AP Physics Ch 4-6 Test Bank **Name_____ #:__**

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

1. A 27 kg object is accelerated at a rate of 1.7 m/s^2. What force does the object experience?
   A) 46 N B) 16 N C) 98 N D) 63 N

2. It takes 4500 N to accelerate a car at a rate of 3.42 m/s^2. What is the mass of the car?
   A) 1700 kg B) 1040 kg C) 1510 kg D) 1310 kg

3. A Ferrari accelerates from 0 to 100.0 km/h in 4.80 s. What force (in Newtons) does a passenger of mass 68.0 kg experience during acceleration?
   A) 82.0 N B) 311 N C) 394 N D) 342 N

4. A child pulls on a wagon handle at an angle 37° above the horizontal with a force of 45 N. If the wagon accelerates at 8.1 m/s^2 horizontally, what is the mass of the wagon? Assume frictional forces are negligible.
   A) 5.6 kg B) 4.4 kg C) 3.7 kg D) 3.1 kg

5. A child on a sled starts from rest at the top of a 15.0° slope. If the trip to the bottom takes 15.2 s how long is the slope? Assume that frictional forces may be neglected.
   A) 293 m B) 147 m C) 1130 m D) 586 m

6. On its own, a tow truck has a maximum acceleration of 3.0 ms^{-2}. What would be the maximum acceleration when the truck was towing a bus of twice its own mass?
   A) 2.5 $m.s^{-2}$ B) 1.5 $m.s^{-2}$ C) 1.0 $m.s^{-2}$ D) 2.0 $m.s^{-2}$

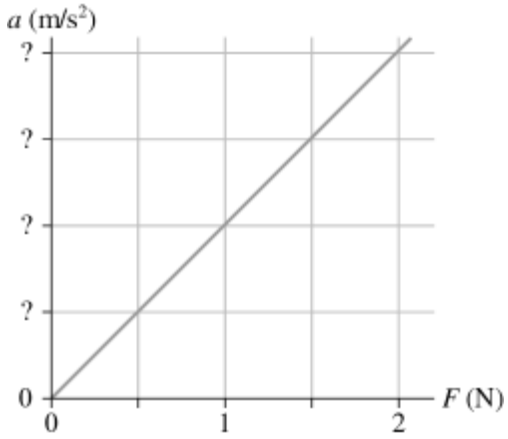
7. A 1100 kg car traveling at 27 m/s starts to decelerate and comes to a complete stop in 578.0 m. What is the average braking force acting on the car?
   A) –410 N B) –690 N C) –340 N D) –550 N

8. The engine of a 1250 kg car provides a forward directed force of 3651 N. If the car accelerates at a rate of 2.60 m/s^2, what is the total resistive force (wind resistance, friction, etc.) acting on the car?
   A) 401 N B) 485 N C) 8600 N D) 2400 N

9. Two children fighting over a toy pull on the toy in different directions. One child pulls to the north with a force of 5.3 N, and the other child pulls to the east with a force of 6.3 N. What is the magnitude of the net force on the toy?
   A) 9.3 N B) 1.0 N C) 12 N D) 8.2 N

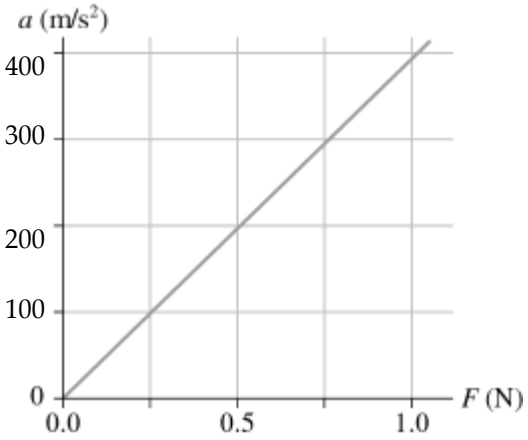
10. Two forces act on a 55 kg object. One force has magnitude 65 N directed 59° clockwise from the positive x–axis, and the other has a magnitude 35 N at 32° clockwise from the positive y–axis. What is the magnitude of this object's acceleration?
    A) 1.5 m/s^2 B) 1.7 m/s^2 C) 1.1 m/s^2 D) 1.3 m/s^2

11. The figure shows an acceleration–versus–force graph for a 125 g object. What should be the value of the first tick–mark on the vertical scale?



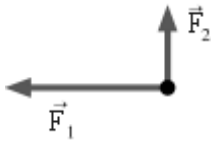
A) 4 B) 0.00400 C) 8 D) 0.00800

12. The figure shows an object's acceleration–versus–force graph. What is the object's mass in grams?



A) 1.6 B) 400,000 C) 2.5 D) 630

13. The figure shows two forces acting on an object. They have magnitudes $F_1 = 6.3$ N and $F_2 = 2.1$ N. What third force will cause the object to be in equilibrium?



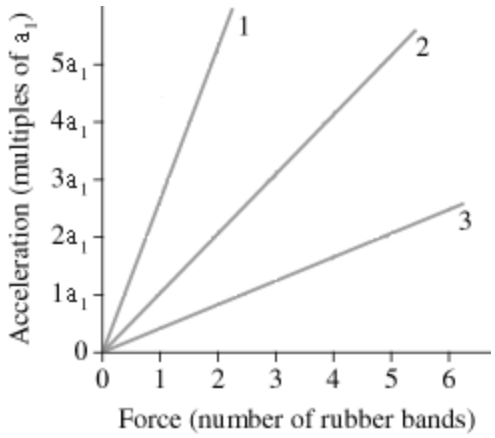
A) 4.2 N at 162° counterclockwise from $\vec{F}_1$ B) 4.2 N at 108° counterclockwise from $\vec{F}_1$

C) 6.6 N at 108° counterclockwise from $\vec{F}_1$ D) 6.6 N at 162° counterclockwise from $\vec{F}_1$

14. The figure shows two forces acting on an object, with magnitudes $F_1 = 78$ N and $F_2 = 26$ N. What third force will cause the object to be in equilibrium?

A) 52 N pointing down
B) 82 N pointing down
C) 82 N pointing up
D) 52 N pointing up

15. The figure shows an acceleration–versus–force graph for three objects pulled by rubber bands. The mass of object 2 is 36 kg. What are the masses of objects 1 and 3?



A) 72 kg and 18 kg
B) 14 kg and 72 kg
C) 90 kg and 18 kg
D) 14 kg and 90 kg

16. An object accelerates at 4.1 m/s^2 under the action of two rubber bands. What will be the object's acceleration if it is pulled by four rubber bands?

A) 8.2 m/s^2
B) 2.1 m/s^2
C) 4.1 m/s^2
D) 16 m/s^2

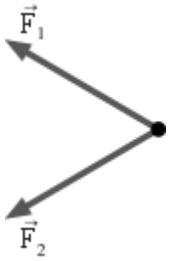
17. An object accelerates at 7.0 m/s^2 under the action of two rubber bands. What will be the acceleration of two of these objects glued together if they are pulled by four rubber bands?

