Chapter 5

More Applications of Newton's Laws

1. A body of mass 1 kg moving at a speed of 4 m/s starts to slide on a surface. It slides 16 m and comes to a stop. What mass would stop after sliding a distance of 8 m when it is started at the 4 m/s speed? Assume all surfaces have the same coeffcient of kinetic friction as in the initial experiment.
a. 0.5 kg
b. 2 kg
c. 2.5 kg
d. 4 kg
e. No mass would stop in less than 16 m.

ANS: e

2. A skydiver jumps out of a plane. Before reaching terminal velocity, her
a. displacement remains constant.
b. velocity decreases.
c. acceleration remains constant.
d. acceleration decreases.
e. acceleration increases.

ANS: d

3. A skydiver jumps out of a plane. Before reaching terminal velocity, her
a. displacement remains constant.
b. velocity decreases.
c. acceleration remains constant.
d. acceleration increases.
e. velocity increases.

ANS: e [AU: SAME QUESTION – WITH DIFFERENT ANSWERS??

4. A bowling ball, a basketball, and a baseball are dropped at the same time from a height of 100 m. Predict the order in which they will hit the ground, if air resistance is taken into account.
a. bowling ball, basketball, baseball
b. basketball, baseball, bowling ball
c. baseball, bowling ball, basketball
d. bowling ball, baseball, basketball
e. baseball, basketball, bowling ball

ANS: d

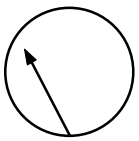
5. What is the magnitude of the net force on a skydiver in N when an 810 N gravitational force and a 750 N force of air resistance act on him?
a. 1.1
b. 11
c. 60
d. 560
e. 1560

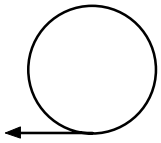
ANS: c

6. What is the magnitude of the net acceleration of a skydiver in m/s^2 when an 810 N gravitational force and a 750 N force of air resistance act on him?
a. 0.75
b. 13
c. 60
d. 73
e. 80

ANS: a

7. A ball attached to a string moves clockwise in a vertical circular path in a uniform gravitational field directed downwards. What is the direction of the acceleration vector when the ball is at the lowest point of its path?


a.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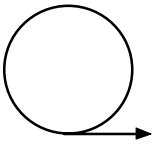
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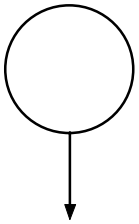
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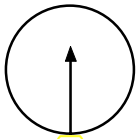
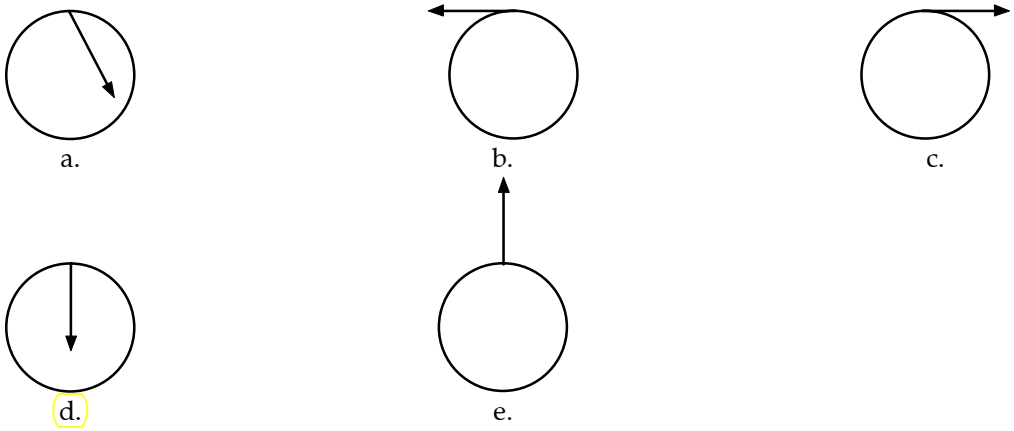

e.

