_\_ 16. Suppose a car is moving in a straight line and steadily increases its speed. It moves from 35 km/h to 40 km/h the first second and from 40 km/h to 45 km/h the next second. What is the car's acceleration?
- 5 km/h·s
  - 10 km/h·s
  - 35 km/h·s
  - 40 km/h·s
  - 45 km/h·s
- \_\_\_\_\_ 17. A ball is thrown straight up. At the top of its path its instantaneous speed is
- 0 m/s.
  - about 5 m/s.
  - about 10 m/s.
  - about 20 m/s.
  - about 50 m/s.
- \_\_\_\_\_ 18. A ball is thrown straight up. At the top of its path its acceleration is
- 0 m/s<sup>2</sup>.
  - about 5 m/s<sup>2</sup>.
  - about 10 m/s<sup>2</sup>.
  - about 20 m/s<sup>2</sup>.
  - about 50 m/s<sup>2</sup>.
- \_\_\_\_\_ 19. When something falls to the ground, it accelerates. This acceleration is called the acceleration due to gravity and is symbolized by the letter  $g$ . What is the value of  $g$  on Earth's surface?
- 0 m/s<sup>2</sup>
  - about 5 m/s<sup>2</sup>
  - about 10 m/s<sup>2</sup>
  - about 20 m/s<sup>2</sup>
  - about 50 m/s<sup>2</sup>
- \_\_\_\_\_ 20. A car accelerates at 2 m/s<sup>2</sup>. Assuming the car starts from rest, how much time does it need to accelerate to a speed of 20 m/s?
- 2 seconds
  - 10 seconds
  - 20 seconds
  - 40 seconds
  - none of the above
- \_\_\_\_\_ 21. If a freely falling object were somehow equipped with a speedometer, its speed reading would increase each second by
- about 5 m/s.
  - about 10 m/s.
  - about 15 m/s.
  - a variable amount.
  - a rate that depends on its initial speed.

- \_\_\_\_\_ 22. If a ball were equipped with a speedometer and allowed to fall freely on a planet where the acceleration due to gravity is  $23 \text{ m/s}^2$ , the reading on the speedometer would increase each second by
- a rate that depends on its initial speed.
  - 10 m/s.
  - 12 m/s.
  - 23 m/s.
  - 46 m/s.
- \_\_\_\_\_ 23. If you drop a feather and a coin at the same time in a vacuum tube, which will reach the bottom of the tube first?
- Neither—they will both reach the bottom at the same time.
  - The coin
  - The feather
- \_\_\_\_\_ 24. If a projectile is fired straight up at a speed of 30 m/s, the total time to return to its starting point is about
- 3 second.
  - 6 seconds.
  - 30 seconds.
  - 60 seconds.
  - not enough information to estimate.
- \_\_\_\_\_ 25. The vertical height attained by a basketball player who achieves a hang time of a full one second is about
- 0.8 m.
  - 1 m.
  - 1.2 m.
  - 2.5 m.
  - more than 2.5 m.
- \_\_\_\_\_ 26. Suppose a jumper claims a hang time of 2 seconds. Then that jumper must be able to jump a vertical distance of
- 1 m.
  - 2 m.
  - 3 m.
  - 4 m.
  - 5 m.
- \_\_\_\_\_ 27. The law of inertia applies to
- objects at rest.
  - moving objects.
  - both moving and nonmoving objects.
- \_\_\_\_\_ 28. After a cannonball is fired into frictionless space, the amount of force needed to keep it going equals
- zero, since no force is necessary to keep it moving.
  - twice the force with which it was fired.
  - one half the force with which it was fired.
  - the same amount of force with which it was fired.
  - one quarter the force with which it was fired.
- \_\_\_\_\_ 29. A sheet of paper can be withdrawn from under a container of milk without toppling it if the paper is jerked quickly. The reason this can be done is that
- gravity pulls very hard on the milk carton.
  - the milk carton has very little weight.
  - the milk carton has inertia.
  - none of the above

- \_\_\_\_\_ 30. Compared to its weight on Earth, a 10-kg object on the moon will weigh
- the same amount.
  - less.
  - more.
- \_\_\_\_\_ 31. Compared to its mass on Earth, the mass of a 10-kg object on the moon is
- the same.
  - more.
  - less.
- \_\_\_\_\_ 32. The mass of a sheep that weighs 110 N is about
- 1 kg.
  - 11 kg.
  - 110 kg.
  - 1100 kg.
  - none of the above
- \_\_\_\_\_ 33. An object following a straight-line path at constant speed
- has no forces acting on it.
  - has a net force acting on it in the direction of motion.
  - has zero acceleration.
  - must be moving in a vacuum.
  - none of the above
- \_\_\_\_\_ 34. Friction
- comes from microscopic bumps that act as obstructions to the object's motion.
  - is the name given to the force acting between surfaces sliding past one another.
  - acts in a direction that opposes the motion of an object.
  - all of the above
  - none of the above
- \_\_\_\_\_ 35. A 15-N force and a 45-N force act on an object in opposite directions. What is the net force on the object?
- 15 N
  - 30 N
  - 45 N
  - 60 N
  - none of the above
- \_\_\_\_\_ 36. You would have the largest mass of gold if your chunk of gold weighed 1 N on
- Earth.
  - Jupiter.
  - the moon.
- \_\_\_\_\_ 37. Equilibrium occurs when
- all the forces acting on an object are balanced.
  - the sum of the  $+x$  forces on an object equals the sum of the  $-x$  forces.
  - the net force on the object is zero.
  - the sum of the upward forces equals the sum of the downward forces.
  - all of the above
- \_\_\_\_\_ 38. What would be the safest way to put up a clothesline?
- It doesn't make any difference which way the line is strung.
  - With the line very tight
  - With some slack in the line