A) 3.5 m/s^2
B) 14 m/s^2
C) 28 m/s^2
D) 7.0 m/s^2

18. Joe and Bill are playing tug–of–war. Joe is pulling with a force of 200 N. Bill is simply hanging on to the rope. Neither person is moving. What is the tension of the rope?

A) 300 N
B) 200 N
C) 0 N
D) 400 N

19. The figure shows two forces of equal magnitude acting on an object. If the common magnitude of the forces is 4.6 N and the angle between them is 40°, what third force will cause the object to be in equilibrium?



A) 3.5 N pointing to the right
B) 4.3 N pointing to the right
C) 7.0 N pointing to the right
D) 8.6 N pointing to the right

20. Under the action of a constant force an object accelerates at 7.8 m/s^2. What will the acceleration be if (a) The force is halved? (b) The object's mass is halved? (c) The force and the object's mass are both halved? (d) The force is halved and the object's mass is doubled?
A) (a) 3.9 m/s^2, (b) 16 m/s^2, (c) 2.0 m/s^2, (d) 7.8 m/s^2
B) (a) 3.9 m/s^2, (b)16 m/s^2, (c) 7.8 m/s^2, (d) 7.8 m/s^2
C) (a) 3.9 m/s^2, (b) 16 m/s^2, (c) 7.8 m/s^2, (d) 2.0 m/s^2
D) (a) 16 m/s^2, (b) 3.9 m/s^2, (c) 2.0 m/s^2, (d) 7.8 m/s^2

21. Consider what happens when you jump up in the air. Which of the following is the most accurate statement?
A) You are able to spring up because the earth exerts a force upward on you which is stronger than the downward force you exert on the earth.
B) When you push down on the earth with a force greater than your weight, the earth will push back with the same magnitude force and thus propel you into the air.
C) Since the ground is stationary, it cannot exert the upward force necessary to propel you into the air. Instead, it is the internal forces of your muscles acting on your body itself which propels the body into the air.
D) It is the upward force exerted by the ground that pushes you up, but this force can never exceed your weight.

22. A small car and an SUV are at a stoplight. The car has a mass equal to half that of the SUV, and the SUV's engine can produce a maximum force equal to twice that of the car. When the light turns green, both drivers floor it at the same time. Which vehicle pulls ahead of the other vehicle after a few seconds?
A) the SUV
B) It is a tie.
C) the car

23. An object is moving to the right in a straight line. The net force acting on the object is also directed to the right, but the magnitude of the force is decreasing with time. The object will
A) stop and then begin moving to the left.
B) continue to move to the right, with its speed increasing with time.
C) continue to move to the right, with its speed decreasing with time.
D) continue to move to the right with a constant speed.

24. You are making a circular turn in your car when you hit a big patch of ice, causing the force of friction between the tires and the road to become zero. While the car is on the ice, it
    A) moves along a straight–line path.
    B) continues to follow the same circular path as initially.
    C) continues to follow a circular path, but with a radius larger than the original radius.
    D) moves along a path that is neither straight nor circular.

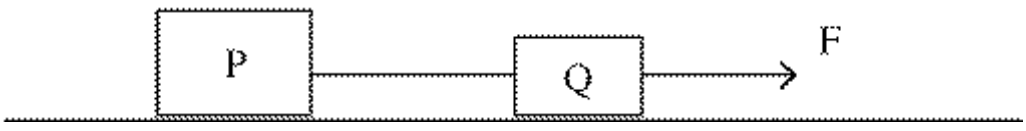
25. A stalled car is being pushed up a hill by three people, and it is moving at a constant speed. The net force on the car is
    A) in the opposite direction of the car's motion.
    B) zero.
    C) in the same direction of the car's motion.
    D) None of the above

26. Suppose you are playing hockey on a new–age ice surface in which there is no friction between the ice and the hockey puck. You wind up and hit the puck as hard as you can. Just after the puck loses contact with your stick, the puck
    A) will speed up a little, and then slow down.
    B) will speed up a little, and then move at a constant speed.
    C) will start to slow down.
    D) will not slow down or speed up.

27. A ball is tossed vertically upward. When it reaches its highest point (before falling back downward),
    A) the velocity is zero, the acceleration is zero, and the force of gravity acting on the ball is zero.
    B) the velocity is zero, the acceleration is zero, and the force of gravity acting on the ball is directed downward.
    C) the velocity is zero, the acceleration is directed downward, and the force of gravity acting on the ball is directed downward.
    D) None of the above

28. A person gives a shopping cart an initial push along a horizontal floor to get it moving, and then lets go. The cart travels forward along the floor, gradually slowing as it moves. Consider the *horizontal force(s)* on the cart while it is moving forward and slowing. Which of the following statements is correct?
    A) Only a forward force is acting, which diminishes with time.
    B) Only a backward force is acting, no forward force.
    C) Both a forward and a backward force are acting on the cart, but the backward force is larger.
    D) Both a forward and a backward force are acting on the cart, but the forward force is larger.

29. Two bodies P and Q on a perfectly smooth horizontal surface are connected by a light cord. The mass of P is greater than that of Q. A horizontal force $\vec{\mathbf{F}}$ is applied to Q as shown in the figure, accelerating the bodies to the right.



The magnitude of the force exerted by the connecting cord **on body P** will be
    A) less than F but not zero.
    B) zero.
    C) equal to F.
    D) greater than F.

30. An object is moving to the right, and experiencing a net force that is directed to the right. The magnitude of the force is decreasing with time. The speed of the object is

A) decreasing. B) constant in time. C) increasing.

31. If you jumped out of a plane, you would begin speeding up as you fall downward. Eventually, due to wind resistance, your velocity would become constant with time. After this occurs, the magnitude of the force of wind resistance is

A) is greater than the force of gravity acting on you.
B) is much smaller than the force of gravity acting on you.
C) is slightly smaller than the force of gravity acting on you.
D) equal to the force of gravity acting on you.

32. An object is moving with a constant velocity. Which statement(s) MUST be true?

A) The net force on the object is zero.
B) A small net force is acting on the object, in the direction of motion.
C) No forces are acting on the object.
D) Two of the above statements are true.

33. A woman is straining to lift a large crate, without success. It is too heavy. We denote the forces on the crate as follows: P is the upward force being exerted on the crate by the person, C is the contact force on the crate by the floor, and W is the weight of the crate.

How are the magnitudes of these forces related, while the person is trying unsuccessfully to lift the crate?

A) $P + C < W$ B) $P + C = W$ C) $P + C > W$ D) $P = C$

34. Suppose the force of wind resistance is proportional to the speed of the object and in the direction opposite the object's velocity. If you throw an object upward, when is the magnitude of the acceleration the highest?

A) It is highest at the top of its trajectory.
B) It is highest right after the object is released.
C) The acceleration of the object is the same throughout the entire trajectory.