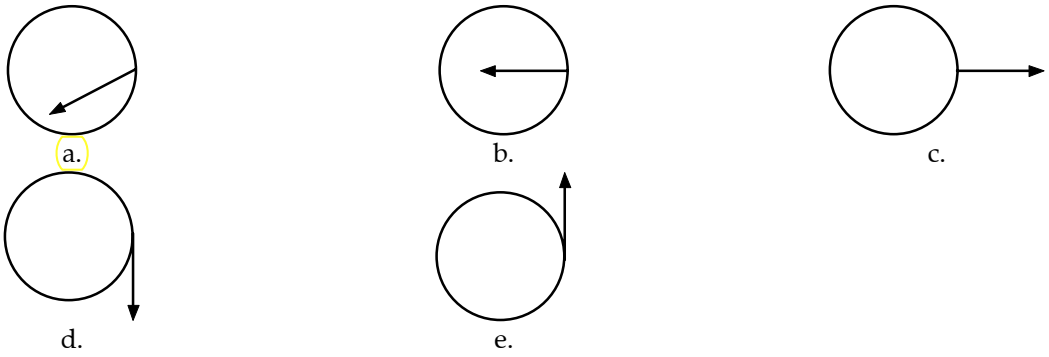
ANS: e

8. A ball attached to a string moves clockwise in a vertical circular path in a uniform gravitational field directed downwards. What is the direction of the acceleration vector when the ball is at the highest point of its path?



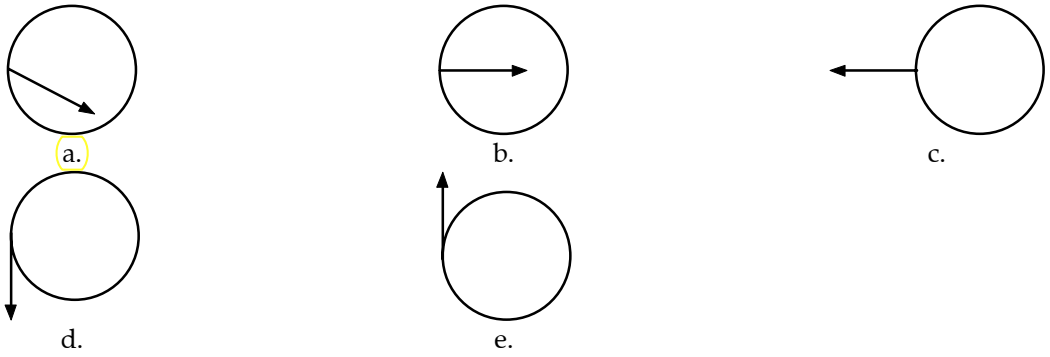
ANS: d

9. A ball attached to a string moves clockwise in a vertical circular path in a uniform gravitational field directed downwards. What is the direction of the acceleration vector when the ball is at the position indicated in the diagram?



ANS: a

10. A ball attached to a string moves clockwise in a vertical circular path in a uniform gravitational field directed downwards. What is the direction of the acceleration vector when the ball is at the position indicated in the diagram?



ANS: a

11. A minimum force of 25 N is needed to make a 15 kg block resting on a horizontal surface start to move. What is the coefficient of static friction between the block and the surface?
a. 0.12
b. 0.15
c. 0.17
d. 0.19
e. 0.21

ANS: c

12. A 1200 kg car is moving in a straight line at a constant speed of 15 m/s when the brakes are applied. The coefficient of friction between the car and the road is 0.25. How far in m does the car travel after the brakes are applied?
a. 37
b. 39
c. 41
d. 44
e. 46

ANS: e

13. A 1500 kg car is moving at 21 m/s when the brakes are applied. If the coefficient of friction between the car and the road is 0.37, what time in s does it take the car to stop?
a. 5.8
b. 6.2
c. 6.4
d. 6.6
e. 6.8

ANS: a

14. A 1500 kg car is moving at 17 m/s. How fast is the car moving in m/s 2.2 s after the brakes are applied if the coefficient of friction between the car and the road is 0.32?
a. 10
b. 11
c. 12
d. 13
e. 14

ANS: a

15. A 12 N force parallel to a 30° incline propels a block up the incline with constant speed. If the coefficient of friction is 0.25, what is the mass of the block in kg?
a. 0.72
b. 0.98
c. 1.2
d. 1.5
e. 1.7

ANS: e

16. A block slides down a 26° incline with a constant speed. What is the coefficient of friction between the block and the incline?
a. 0.98
b. 0.82
c. 0.69
d. 0.55
e. 0.49

ANS: e

17. A skier is moving down a 5.0° slope at 15 m/s. If the coefficient of friction between her and the slope is 0.18, what is her stopping distance in m?
a. 64
b. 125
c. 250
d. 560
e. 1200