- \_\_\_\_\_ 39. Friction is a force that always acts
- perpendicular to an object's motion.
  - opposite to an object's motion.
  - in the same direction as an object's motion.
- \_\_\_\_\_ 40. What is the maximum resultant possible when adding a 2-N force to an 8-N force?
- 2 N
  - 6 N
  - 8 N
  - 10 N
  - 16 N
- \_\_\_\_\_ 41. The weight of a person can be represented by a vector that acts
- in a direction that depends on where the person is standing.
  - perpendicular to the ground underneath the person.
  - parallel to the ground.
  - straight down, even if the person is standing on a hill.
  - all of the above
- \_\_\_\_\_ 42. Which has more mass, a kilogram of feathers or a kilogram of iron?
- The feathers
  - The iron
  - Neither—they both have the same mass.
- \_\_\_\_\_ 43. How much does a 3.0-kg bag of bolts weigh?
- 7.2 N
  - 14.4 N
  - 22.8 N
  - 29.4 N
  - 58.8 N
- \_\_\_\_\_ 44. A bag of sports equipment has a mass of 10.0 kilograms and a weight of
- 0.98 N.
  - 9.8 N.
  - 98 N.
  - 980 N.
  - none of the above
- \_\_\_\_\_ 45. A 5-N force and a 30-N force act in the same direction on an object. What is the net force on the object?
- 5 N
  - 25 N
  - 30 N
  - 35 N
  - none of the above
- \_\_\_\_\_ 46. An object weighs 30 N on Earth. A second object weighs 30 N on the moon. Which has the greater mass?
- The one on Earth
  - The one on the moon
  - They have the same mass.
  - Not enough information to say

- \_\_\_\_\_ 47. What is the minimum resultant possible when adding a 5-N force to an 8-N force?
- 5 N
  - 3 N
  - 8 N
  - 13 N
  - 40 N
- \_\_\_\_\_ 48. Accelerations are produced by
- forces.
  - velocities.
  - accelerations.
  - masses.
  - none of the above
- \_\_\_\_\_ 49. The acceleration produced by a net force on an object is
- inversely proportional to the mass of the object.
  - directly proportional to the magnitude of the net force.
  - in the same direction as the net force.
  - all of the above
  - none of the above
- \_\_\_\_\_ 50. When an object reaches terminal velocity its acceleration is
- 0 m/s<sup>2</sup>.
  - 4.9 m/s<sup>2</sup>.
  - 9.8 m/s<sup>2</sup>.
- \_\_\_\_\_ 51. A heavy person and a light person parachute together and wear the same size parachutes. Assuming they open their parachutes at the same time, which person reaches the ground first?
- the light person
  - the heavy person
  - Neither -- they both reach the ground together.
- \_\_\_\_\_ 52. When a woman stands with two feet on a scale, the scale reads 280 N. When she lifts one foot, the scale reads
- less than 280 N.
  - more than 280 N.
  - 280 N.
- \_\_\_\_\_ 53. A book weighs 4 N. When held at rest in your hands, the net force on the book is
- 0 N.
  - 0.4 N.
  - 4 N.
  - 39 N.
  - none of the above
- \_\_\_\_\_ 54. An apple weighs 1 N. The net force on the apple when it is in free fall is
- 0 N.
  - 0.1 N.
  - 1 N.
  - 9.8 N.
  - none of the above

- \_\_\_\_\_ 55. A girl pulls on a 10-kg wagon with a constant force of 20 N. What is the wagon's acceleration?
- 0.5 m/s<sup>2</sup>
  - 2 m/s<sup>2</sup>
  - 10 m/s<sup>2</sup>
  - 20 m/s<sup>2</sup>
  - 200 m/s<sup>2</sup>
- \_\_\_\_\_ 56. A force of 3 N accelerates a mass of 3 kg at the rate of 1 m/s<sup>2</sup>. The acceleration of a mass of 6 kg acted upon by a force of 6 N is
- twice as much.
  - half as much.
  - the same.
  - none of the above
- \_\_\_\_\_ 57. A push on a 1-kilogram brick accelerates the brick. Neglecting friction, to equally accelerate a 10-kilogram brick, one would have to push
- with 100 times as much force.
  - with 10 times as much force.
  - with just as much force.
  - with  $\frac{1}{10}$  the amount of force.
  - none of the above
- \_\_\_\_\_ 58. Pressure is defined as
- time per area.
  - velocity per time.
  - force per time.
  - force per area.
  - distance per time.
- \_\_\_\_\_ 59. The unit of pressure is
- newtons per meter.
  - newtons per square meter (or pascals).
  - the newton.
  - the meter.
  - meters per second squared.
- \_\_\_\_\_ 60. Which of the following would exert the most pressure on the ground?
- A woman standing in running shoes
  - A woman standing on skis
  - A woman standing in high-heel shoes
- \_\_\_\_\_ 61. A tennis ball and a solid steel ball with the same diameter are dropped at the same time. Which ball has the greater force acting on it?
- The steel ball
  - The tennis ball
  - They both have the same force acting on them.
- \_\_\_\_\_ 62. A tennis ball and a solid steel ball with the same diameter are dropped at the same time. In the absence of air resistance, which ball has the greater acceleration?
- The steel ball
  - The tennis ball
  - They both have the same acceleration.