35. A dog is standing in the tail bed of a pickup truck. The tail bed is coated with ice, causing the force of friction between the dog and the truck to be zero. The truck is initially at rest, and then accelerates to the right, moving along a flat road. As seen from a stationary observer (watching the truck move to the right), the dog

A) moves to the right at the same rate as the truck, so it doesn't slide.
B) does not move left or right, but simply slides toward the back of the truck.
C) moves to the right, but not as quickly as the truck is moving to the right, causing it to slide toward the back of the truck.
D) moves to the left, as the truck moves to the right, causing the dog to slide toward the back of the truck.

36. A ball is thrown vertically upward, reaches a highest point, and comes back down. At the **top** of its path, what forces, if any, act on the ball? Explain your answer.
    A) no forces
    B) only an upward force
    C) only a downward force
    D) an upward and a downward force, opposing and equal

37. A large truck collides head–on with a cyclist. During the collision
    A) the truck exerts a greater amount of force on the cyclist than the cyclist exerts on the truck.
    B) the truck exerts a force on the cyclist, but the cyclist exerts no force on the truck.
    C) the truck exerts the same amount of force on the cyclist as the cyclist exerts on the truck.
    D) the truck exerts a smaller amount of force on the cyclist than the cyclist exerts on the truck.

38. Bill and Susan are both standing on identical skateboards (with really good ball bearings), initially at rest. Bill weighs three times as much as Susan. Bill pushes horizontally on Susan's back, causing Susan to start moving away from Bill. Immediately after Bill stops pushing,
    A) Susan and Bill are moving away from each other, with equal speeds.
    B) Susan and Bill are moving away from each other, and Susan's speed is three times that of Bill.
    C) Susan is moving away from Bill, and Bill is stationary.
    D) Susan and Bill are moving away from each other, and Susan's speed is three times less than that of Bill.

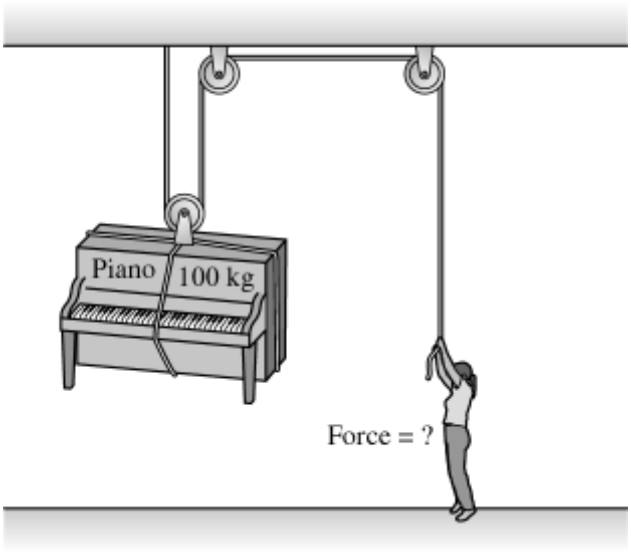
39. A fish is to be weighed at the harbor. If the mass of the fish is 69.0 kg, what will be the reading on the scale? (Use $g = 9.8\ m/s^2$.)
    A) 7.74 N B) 7.04 N C) 744 N D) 676 N

40. A skydiver reaches a "terminal velocity" of 120 km/h. If the skydiver has a mass of 59.0 kg, what is the magnitude of the upward force on the skydiver due to wind resistance? (Use $g = 9.8\ m/s^2$.)
    A) 6.02 N B) 5.42 N C) 578 N D) 636 N

41. A person with a mass of 78 kg is riding in an elevator that is accelerating upward at $1.80\ m/s^2$. What is the person's apparent weight? (Use $g = 9.8\ m/s^2$.)
    A) 960 N B) 900 N C) 620 N D) 760 N

42. A 80 N force is needed to slide a 50.0 kg box across a flat surface at a constant velocity. What is the coefficient of kinetic friction between the box and the floor? (Use $g = 9.8\ m/s^2$.)
    A) 0.13 B) 0.15 C) 0.18 D) 0.16

43. A piano mover raises a 100 kg piano at a constant rate using a frictionless pulley system, as shown in the figure. With roughly what force is the mover pulling down on the rope?

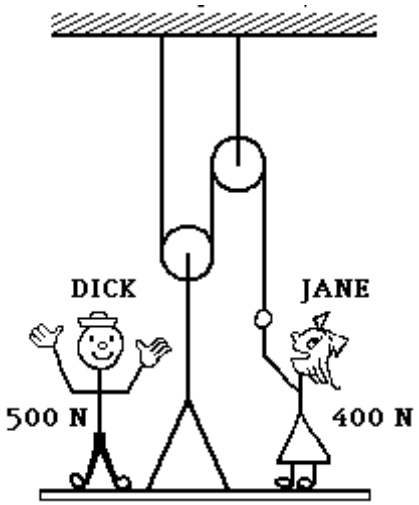


A) 250 N
B) 1000 N
C) 500 N
D) 2000 N
E) Depends on the velocity!

44. An object at rest on an inclined plane starts to slide when the incline angle is increased to 17°. What is the coefficient of static friction between the object and the incline? (Use $g = 9.8\ m/s^2$.)
A) 0.37 B) 0.33 C) 0.27 D) 0.31

45. A 6.0 kg box slides down an inclined plane that makes an angle of 39° with the horizontal. If the coefficient of kinetic friction is 0.19, at what rate does the box accelerate down the slope? (Use $g = 9.8\ m/s^2$.)
A) $5.5\ m/s^2$ B) $4.7\ m/s^2$ C) $6.2\ m/s^2$ D) $5.2\ m/s^2$

46. Starting from rest, a 75 kg skier slides down a 17.0° slope. If the coefficient of kinetic friction between the skis and snow is 0.120 and it takes 16.9 s to get to the bottom, how long is the ski trail? (Use $g = 9.8\ m/s^2$.)
A) 124 m B) 186 m C) 248 m D) 496 m

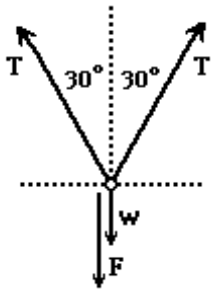


47. Dick and Jane stand on a platform of negligible weight, as shown in the figure. Dick weighs 500 N and Jane weighs 400 N. Jane is supporting some of her weight on the end of the rope she is holding. What is the downward force she is exerting on the platform?
A) 300 N B) 50 N C) 0 D) 100 N E) 240 N

48. You push downward on a trunk at an angle 25° below the horizontal with a force of 750 N. If the trunk is on a flat surface and the coefficient of static friction is 0.76, what is the most massive trunk you will be able to move? (Use $g = 9.8\ m/s^2$.)
A) 68 kg B) 59 kg C) 54 kg D) 82 kg

49. Jason takes off across level water on his jet–powered skis. The combined mass of Jason and skis is 75 kg (the mass of the fuel is negligible). The skis have a thrust of 200 N and a coefficient of kinetic friction on water of 0.1. Unfortunately, the skis run out of fuel after only 67 s. How far has Jason traveled when he finally coasts to a stop?
A) 10,000 m B) 5400 m C) 7600 m D) 3800 m