- \_\_\_\_\_ 63. The terminal speed for a person parachuting (with the chute open) is about
- 0 km/h.
  - 15 km/h.
  - 150 km/h.
  - 1500 km/h.
- \_\_\_\_\_ 64. A block is at rest on an incline. The force of friction necessary to prevent the block from sliding increases when the incline angle is
- increased.
  - decreased.
  - neither A nor B (Force of friction stays the same.)
- \_\_\_\_\_ 65. Consider a ball rolling down the decreasing slope inside a semicircular bowl (the slope is steep at the top rim, gets less steep toward the bottom, and is zero (no slope) at the bottom). As the ball rolls from the rim downward toward the bottom, its rate of gaining speed
- increases.
  - remains the same.
  - decreases.
- \_\_\_\_\_ 66. A speeding truck locks its brakes and it skids to a stop. If the truck's total mass were doubled, its skidding distance would be
- half as far.
  - nearly as far, but not quite.
  - the same.
  - twice as far.
  - four times as far.
- \_\_\_\_\_ 67. If the force acting on a cart doubles, what happens to the cart's acceleration?
- It quarters.
  - It halves.
  - It stays the same.
  - It doubles.
  - It quadruples.
- \_\_\_\_\_ 68. Suppose a cart is being moved by a force. If suddenly a load is dumped into the cart so that the cart's mass doubles, what happens to the cart's acceleration?
- It quarters.
  - It halves.
  - It stays the same.
  - It doubles.
  - It quadruples.
- \_\_\_\_\_ 69. You are on a frozen pond, and the ice starts to crack. If you lie down on the ice and begin to crawl, this will
- increase the pressure on the ice.
  - decrease the pressure on the ice.
  - increase the total force on the ice.
  - decrease the total force on the ice.
- \_\_\_\_\_ 70. A 20-N falling object encounters 4 N of air resistance. The magnitude of the net force on the object is
- 0 N.
  - 4 N.
  - 16 N.
  - 20 N.
  - none of the above

- \_\_\_\_\_ 71. A sportscar has a mass of 1500 kg and accelerates at 5 meters per second squared. What is the magnitude of the force acting on the sportscar?
- 300 N.
  - 1500 N.
  - 2250 N.
  - 7500 N.
  - none of the above
- \_\_\_\_\_ 72. A tow truck exerts a force of 2000 N on a car, accelerating it at 1 m/s/s. What is the mass of the car?
- 667 kg
  - 1000 kg
  - 2000 kg
  - 8000 kg
  - none of the above
- \_\_\_\_\_ 73. A jet has a mass of 40,000 kg. The thrust for each of four engines is 20,000 N. What is the jet's acceleration when taking off?
- 0.3 m/s<sup>2</sup>
  - 0.5 m/s<sup>2</sup>
  - 1 m/s<sup>2</sup>
  - 2 m/s<sup>2</sup>
  - none of the above
- \_\_\_\_\_ 74. You pull horizontally on a 50-kg crate with a force of 450 N and the friction force on the crate is 250 N. The acceleration of the crate is
- 2 m/s<sup>2</sup>.
  - 4 m/s<sup>2</sup>.
  - 9 m/s<sup>2</sup>.
  - 14 m/s<sup>2</sup>.
- \_\_\_\_\_ 75. How much force is needed to accelerate a 4.0-kg physics book to an acceleration of 2.0 m/s<sup>2</sup>?
- 0 N
  - 2.0 N
  - 0.5 N
  - 8.0 N
  - 24.0 N
- \_\_\_\_\_ 76. A jumbo jet cruises at a constant velocity when the total thrust of the engines on the jet is 50,000 N. How much air resistance acts on the jet?
- 0 N
  - 25,000 N
  - 50,000 N
  - 75,000 N
  - 100,000 N
- \_\_\_\_\_ 77. Whenever an object exerts a force on another object, the second object exerts a force of the same magnitude, but in the opposite direction to that of the first object.
- Sometimes true
  - Always true
  - Always false

- \_\_\_\_\_ 78. A high school student hits a nail with a hammer. During the collision, there is a force
- on the nail but not on the hammer.
  - on the nail and also on the hammer.
  - on the hammer but not on the nail.
- \_\_\_\_\_ 79. Forces always occur
- as single quantities.
  - by themselves.
  - in pairs.
  - in triplets.
- \_\_\_\_\_ 80. An archer shoots an arrow. Consider the action force to be the bowstring against the arrow. The reaction to this force is the
- arrow's push against the bowstring.
  - weight of the arrow.
  - friction of the ground against the archer's feet.
  - air resistance against the bow.
  - grip of the archer's hand on the bow.
- \_\_\_\_\_ 81. A player catches a ball. Consider the action force to be the impact of the ball against the player's glove. What is the reaction to this force?
- The muscular effort in the player's arms
  - The force the glove exerts on the ball
  - Friction of the ground against the player's shoes
  - The player's grip on the glove
  - none of the above
- \_\_\_\_\_ 82. As a ball falls, the action force is the pull of Earth's mass on the ball. What is the reaction to this force?
- The pull of the ball's mass on Earth
  - The acceleration of the ball
  - Nonexistent in this case
  - Air resistance acting against the ball
  - none of the above
- \_\_\_\_\_ 83. A person is attracted towards the center of Earth by a 440-N gravitational force. The force with which Earth is attracted toward the person is
- 440 N.
  - very very small.
  - very very large.
- \_\_\_\_\_ 84. An unfortunate bug splatters against the windshield of a moving car. Compared to the deceleration of the car, the deceleration of the bug is
- larger.
  - the same.
  - smaller.
- \_\_\_\_\_ 85. According to Newton's third law, if you push gently on something, it will push
- gently on something else.
  - on you only if you aren't moving.
  - gently on you.
  - on something only under the right conditions.