50. Kieran takes off down a 50 m high, 10° slope on his jet–powered skis. The skis have a thrust of 280 N. The combined mass of skis and Kieran is 50kg (the fuel mass is negligible). Kieran's speed at the bottom is 40 m/s. What is the coefficient of kinetic friction of his skis on snow?
A) 0.23 B) 0.47 C) 0.58 D) 0.29



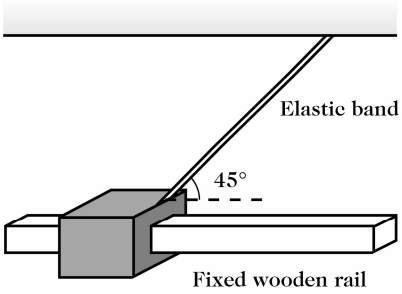
51. A 6.0 kg box is held at rest by two ropes that form 30° angles with the vertical. An external force F acts vertically downward on the box. The force exerted by each of the two ropes is denoted by T. A force diagram, showing the four forces that act on the box in equilibrium, is shown in the figure. The magnitude of force F is 410 N. The magnitude of force T is closest to:

A) 271 N B) 235 N C) 376 N D) 188 N E) 470 N

52. A 200 g hockey puck is launched up a metal ramp that is inclined at a 30° angle. The coefficients of static and kinetic friction between the hockey puck and the metal ramp are $\mu_s = 0.40$ and $\mu_k = 0.30$, respectively. The puck's initial speed is 63 m/s. What vertical height does the puck reach above its starting point?

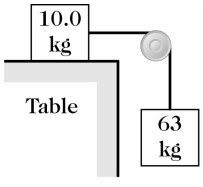
A) 270 cm B) 66 cm C) 130 cm D) 200 cm

53. A device has a 100 g wooden shuttle that is pulled horizontally along a square frictionless wooden rail by an elastic band. The shuttle is released when the elastic band has 6.4 N tension at a 35° angle. What is the magnitude of the initial acceleration of the shuttle? (See the figure.)



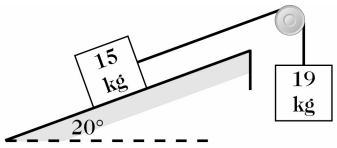
A) 62 m/s^2 B) 52 m/s^2 C) 64 m/s^2 D) 37 m/s^2

54. A 10.0 kg block on a table is connected by a string to a 63 kg mass, which is hanging over the edge of the table. Assuming that frictional forces may be neglected, what is the magnitude of acceleration of the 10.0 kg block when the other block is released? (See the figure.)



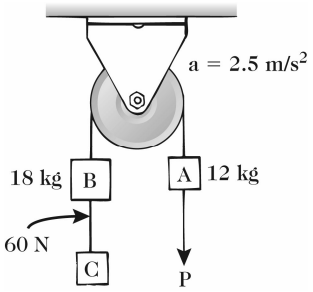
A) 7.5 m/s^2 B) 8.1 m/s^2 C) 9.0 m/s^2 D) 8.5 m/s^2

55. A 15 kg block is on a ramp that is inclined at 20° above the horizontal. It is connected by a string to a 19 kg mass that hangs over the top edge of the ramp. Assuming that frictional forces may be neglected, what is the magnitude of the acceleration of the 19 kg block? (See the figure.)



A) 4.0 m/s^2 B) 4.5 m/s^2 C) 4.2 m/s^2 D) 3.8 m/s^2

56. A tightrope walker walks across a 30.0 m long wire tied between two poles. The center of the wire is displaced vertically downward by 1.0 m when he is halfway across. If the tension in both halves of the wire at this point is 6294 N, what is the mass of the tightrope walker? Neglect the mass of the wire.
A) 74 kg B) 91 kg C) 85 kg D) 43 kg



Three blocks, connecting ropes, and a light frictionless pulley comprise a system, as shown. An external force P is applied downward on block A. The system accelerates at the rate of 2.5 m/s^2. The tension in the rope connecting block B and block C equals 60 N.

57. In the figure above, the external force P is closest to:
A) 210 N B) 190 N C) 230 N D) 170 N E) 250 N

58. What is the mass of an object that experiences a gravitational force of 685 N near Earth's surface?
A) 72.7 kg B) 68.5 kg C) 71.3 kg D) 69.9 kg

59. If I weigh 741 N on Earth and 5320 N on the surface of a nearby planet, what is the acceleration due to gravity on that planet?
A) 81.0 m/s^2 B) 51.4 m/s^2 C) 70.4 m/s^2 D) 61.2 m/s^2

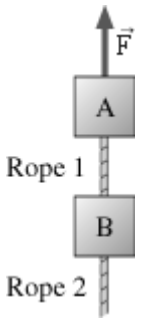
60. Joe and Bill are playing tug–of–war. Joe is pulling with a force of 200 N. Bill is simply hanging on to the rope. Neither person is moving. What is the tension of the rope?
A) 300 N B) 200 N C) 400 N D) 0 N

61. Joe and Bill are playing tug–of–war. Joe is pulling with a force of 200 N. Bill is simply hanging on, but skidding toward Joe at a constant velocity. What is the force of friction between Bill's feet and the ground?
A) 400 N B) less than 200 N
C) greater than 200 N, but less than 400 N D) 200 N

62. A person who normally weighs 200 pounds is standing on a scale inside an elevator. The elevator is moving upwards with a speed of 7 m/s, and then begins to slow down at a rate of $5\ m/s^2$. Before the elevator begins to slow down, the reading of the scale is _____, and while the elevator is slowing down, the reading of the scale is _____.

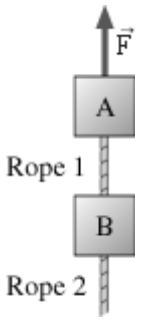
A) less than 200 pounds, 100 pounds
B) greater than 200 pounds, 100 pounds
C) greater than 200 pounds, 0 pounds
D) 200 pounds, 100 pounds
E) None of the above

63. The figure shows two 1.0 kg blocks connected by a rope. A second rope hangs beneath the lower block. Both ropes have a mass of 250 g. The entire assembly is accelerated upward at $2.3\ m/s^2$ by force $\vec{F}$. What is the tension at the top end of rope 1?



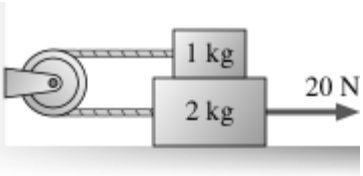
A) 2.9 N B) 3.5 N C) 15 N D) 18 N

64. The figure shows two 1.0 kg blocks connected by a rope. A second rope hangs beneath the lower block. Both ropes have a mass of 250 g. The entire assembly is accelerated upward at $5.5\ m/s^2$ by force $\vec{F}$. What is the tension at the bottom end of rope 1?



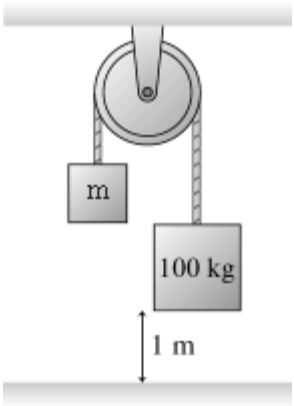
A) 38 N B) 6.9 N C) 19 N D) 23 N

65. A rope pulls on the lower block in the figure with a tension force of 20 N. The coefficient of kinetic friction between the lower block and the surface is 0.16. The coefficient of kinetic friction between the lower block and the upper block is also 0.16. What is the acceleration of the 2.0 kg block?



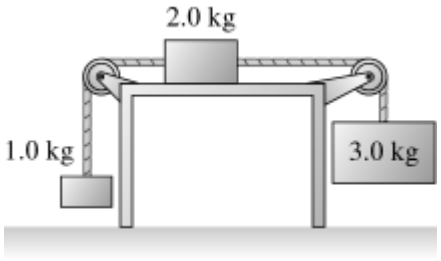
A) 7.6 m/s^2 B) 8.4 m/s^2 C) 9.2 m/s^2 D) 6.9 m/s^2

66. The figure shows a 100 kg block being released from rest from a height of 1.0 m. It then takes 0.90 s to reach the floor. What is the mass of the block on the left?



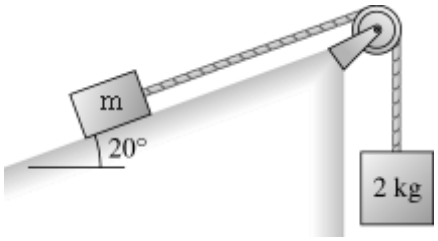
A) 42 kg B) 54 kg C) 48 kg D) 60 kg

67. Consider the following figure. Assume the strings and pulleys have negligible masses and the coefficient of kinetic friction between the 2.0 kg block and the table is 0.25. What is the acceleration of the 2.0 kg block?



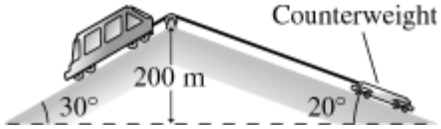
A) 3.2 m/s^2 B) 1.7 m/s^2 C) 4.0 m/s^2 D) 2.5 m/s^2

68. The figure shows a block of mass m resting on a 20° slope. The block has coefficients of friction $\mu_s = 0.55$ and $\mu_k = 0.45$ with the surface. It is connected via a massless string over a massless, frictionless pulley to a hanging block of mass 2.0 kg. What is the minimum mass m that will stick and not slip?



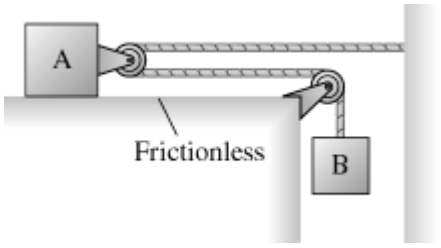
A) 3.9 kg B) 1.4 kg C) 3.8 kg D) 2.3 kg

69. The figure shows a 2000 kg cable car descending a high hill. A counterweight of mass 1800 kg on the other side of the hill aids the brakes in controlling the cable car's speed. The rolling friction of both the cable car and the counterweight are negligible. How much braking force does the cable car need to descend at constant speed?



A) 3800 N B) 2900 N C) 980 N D) 2000 N

70. A wooden block A of mass 4.0 kg slides on a frictionless table when pulled via a massless string and pulley array by a hanging box B of mass 5.0 kg, as shown in the figure. What is the acceleration of block A as it slides on the frictionless table? **Hint:** Think carefully about the acceleration constraint.



A) 4.1 m/s^2 B) 3.1 m/s^2 C) 3.5 m/s^2 D) 2.7 m/s^2

71. A 100 g ball of clay is thrown horizontally with a speed of 50.0 m/s toward a 900 g block resting on a frictionless surface. It hits the block and sticks. The clay exerts a constant force on the block during the 10.0 ms it takes the clay to come to rest relative to the block. After 10.0 ms, the block and the clay are sliding along the surface as a single system. What is the force of the clay on the block during the collision?
A) 500 N B) 4500 N C) 450 N D) 2250 N

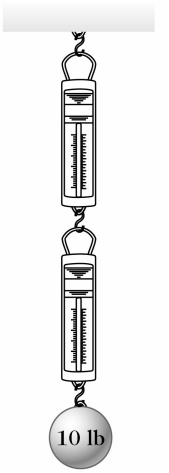
72. A 22 kg box must be slid across the floor. If the coefficient of static friction between the box and floor is 0.37, what is the minimum force needed to start the box moving from rest?
A) 112 N B) 80 N C) 56 N D) 216 N

73. In a shuffleboard game, the puck slides a total of 12 m before coming to rest. If the coefficient of kinetic friction between the puck and board is 0.10, what was the initial speed of the puck?
A) 4.8 m/s B) 48.5 m/s C) 4.3 m/s D) 3.8 m/s

74. A driver in a 1000.0 kg car traveling at 24 m/s slams on the brakes and skids to a stop. If the coefficient of friction between the tires and the road is 0.80, how long will the skid marks be?
A) 34 m B) 46 m C) 30 m D) 37 m

75. Jason takes off across level water on his jet–powered skis. The combined mass of Jason and skis is 75 kg (the mass of the fuel is negligible). The skis have a thrust of 200 N and a coefficient of kinetic friction on water of 0.1. Unfortunately, the skis run out of fuel after only 90 s. What is Jason's top speed?
A) 24 m/s B) 150 m/s C) 240 m/s D) 90 m/s

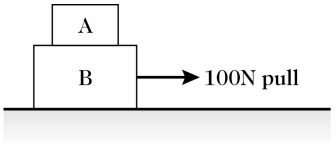
76. A 200 g hockey puck is launched up a metal ramp that is inclined at a 30° angle. The coefficients of static and kinetic friction between the hockey puck and the metal ramp are $\mu_s = 0.40$ and $\mu_k = 0.30$, respectively. The puck's initial speed is 16 m/s. What vertical height does the puck reach above its starting point?
A) 8.6 cm B) 17 cm C) 4.2 cm D) 13 cm



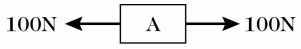
77. In the figure, a 10 lb weight is suspended from two spring scales, each of which has negligible weight. Thus
A) the lower scale will read zero, the top scale will read 10 lb.
B) each scale will read 5 lb.
C) the top scale will read zero, the lower scale will read 10 lb.
D) each scale will show a reading between one and 10 lb, such that the sum of the two is 10 lb. However, exact readings cannot be determined without more information.
E) None of these is true.

78. If you were to move into outer space far from any stars or planets,
A) your weight would change, but your mass would not change.
B) your mass would change, but your weight would not change.
C) both your weight and mass would change.
D) neither your weight nor your mass would change.
E) None of these is true.