- \_\_\_\_\_ 86. Earth pulls on the moon, and similarly the moon pulls on Earth. This is evidence that the
- Earth and moon are simply pulling on each other.
  - Earth's and moon's pulls comprise an action-reaction pair.
  - both a and b
  - neither a or b
- \_\_\_\_\_ 87. Bronco the skydiver falls toward Earth. The attraction of Earth on Bronco pulls him down. The reaction to this force is
- Bronco finally pushing against Earth's surface.
  - Bronco pulling up on Earth.
  - Earth's surface finally pushing against Bronco.
  - neither A, B, nor C
- \_\_\_\_\_ 88. A force is exerted on the tires of a car to accelerate the car along the road. The force is exerted by the
- road.
  - engine.
  - tires.
  - air.
- \_\_\_\_\_ 89. A karate chop delivers a blow of 2300 N to a board that breaks. The force that acts on the hand during this feat
- is less than 2300 N.
  - is 2300 N.
  - is more than 2300 N.
  - cannot be determined.
- \_\_\_\_\_ 90. Your friend says that the heavyweight champion of the world cannot exert a force of 95 N on a piece of tissue paper with his best punch. The tissue paper is held in midair, no wall and no tricks.
- You agree that it can't be done.
  - You disagree, for a good punch easily delivers this much force.
  - You have reservations about this claim.
- \_\_\_\_\_ 91. A woman weighing 550 N sits on the floor. She exerts a force on the floor of
- 5.5 N.
  - 55 N.
  - 550 N.
  - 1100 N.
  - 5500 N.
- \_\_\_\_\_ 92. Two people pull on a rope in a tug-of-war. Each pulls with 400 N of force. What is the tension in the rope?
- 0 N
  - 400 N
  - 600 N
  - 800 N
  - none of the above
- \_\_\_\_\_ 93. Which has more momentum, a large truck moving at 30 miles per hour or a small truck moving at 30 miles per hour?
- Both have the same momentum.
  - The small truck
  - The large truck

- \_\_\_\_\_ 94. Compared to a sports car moving at 30 miles per hour, the same sports car moving at 60 miles per hour has
- twice as much momentum.
  - four times as much momentum.
  - the same momentum.
- \_\_\_\_\_ 95. The momentum change of an object is equal to the
- impulse acting on it.
  - velocity change of the object.
  - force acting on it.
  - force acting on it times its velocity.
  - object's mass times the force acting on it.
- \_\_\_\_\_ 96. In order to increase the final momentum of a golf ball, we could
- increase the force acting on it.
  - follow through when hitting the ball.
  - increase the time of contact with the ball.
  - swing as hard as possible.
  - all of the above
- \_\_\_\_\_ 97. The reason padded dashboards are used in cars is that they
- look nice and feel good.
  - decrease the impulse in a collision.
  - increase the force of impact in a collision.
  - decrease the momentum of a collision.
  - increase the time of impact in a collision.
- \_\_\_\_\_ 98. A table tennis ball launcher is fired. Compared to the force on the ball, the force on the launcher is
- larger.
  - the same.
  - smaller.
- \_\_\_\_\_ 99. A table tennis ball launcher is fired. Compared to the impulse on the ball, the impulse on the launcher is
- smaller.
  - larger.
  - the same.
- \_\_\_\_\_ 100. Momentum of a system is conserved only when
- there are no internal forces acting on the system.
  - the system is not moving.
  - there are no forces acting on the system.
  - there is no net external force acting on the system.
  - the system has zero momentum.
- \_\_\_\_\_ 101. A collision is considered elastic if
- there is no lasting deformation.
  - the objects don't stick together.
  - the objects that collide don't get warmer.
  - after the collision, the objects have the same shape as before the collision.
  - all of the above

- \_\_\_\_\_ 102. A freight train rolls along a track with considerable momentum. If it were to roll at the same speed but had twice as much mass, its momentum would be
- zero.
  - unchanged.
  - quadrupled.
  - doubled.
- \_\_\_\_\_ 103. Suppose a cannon is made of a strong but very light material. Suppose also that the cannonball is more massive than the cannon itself. For such a system
- conservation of momentum would not hold.
  - conservation of energy would not hold.
  - the target would be a safer place than where the operator is located.
  - the force on the cannonball would be greater than the force on the cannon.
  - recoil problems would be lessened.
- \_\_\_\_\_ 104. Two objects, A and B, have the same size and shape, but A is twice as heavy as B. When they are dropped simultaneously from a tower, they reach the ground at the same time, but A has a higher
- acceleration.
  - momentum.
  - speed.
  - all of the above
  - none of the above
- \_\_\_\_\_ 105. In order to catch a ball, a baseball player moves his or her hand backward in the direction of the ball's motion. Doing this reduces the force of impact on the player's hand principally because
- the time of impact is decreased.
  - the time of impact is increased.
  - the velocity of the hand is reduced.
  - the momentum of impact is reduced.
  - none of the above
- \_\_\_\_\_ 106. A cannon fires a cannonball. The speed of the cannonball will be the same as the speed of the recoiling cannon
- if the mass of the cannonball equals the mass of the cannon.
  - because momentum is conserved.
  - because velocity is conserved.
  - because both velocity and momentum are conserved.
  - none of the above
- \_\_\_\_\_ 107. When you jump off a step, you usually bend your knees as you reach the ground. By doing this, the time of the impact is about 10 times more what it would be in a stiff-legged landing, and the average force on your body is reduced by
- less than 10 times.
  - about 10 times.
  - more than 10 times.
- \_\_\_\_\_ 108. A 1-N apple falls to the ground. The apple hits the ground with an impact force of
- 1 N.
  - 2 N.
  - 4 N.
  - 9.8 N.
  - Not enough information to say