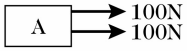
79. Two blocks, A and B, are being pulled to the right along a horizontal surface by a horizontal 100 N pull, as shown in the figure. Both of them are moving together at a constant velocity of 2.0 m/s to the right, and both weigh the same. Which of the figures below shows a correct free-body diagram of the horizontal forces acting on upper block, A?



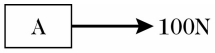
A)



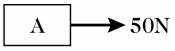
B)



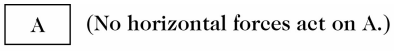
C)



D)



E)



80. A rope is tied to a large crate, which is sitting on a flat surface. The coefficient of static friction between the crate and the ground is 0.9. If a person is to pull on the rope with the minimum force needed such that the crate begins to slide, the angle between the rope and the ground should be
    A) 90 degrees.
    B) 0 degrees (rope is horizontal).
    C) greater than 0 degrees but less than 90 degrees.

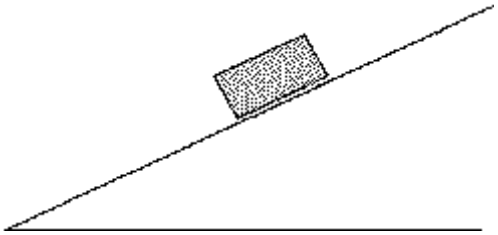
81. A cyclist is riding up a hill having a constant slope of 30° with respect to the horizon at a constant speed (in a straight line). Which statement is true?
    A) The net force on the bike (due to gravity, the normal force, and friction) is zero.
    B) The net force on the bike (due to gravity, the normal force, and friction) is in the opposite direction of motion.
    C) The net force on the bike (due to gravity, the normal force, and friction) is in the direction of motion.
    D) None of the above statements are true.

82. A brick initially has its largest–area face in contact with a rough surface, as shown on the left in the figure. A force F is required to pull the brick along the surface at constant speed.

The brick is now flipped so that a face of smaller area is in contact, as on the right in the figure. The material of the brick is uniform on all faces. What force is now required to pull the brick along at constant speed as before?

A) a greater force
B) a smaller force
C) the same force
D) One cannot say without knowing the coefficient of friction.

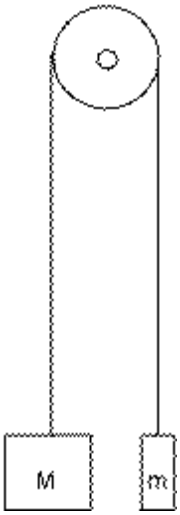
83. A block is at rest on a rough incline as shown.



The frictional force acting on the block, along the incline, is

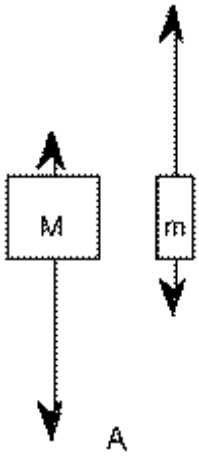
A) zero.
B) less than the weight of the block.
C) greater than the weight of the block.
D) equal to the weight of the block.

84. Two unequal masses M and m are connected by a light cord passing over a pulley of negligible mass. When released, the system accelerates. Friction is negligible.

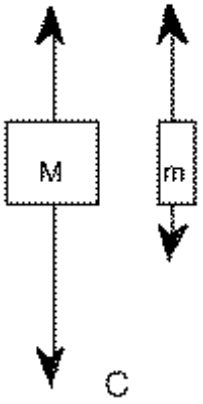


Which figure below gives the correct free–body force diagrams for the two masses in the moving system?

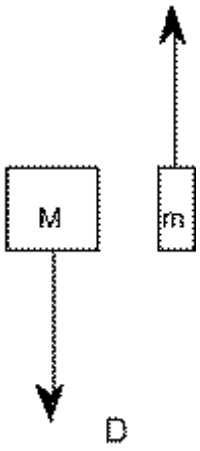
A)



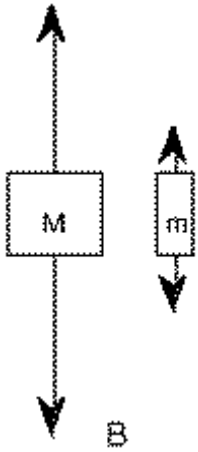
B)



C)



D)



85. Calculate the angular speed, in rad/s, of a flywheel turning at 520.0 rpm.
A) 8.656 rad/s B) 54.44 rad/s C) 40.83 rad/s D) 60.97 rad/s

86. Through what angle in degrees does a 33 rpm record turn in 0.25 s?
A) 28° B) 36° C) 58° D) 50°

87. An electrical motor spins at a constant 2857.0 rpm. If the armature radius is 2.685 cm, what is the acceleration of the edge of the rotor?
A) 844.4 m/s^2 B) 84.40 m/s^2 C) 241,100 m/s^2 D) 2403 m/s^2

88. A satellite is in orbit around a planet. The orbital radius is 34.0 km and the gravitational acceleration at that height is 2.3 m/s^2. What is the satellite's orbital speed?
A) 280 m/s B) 28 m/s C) 88 m/s D) 8.8 m/s

89. A 23 kg mass is connected to a nail on a frictionless table by a (massless) string of length 1.3 m. If the tension in the string is 51 N while the mass moves in a uniform circle on the table, how long does it take for the mass to make one complete revolution?
A) 5.2 s B) 4.8 s C) 4.5 s D) 3.8 s

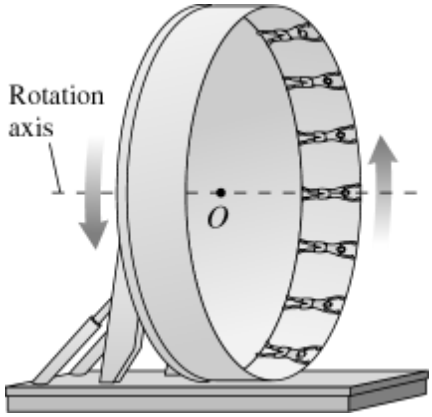
90. A new roller coaster contains a loop–the–loop in which the car and rider are completely upside down. If the radius of the loop is 13.2 m, with what minimum speed must the car traverse the loop so that the rider does not fall out while upside down at the top? Assume the rider is not strapped to the car.

A) 10.1 m/s B) 14.9 m/s C) 12.5 m/s D) 11.4 m/s

91. A tetherball is on a 2.1 m string that makes an angle of 44° with the vertical as it moves around the pole in a horizontal plane. If the mass of the ball is 1.3 kg, what is the ball's speed?

A) 2.9 m/s B) 3.7 m/s C) 3.4 m/s D) 4.2 m/s

92. In an amusement park ride, passengers stand inside an 8 m radius cylinder. Initially, the cylinder rotates with its axis oriented along the vertical. After the cylinder has acquired sufficient speed, it tilts into a vertical plane, that is, the axis tilts into the horizontal, as shown in the figure. Suppose that, once the axis has tilted into the horizontal, the ring rotates once every 4.5 s. If a rider's mass is 40 kg, with how much force does the ring push on her at the top of the ride?



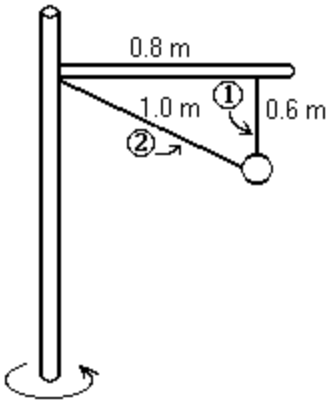
A) 620 N B) 1000 N C) 390 N D) 230 N

93. Future space stations will create an artificial gravity by rotating. Consider a cylindrical space station of 380 m diameter rotating about its axis. Astronauts walk on the inside surface of the space station. What rotation period will provide "normal" gravity?

A) 4.4 s B) 39 s C) 6.2 s D) 28 s

94. An aerobatic aircraft is to perform a spiral maneuver. If the engine provides a tangential acceleration of 5.41 m/s^2, what is the radial acceleration it will experience at the end of a circle 30.8 m in radius, if the speed at the beginning of the stunt was 55.0 m/s?

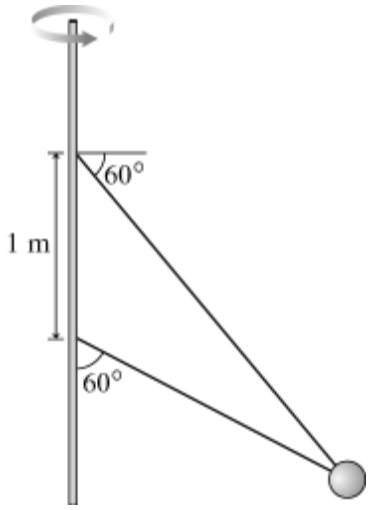
A) 257 m/s^2 B) 132 m/s^2 C) 98 m/s^2 D) 166 m/s^2



95. A ball of mass 8.0 kg is suspended by two wires from a horizontal arm, which is attached to a vertical shaft, as shown in the figure. The shaft is in uniform rotation about its axis such that the linear speed of the ball equals 2.3 m/s. The tension in wire 1 is closest to:

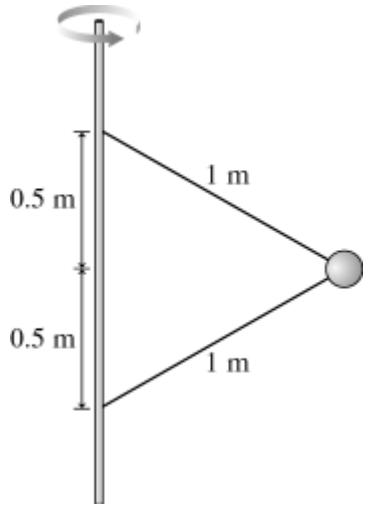
A) 20 N B) 9.8 N C) 39 N D) 29 N E) 49 N

96. The figure shows two wires tied to a 3.3 kg sphere that revolves in a horizontal circle at constant speed. At this particular speed the tension is the same in both wires. What is the tension?



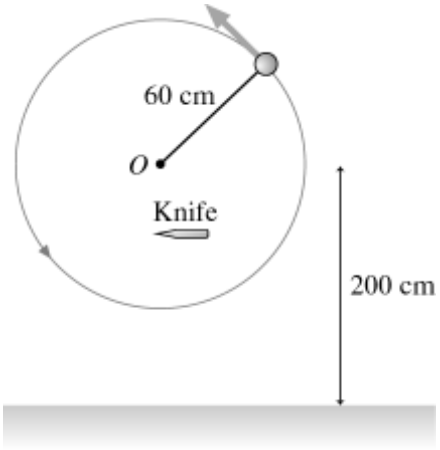
A) 32 N B) 44 N C) 24 N D) 22 N

97. The figure shows two wires that are tied to a 710 g mass that revolves in a horizontal circle at a constant speed of 7.5 m/s. What is the tension in the upper wire?



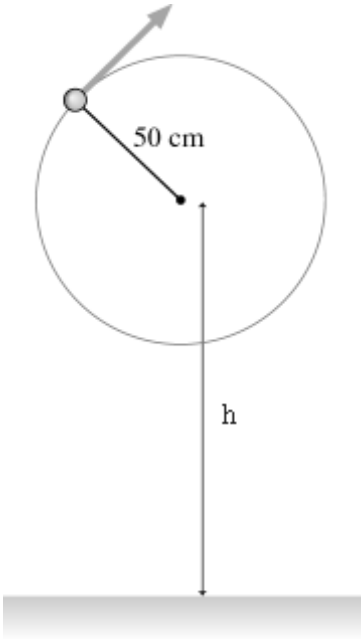
A) 27 N B) 20 N C) 34 N D) 41 N

98. A 90 g bead on a 60 cm long string is swung in a vertical circle about a point 200 cm above the floor. The tension in the string when the bead is at the very bottom of the circle is 2.2 N. A very sharp knife is suddenly inserted, as shown in the figure, to cut the string directly below the point of support. How far to the right of the center of the circle does the ball hit the floor?



A) 190 cm B) 240 cm C) 200 cm D) 160 cm

99. The figure shows a 3.0 kg ball tied to the end of a 50 cm long string being swung in a circle in a vertical plane at constant speed. The center of the circle is h = 510 cm above the floor. The ball is swung at the minimum speed necessary to make it over the top without the string going slack. If the string is released at the instant the ball is at the top of the loop, how far to the right of the center of the circle does the ball hit the ground?



A) 230 cm B) 210 cm C) 0.0 cm D) 240 cm

100. What is the magnitude of the force exerted by Earth on the Moon?

A) 7.67×10^{31} N B) 7.67×10^{28} N C) 2.01×10^{20} N D) 2.01×10^{26} N

101. An astronaut is in equilibrium when he is positioned 140 km from planet X and 581 km from planet Y, along the straight line joining the planets' centers. What is the ratio of the masses X/Y?

A) 0.0581 B) 4.15 C) 17.2 D) 0.241

102. At a given point above the surface of Earth, the gravitational acceleration is equal to 7.8 m/s^2. The altitude of this point, above the surface of Earth, in km, is closest to:

A) 770 B) 1500 C) 970 D) 2400 E) 2000

103. What is the gravitational force acting on a person due to another person standing 2 meters away? Assume each individual has 59 kg mass.

A) 9.8×10^{-10} N
B) 8.5×10^{3} N
C) 2.0×10^{-9} N
D) 1.2×10^{-7} N
E) 5.8×10^{-8} N

104. The weight of spaceman Speff, solely due to the gravitational pull of planet X at its surface, is 389 N. If he moves to a distance of 1.86×10^4 km above the planet's surface, his weight changes to 24.31 N. What is the mass of planet X, if Speff's mass is 75 kg?