- \_\_\_\_\_ 109. A moving freight car runs into an identical car at rest on the track. The cars couple together. Compared to the velocity of the first car before the collision, the velocity of the combined cars after the collision is
- zero.
  - one half as large.
  - the same.
  - twice as large.
  - More information is needed to say.
- \_\_\_\_\_ 110. Two gliders having the same mass and speed move toward each other on an air track and stick together. After the collision, the velocity of the gliders is
- twice the original velocity.
  - one half the original velocity.
  - zero.
  - the same as the original velocity.
  - There is not enough information to say.
- \_\_\_\_\_ 111. The force that accelerates a rocket into outer space is exerted on the rocket by
- the exhaust gases.
  - Earth's gravity.
  - atmospheric pressure.
  - rocket's wings.
  - none of the above
- \_\_\_\_\_ 112. If all people, animals, trains and trucks all over the world began to walk or run towards the east, then
- Earth would spin a bit slower.
  - Earth's spin would not be affected at all.
  - Earth would spin a bit faster.
- \_\_\_\_\_ 113. A table tennis ball moving forward with 5 units of momentum strikes and bounces backward off a heavy bowling ball that is initially at rest and free to move. The bowling ball is set in motion with a momentum of
- less than 5 units.
  - 5 units.
  - more than 5 units.
  - not enough information.
- \_\_\_\_\_ 114. Superman is at rest in space when he throws an asteroid that has more mass than he does. Which moves faster, Superman or the asteroid?
- Superman
  - The asteroid
  - They both move at the same speed.
- \_\_\_\_\_ 115. A cannonball shot from a long-barrel cannon travels faster than one shot from a short-barrel cannon because the cannonball receives a greater
- force.
  - impulse.
  - both A and B
  - neither A nor B
- \_\_\_\_\_ 116. While roller-skating, Granny collides with her tiny grandson Ambrose who is at rest. Ignoring any friction effects, Ambrose's speed after the collision will be greatest when
- Granny catches him and they both move together.
  - he and Granny make a bouncing collision, each going in opposite directions.

- \_\_\_\_ 117. A 2-kg ball is thrown at 3 m/s. What is the ball's momentum?
- 2 kg·m/s
  - 3 kg·m/s
  - 6 kg·m/s
  - 9 kg·m/s
  - none of the above
- \_\_\_\_ 118. A ball is moving at 6.0 m/s and has a momentum of 24.0 kg·m/s. What is the ball's mass?
- 0.3 kg
  - 4.0 kg
  - 24.0 kg
  - 144.0 kg
  - none of the above
- \_\_\_\_ 119. A 5.0-kg chunk of putty moving at 10.0 m/s collides with and sticks to a 7.0-kg bowling ball that is initially at rest. The bowling ball with its putty passenger will then be set in motion with a momentum of
- 0 kg·m/s.
  - 2.0 kg·m/s.
  - 15.0 kg·m/s.
  - 50.0 kg·m/s.
  - more than 50.0 kg·m/s.
- \_\_\_\_ 120. In physics, work is defined as
- force times time.
  - force divided by distance.
  - distance divided by time.
  - force divided by time.
  - force times distance.
- \_\_\_\_ 121. If you lift one load up two stories, how much work do you do compared to lifting one load up only one story?
- One quarter as much
  - One half as much
  - The same amount
  - Twice as much
  - Four times as much
- \_\_\_\_ 122. If Nellie Newton pushes an object with twice the force for twice the distance, she does
- twice the work.
  - the same work.
  - four times the work.
  - eight times the work.
- \_\_\_\_ 123. The unit of work is the
- watt.
  - meter.
  - joule.
  - newton.
  - second.



- \_\_\_\_\_ 124. Power is defined as the
- force on an object divided by the time the force acts.
  - work done times the time taken to do that work.
  - work done on an object divided by the time taken to do the work.
  - distance divided by the time taken to move that distance.
  - force on an object times the distance the object moves.
- \_\_\_\_\_ 125. The amount of potential energy possessed by an elevated object is equal to
- the power used to lift it.
  - the distance it is lifted.
  - the force needed to lift it.
  - the work done in lifting it.
  - the value of the acceleration due to gravity.
- \_\_\_\_\_ 126. Kinetic energy of an object is equal to
- its mass multiplied by its acceleration squared.
  - one half the product of its mass times its speed squared.
  - its mass multiplied by its speed.
  - one half the product of its mass times its speed.
  - its mass multiplied by its acceleration.
- \_\_\_\_\_ 127. An arrow in a bow has 70 J of potential energy. Assuming no loss of energy to heat, how much kinetic energy will it have after it has been shot?
- 0 J
  - 35 J
  - 50 J
  - 70 J
  - 140 J
- \_\_\_\_\_ 128. Energy is changed from one form to another with no net loss or gain.
- Sometimes true
  - Always false
  - Always true
- \_\_\_\_\_ 129. When a car's speed triples, its kinetic energy
- remains the same.
  - triples.
  - increases by four times.
  - increases by nine times.
  - none of the above
- \_\_\_\_\_ 130. Rockets are launched from an airplane in the forward direction of motion. The kinetic energy of the airplane will be
- unchanged.
  - increased.
  - decreased.
- \_\_\_\_\_ 131. A job is done slowly, and an identical job is done quickly. Both jobs require the same amount of work but different amounts of
- energy.
  - power.
  - both A and B
  - none of the above