A) 2.96×10^{18} kg B) 2.96×10^{24} kg C) 2.96×10^{17} kg D) 1.59×10^{18} kg

105. If we assume that an electron is orbiting a proton just like the moon orbits Earth, find the electron's orbital speed due to the gravitational attraction between itself and the proton. Take the orbital radius as 1.00×10^{-10} m. (This is a very wrong assumption to make.)

A) 1.11×10^{-27} m/s B) 3.33×10^{-14} m/s C) 1.06×10^{-27} m/s D) 1.11×10^{-13} m/s

106. Spaceman Speff orbits planet X with his spaceship. To remain in orbit at 421 km from the planet's center, he should maintain a speed of 80 m/s. What is the mass of planet X?

A) 5.1×10^{14} kg B) 4.0×10^{19} kg C) 5.1×10^{17} kg D) 4.0×10^{16} kg

107. From what height off the surface of Earth should an object be dropped to initially experience an acceleration of 0.5400 g?

A) 2930 km B) 1689 km C) 2298 km D) 5426 km

108. Suppose we want a satellite to revolve around Earth 5 times a day. What should the radius of its orbit be? (Neglect the presence of the Moon.)

A) 2.11×10^7 m B) 1.44×10^7 m C) 7.22×10^7 m D) 0.69×10^7 m

109. A proton moving at 0.999 of the speed of light orbits a black hole 4972 km from the center of the attractor. What is the mass of the black hole?

A) 6.71×10^{25} kg B) 6.71×10^{30} kg C) 6.71×10^{33} kg D) 6.71×10^{36} kg

110. You are the science officer on a visit to a distant solar system. Prior to landing on a planet you measure its diameter to be 1.8×10^7 m. You have previously determined that the planet orbits 2.9×10^{11} m from its star with a period of 402 Earth days. Once on the surface you find that the acceleration due to gravity is 19.5 m/s^2. What are the masses of (a) the planet and (b) the star?

A) (a) 2.4 kg $\times 10^{25}$ kg
(b) 1.2 kg $\times 10^{31}$ kg

B) (a) 2.4 kg $\times 10^{25}$ kg
(b) 7.1 kg $\times 10^{30}$ kg

C) (a) 4.3 kg $\times 10^{25}$ kg
(b) 1.2 kg $\times 10^{31}$ kg

D) (a) 4.3 kg $\times 10^{25}$ kg
(b) 7.1 kg $\times 10^{30}$ kg

111. Find the orbital speed of an ice cube in the rings of Saturn, if the mass of Saturn is 5.67×10^{26} kg and the rings have an average radius of 100,000 km.

A) 1.95 km/s B) 19.5 km/s C) 27.5 km/s D) 13.8 km/s

	Mass	Radius	orbital radius	orbital period
Moon A	4×10^{20}kg		2×10^{8}m	4×10^{6}s
Moon B	1.5×10^{20}kg	2×10^{5}m	3×10^{8}m	

Ekapluto is an unknown planet that has two moons in circular orbits. The table summarizes the hypothetical data about the moons.

112. In the table, the mass of Ekapluto is closest to:
A) 1×10^{23} kg B) 1×10^{22} kg C) 3×10^{23} kg D) 1×10^{24} kg E) 3×10^{22} kg

113. A person ties a rock to a string and whirls it around in a vertical circle such that sometimes the rock is going straight upward and sometimes the rock is going straight down. She whirls the rock at the minimum speed (constant in time) such that the string is always taut (no sag). If she were to use a longer string, she would have to whirl the rock at a
A) higher velocity. B) the same velocity. C) lower velocity.

114. A person ties a rock to a string and whirls it around in a vertical circle such that sometimes the rock is going straight upward and sometimes the rock is going straight down. She whirls the rock at the minimum speed (constant in time) such that the string is always taut (no sag). When is the tension the highest?
A) The tension is constant as the rock moves around in a circle.
B) It is highest when the rock is at the lowest elevation.
C) It is highest when the rock is at the highest elevation.

115. A merry–go–round is spinning at a fixed rate. As a person is walking toward the edge,
A) the force of static friction must decrease in order for the person not to slide off.
B) the force of static friction must increase in order for the person not to slide off.
C) the force of static friction such that the person does not slide off remains the same.

116. You need to make a sharp turn on a flat road, making a radius of curvature of 15 meters. How does the required force of static friction between your tires compare if you make the turn at 30 mph vs. 60 mph?
A) The force of friction is the same for both speeds since the radius of curvature is the same.
B) The force of friction needs to be four times as large.
C) The force of friction needs to be twice as large.
D) None of the above

117. If you stood on a planet having a mass four times higher than Earth's mass, and a radius two times longer than Earth's radius, you would weigh
A) two times more than you do on Earth. B) four times more than you do on Earth.
C) the same as you do on Earth. D) two times less than you do on Earth.

118. A satellite having orbital speed V orbits a planet of mass M. If the planet had half as much mass, the orbital speed of the satellite would be:
A) $V/\sqrt{2}$ B) V C) V/2 D) 2V E) $V\sqrt{2}$

119. A satellite of mass M takes time T to orbit a planet. If the satellite had twice as much mass, the time for it to orbit the planet would be:
A) T B) 4T C) T/4 D) 2T E) T/2

120. If the Moon were twice the distance from Earth than it currently is, the amount of time it would take to go around Earth would be roughly (the current orbital period of the Moon is four weeks)
A) eight weeks. B) 88 weeks. C) 11 weeks. D) six weeks.

121. If an astronaut were exactly half way between Earth and the Moon, the net gravitational force exerted on the astronaut by these two objects would be
A) directed toward the Moon. B) zero. C) directed toward Earth.

Answer Key
Testname: CH 4–6 TEST BANK

1. A
2. D
3. C
4. B
5. A
6. C
7. B
8. A
9. D
10. C
11. A
12. C
13. D
14. A
15. D
16. A
17. D
18. B
19. D
20. C
21. B
22. B
23. B
24. A
25. B
26. D
27. C
28. B
29. A
30. C
31. D
32. A
33. B
34. B
35. B
36. C
37. C
38. B
39. D
40. C
41. B
42. D
43. C
44. D
45. B
46. C
47. D
48. B
49. A

50. B
51. A
52. C
53. B
54. D
55. A
56. C
57. B
58. D
59. C
60. B
61. D
62. D
63. D
64. C
65. D
66. D
67. D
68. D
69. A
70. A
71. C
72. B
73. A
74. D
75. B
76. A
77. E
78. A
79. E
80. C
81. A
82. C
83. B
84. B
85. B
86. D
87. D
88. A
89. B
90. D
91. B
92. D
93. D
94. D
95. C
96. C
97. C
98. D

99. D
100. C
101. A
102. A
103. E
104. B
105. B
106. B
107. C
108. B
109. C
110. A
111. B
112. C
113. A
114. B
115. B
116. B
117. C
118. A
119. A
120. C
121. C