- \_\_\_ 132. Which requires more work: lifting a 70-kg sack vertically 2 meters or lifting a 35-kg sack vertically 4 meters?
- Lifting the 70 kg sack
  - Lifting the 35 kg sack
  - Both require the same amount of work.
- \_\_\_ 133. A ball is thrown into the air with 100 J of kinetic energy, which is transformed to gravitational potential energy at the top of its trajectory. When it returns to its original level after encountering air resistance, its kinetic energy is
- 100 J.
  - more than 100 J.
  - less than 100 J.
  - Not enough information given.
- \_\_\_ 134. An object that has kinetic energy must have
- acceleration.
  - a force applied to maintain it.
  - momentum.
  - none of the above
- \_\_\_ 135. Which has greater kinetic energy, a car traveling at 30 km/h or a half-as-massive car traveling at 60 km/h?
- The 60 km/h car
  - Both have the same kinetic energy.
  - The 30 km/h car
- \_\_\_ 136. A person on a roof throws one ball downward and an identical ball upward at the same speed. The ball thrown downward hits the ground with 140 J of kinetic energy. Ignoring air friction, with how much kinetic energy does the second ball hit the ground?
- less than 140 J
  - 140 J
  - 280 J
  - more than 280 J
  - none of the above
- \_\_\_ 137. An object at rest may have
- energy.
  - speed.
  - velocity.
  - momentum.
  - none of the above
- \_\_\_ 138. A heavy object and a light object are released from rest at the same height and time in a vacuum. As they fall, they have equal
- energies.
  - weights.
  - momenta.
  - all of the above
  - none of the above
- \_\_\_ 139. If an object has kinetic energy, then it also must have
- impulse.
  - force.
  - momentum.
  - acceleration.
  - none of the above

- \_\_\_\_\_ 140. If the velocity of a moving object doubles, then what else doubles?
- acceleration.
  - kinetic energy.
  - momentum.
  - all of the above
  - none of the above
- \_\_\_\_\_ 141. A pulley system can
- change the direction of a force.
  - multiply the force.
  - increase the amount of work done.
  - Both A and B
  - Both B and C
- \_\_\_\_\_ 142. The ratio of useful work output to total work input is called the
- mechanical advantage.
  - lever arm.
  - pivot point.
  - fulcrum.
  - efficiency.
- \_\_\_\_\_ 143. Consider molecules of hydrogen gas and molecules of heavier oxygen gas that have the same kinetic energy. The molecules with the greater speed are
- hydrogen.
  - Both have the same speed.
  - oxygen.
- \_\_\_\_\_ 144. How much power is required to do 40 J of work on an object in 5 seconds?
- 0 W
  - 5 W
  - 8 W
  - 40 W
  - 200 W
- \_\_\_\_\_ 145. How much work is done on a 20-N crate that you lift 2 m?
- 0 J
  - 1 J
  - 2 J
  - 20 J
  - 40 J
- \_\_\_\_\_ 146. How much power is expended if you lift a 60 N crate 10 meters in 1 second?
- 0 W
  - 6 W
  - 10 W
  - 60 W
  - 600 W

- \_\_\_\_\_ 147. Suppose a moving car has 3000 J of kinetic energy. If the car's speed doubles, how much kinetic energy will it then have?
- 1000 J
  - 1500 J
  - 3000 J
  - 6000 J
  - 12,000 J
- \_\_\_\_\_ 148. If Kelly the skater's speed increases so he has three times the momentum, then his kinetic energy increases by
- one third times.
  - three times.
  - nine times.
  - none of the above (KE remains the same).
- \_\_\_\_\_ 149. A 60-N object moves at 1 m/s. Its kinetic energy is
- 1 J.
  - 3 J.
  - 60 J.
  - more than 60 J.
- \_\_\_\_\_ 150. Sue can easily lift a 45.0-N rock with the help of a lever. When she pushes down with 20.0 N of force, she lifts the rock 0.3 meters. How far does she move her arms to do this?
- 0.3 m
  - 0.7 m
  - 6.0 m
  - 2.3 m
  - 20.0 m
- \_\_\_\_\_ 151. A pulley has two supporting strands. In order for it to lift a load 1 meter, the person pulling will have to pull a distance of
- $\frac{1}{4}$  m.
  - $\frac{1}{2}$  m.
  - 1 m.
  - 2 m.
  - 4 m.
- \_\_\_\_\_ 152. A machine puts out 100 watts of power for every 1000 watts put into it. The efficiency of the machine is
- 10%.
  - 50%.
  - 90%.
  - 110%.
  - none of the above
- \_\_\_\_\_ 153. Which has greater linear speed, a horse near the outside rail of a merry-go-round or a horse near the inside rail?
- The inside horse
  - The outside horse
  - Neither—they both have the same linear speed.

- \_\_\_\_\_ 154. Which of the following is NOT a unit of rotational speed?
- Meters per second
  - Revolutions per minute
  - Revolutions per second
  - Rotations per second
  - Rotations per minute
- \_\_\_\_\_ 155. What is the direction of the force that acts on clothes in the spin cycle of a washing machine?
- Inward
  - Down
  - Outward
  - Up
- \_\_\_\_\_ 156. A tin can whirled on the end of a string moves in a circle because
- the can continually pulls on the string.
  - once the can starts moving, that is its natural tendency.
  - there is a force on the can pulling it outward.
  - there is an inward force acting on the can.
  - all of the above
- \_\_\_\_\_ 157. A ladybug rests on the bottom of a tin can that is being whirled horizontally on the end of a string. Since the ladybug, like the can, moves in a circle, there must be a force on it. What exerts this force?
- Gravity
  - The string
  - There is no force acting on it.
  - The can
  - Your hand
- \_\_\_\_\_ 158. A person weighs less at the equator than at the poles. The reason for this has to do with the
- tidal bulges.
  - influence of the sun, moon, and all the planets.
  - higher temperature at the equator, and expansion of matter.
  - spin of the Earth.
  - none of the above
- \_\_\_\_\_ 159. A car travels in a circle with constant speed. The net force on the car
- is zero because the car is not accelerating.
  - is directed forward, in the direction of travel.
  - is directed toward the center of the curve.
  - none of the above
- \_\_\_\_\_ 160. If Earth rotated more slowly about its axis, your weight would
- decrease.
  - increase.
  - stay the same.
- \_\_\_\_\_ 161. To weigh less in the Northern Hemisphere, you should go
- west.
  - east.
  - south.
  - north.

- \_\_\_\_\_ 162. A possible space habitat of the future is a cylinder in space rotating about its long axis. What is the relative gravitational field along the axis of the habitat?
- One-quarter  $g$
  - One-half  $g$
  - Three-quarters  $g$
  - $g$
  - Zero
- \_\_\_\_\_ 163. Nellie Newton swings a rock into a circular path while holding an attached string overhead. The string makes a 45-degree angle to the vertical (comprising a "conical pendulum"). The centripetal force that holds the rock in its circular path is the
- vertical component of the string tension.
  - horizontal component of the string tension.
  - tension in the string.
  - none of the above
- \_\_\_\_\_ 164. Stunt motorcyclist Biker Bob rides his bike inside a futuristic rotating space station—a giant rotating donut-shaped structure in space. The normal support force feels like weight to him. As he rides his bike in the same direction that the station rotates, the normal force
- remains unaffected.
  - increases.
  - decreases.
- \_\_\_\_\_ 165. A game room in a rotating space habitat is located in a 0.25- $g$  region. If a person can jump 0.5-m high in a 1- $g$  region, how high can the same person jump in the game room?
- 0.5 m
  - 2 m
  - 4 m
  - 8 m
  - More than 8 m
- \_\_\_\_\_ 166. Newton reasoned that the gravitational attraction between Earth and the moon must be \_\_\_\_\_.
- reduced by distance
  - independent of distance
  - directly proportional to distance
  - the same at all distances
  - all of the above
- \_\_\_\_\_ 167. If the mass of Earth increased, with no change in radius, your weight would \_\_\_\_\_.
- stay the same
  - decrease
  - increase also
- \_\_\_\_\_ 168. If the radius of Earth decreased, with no change in mass, your weight would \_\_\_\_\_.
- not change
  - increase
  - decrease
- \_\_\_\_\_ 169. The gravitational force between two massive spheres
- is always an attraction.
  - depends on how massive they are.
  - depends inversely on the square of the distances between them.
  - all of the above

- \_\_\_\_ 170. A very massive object A and a less massive object B move toward each other under the influence of mutual gravitation. Which force, if either, is greater?
- The force on B
  - The force on A
  - Both forces are the same.
- \_\_\_\_ 171. Two objects move toward each other because of gravitational attraction. As the objects get closer and closer, the force between them \_\_\_\_\_.
- remains constant
  - decreases
  - increases
- \_\_\_\_ 172. Suppose the gravitational force between two massive spheres is 100 N. If the distance between the spheres is doubled, what is the force between the masses?
- 400 N
  - 200 N
  - 100 N
  - 50 N
  - 25 N
- \_\_\_\_ 173. By noticing that Uranus's orbit is perturbed and by using the law of gravitation, two astronomers independently discovered \_\_\_\_\_.
- Neptune
  - exceptions to the law of gravitation
  - the law of gravitation fails at large distances
  - Uranus has several moons
- \_\_\_\_ 174. A lunar month is about 28 days. If the moon were closer to Earth than it is now, the lunar month would be \_\_\_\_\_.
- more than 28 days
  - unchanged at 28 days
  - less than 28 days
- \_\_\_\_ 175. A supplier wants to make a profit by buying metal by weight at one altitude and selling it at the same price per pound at another altitude. The supplier should \_\_\_\_\_.
- buy at a low altitude and sell at a high altitude
  - disregard altitude because it has a negligible effect
  - buy at a high altitude and sell at a low altitude
- \_\_\_\_ 176. Each of us weighs a tiny bit less on the ground floor of a skyscraper than we do on the top floor. One reason for this is that \_\_\_\_\_.
- the gravitational field is shielded inside the building
  - the mass of the building attracts you upward slightly
  - both A and B
  - none of the above
- \_\_\_\_ 177. A planet has half the mass of the Earth and half the radius. Compared to its weight on Earth, an apple on this planet would weigh \_\_\_\_\_.
- twice as much
  - one-fourth as much
  - half as much
  - the same
  - zero

- \_\_\_\_\_ 178. Consider the gravitational force between Earth and a meteor in outer space. If the meteor moves so its distance from the Earth's center doubles, the gravitational force on the meteor will be \_\_\_\_\_.
- one quarter
  - half
  - double
  - quadruple
  - eight times greater
- \_\_\_\_\_ 179. Which is greater, the gravitational force between Earth and the moon, or the force between Earth and the sun?
- Earth-moon
  - equal
  - Earth-sun
- \_\_\_\_\_ 180. Since Earth is attracted to the sun, why doesn't it fall into the sun?
- Because it has too much mass to move toward the sun
  - Because it has sufficient tangential velocity
  - Because there is an equal force holding it away from the sun
  - Because it has too much inertia to move toward the sun
  - all of the above
- \_\_\_\_\_ 181. A 560-N woman stands on top of a very tall ladder so she is one Earth radius above Earth's surface. How much does she weigh?
- zero
  - 140 N
  - 280 N
  - 560 N
  - none of the above
- \_\_\_\_\_ 182. Suppose the gravitational force between two spheres is 70 N. If the distance between the spheres is halved, what is the force between the masses?
- 17.5 N
  - 35 N
  - 70 N
  - 140 N
  - 280 N
- \_\_\_\_\_ 183. Suppose the gravitational force between two spheres is 30 N. If the magnitude of each mass doubles, what is the force between the masses?
- 8 N
  - 15 N
  - 30 N
  - 60 N
  - 120 N
- \_\_\_\_\_ 184. A vector is a quantity that has
- magnitude and time.
  - time and direction.
  - magnitude and direction.



- \_\_\_ 185. A scalar is a quantity that has
- direction.
  - magnitude.
  - time.
  - color.
- \_\_\_ 186. In the absence of air friction, the vertical component of a projectile's velocity doesn't change as the projectile moves.
- Always false
  - Always true
  - Sometimes true
- \_\_\_ 187. In the absence of air friction, the horizontal component of a projectile's velocity doesn't change as the projectile moves.
- Sometimes true
  - Always true
  - Always false
- \_\_\_ 188. At the instant a ball is thrown horizontally with a large force, an identical ball is dropped from the same height. Which ball hits the ground first?
- Neither. They both hit the ground at the same time.
  - The dropped ball
  - The horizontally thrown ball
- \_\_\_ 189. A ball thrown in the air will never go as far as physics ideally would predict because
- one can never throw the ball fast enough.
  - gravity is acting.
  - air friction slows the ball.
  - ideally the ball would never land.
  - all of the above
- \_\_\_ 190. At what part of a path does a projectile have minimum speed?
- When it returns to the ground
  - Halfway to the top
  - At the top of its path
  - When it is thrown
  - There's not enough information to say.
- \_\_\_ 191. A projectile is fired horizontally in a vacuum. The projectile maintains its horizontal component of speed because it
- has no vertical component of speed to begin with.
  - is not acted on by any forces.
  - the net force acting on it is zero.
  - is not acted on by any horizontal forces.
  - none of the above
- \_\_\_ 192. Jose can jump vertically 1 meter from his skateboard when it is at rest. When the skateboard is moving horizontally, Jose can jump
- no higher.
  - higher.

- \_\_\_\_\_ 193. Suppose a small plane can fly at 170 km/h relative to the surrounding air. Suppose also that there is a 60 km/h tailwind. How fast does the plane's shadow move across the ground?
- 5 km/h
  - 60 km/h
  - 110 km/h
  - 170 km/h
  - 230 km/h
- \_\_\_\_\_ 194. A cannon with a barrel velocity of 140 m/s launches a cannonball horizontally from a tower. Neglecting air resistance, how far vertically will the cannonball have fallen after 4 seconds?
- 80 m
  - 140 m
  - 560 m
  - 2240 m
  - none of the above

**Problem**

195. What is the average speed of a cheetah that runs 88 m in 5 seconds?
196. A bicycle travels 15 km in 30 minutes. What is its average speed?
197. A jet on an aircraft carrier can be launched from 0 to 40 m/s in 2 seconds. What is the acceleration of the jet?
198. You toss a ball at 5 m/s straight upward. How much time will the ball take to reach the top of its path?
199. A stone is dropped from a cliff. After it has fallen 10 m, what is the stone's velocity?
200. How much (in newtons) does a 10.0-kg bag of grass seed weigh?
201. An unbalanced force of 30 N gives an object an acceleration of  $6.0 \text{ m/s}^2$ . What force would be needed to give it an acceleration of  $1.0 \text{ m/s}^2$ ?
202. Suppose that you exert 300 N horizontally on a 50-kg crate on a factory floor, where friction between the crate and the floor is 100 N. What is the acceleration of the crate?
203. An 8-kg blob of clay moving horizontally at 2 m/s hits a 3-kg blob of clay at rest. What is the speed of the two blobs stuck together immediately after the collision?
204. A car traveling at 50 km/h will skid 20 m when its brakes are locked. If the same car is traveling at 150 km/h, what will be its skidding distance?