ANS: b

18. A car moves in a circle of 30 m radius. It moves with constant speed and makes one complete revolution in 22 s. What is its speed in m/s?
a. 7.5
b. 8.6
c. 9.7
d. 11
e. 12

ANS: b

19. A car is moving in a circle of 25 m radius at a constant speed of 12 m/s. What is the magnitude in m/s^2 of the centripetal acceleration acting on the car?
a. 5.8
b. 6.4
c. 7.2
d. 7.4
e. 7.6

ANS: a

20. A 5.00 kg mass moves in a circle of 0.700 m radius. If the maximum centripetal force that can be applied to the mass is 120 N, what is its maximum speed in m/s?
a. 14.4
b. 14.8
c. 15.2
d. 16.8
e. 4.1

ANS: e

21. A 1200 kg car on a flat surface moves in a circle with a 62 m radius. What is the minimum coefficient of friction needed for the car to continue in the circular path at a speed of 15 m/s without slipping?
a. 0.15
b. 0.23
c. 0.35
d. 0.37
e. 0.41

ANS: d

22. A bicycle and bicyclist of combined mass 62 kg go over a hump of radius 6.0 m at a speed of 5.0 m/s. What is their combined apparent weight at the top of the hump?
a. 610
b. 430
c. 350
d. 310
e. 290

ANS: c

23. A motorcycle and rider moving along a road go over a hump of radius 12 m. What speed in m/s must they have at the top of the hump in order to appear weightless?
a. 9.8
b. 10.8
c. 11.8
d. 12.8
e. 8.9

ANS: b

24. A 0.50 kg mass is swung in a vertical circle. It is fastened to a string 0.40 m long. What is the tension in the string in N at the top of the circle when its speed at that point is 6.0 m/s?
a. 44
b. 43
c. 42
d. 41
e. 40

ANS: e

25. A 0.60 kg mass is swung in a vertical circle. It is fastened to a string 0.35 m long. What is the tension in the string in N at the bottom of the circle when the speed of the mass at that point is 5.5 m/s?
a. 35
b. 43
c. 49
d. 58
e. 61

ANS: d

26. The terminal speed of an object falling through the air is 55 m/s. What is its acceleration in m/s^2 when it is falling at 45 m/s?
a. 9.8
b. 8.3
c. 5.2
d. 3.2
e. 2.8

ANS: d

27. The terminal speed of a skydiver is 66 m/s. What is her acceleration in m/s^2 when she is moving at a speed of 36 m/s?
a. 5.3
b. 6.9
c. 7.2
d. 7.7
e. 8.1

ANS: b

28. If the net force in N on a body is $mg - 0.040v$, what is the terminal speed of a 0.0050 kg body in m/s?
a. 0.98
b. 0.99
c. 1.2
d. 1.4
e. 1.6

ANS: c

29. What is the drag force in N on a 0.14 kg body falling through the air at its terminal velocity of 42 m/s?
a. 1.4
b. 1.2
c. 1.0
d. 0.98
e. 0.96

ANS: a

30. The net force on a 0.035 kg rock falling through the air is $F = mg - 3.2 \times 10^{-4} v^2$. What is its terminal speed in m/s?
a. 22
b. 24
c. 27
d. 31
e. 33

ANS: e

31. A ball falling through the air reaches its terminal speed of 27 m/s when it is 14 m above the ground. How much longer in s does it take to reach the ground?
a. 0.52
b. 1.9
c. 0.26
d. 1.6
e. 0.75

ANS: a

32. A race car travels 44 m/s around a banked (45° with the horizontal) circular (radius = 200 m) track. What is the magnitude of the resultant force in kN on the 80 kg driver of this car?
a. 0,52
b. 0.64
c. 0.68
d. 0.73
e. 0.79

ANS: e

33. An airplane travels 80 m/s as it makes a horizontal circular turn that has a 0.80 km radius. What is the magnitude in kN of the resultant force on the 75 kg pilot of this airplane?
a. 0.69
b. 0.63
c. 0.66
d. 0.60
e. 0.57

ANS: d

34. A 30 kg child rides on a circus ferris wheel that takes her around a vertical circular path with a radius of 20 m every 22 s. What is the magnitude in N of the resultant force on the child at the highest point on this trajectory?
a. 49
b. 250
c. 340
d. 290
e. 760

ANS: a

35. An amusement ride consists of a car moving in a vertical circle on the end of a rigid boom. The radius of the circle is 10 m. The combined weight of the car and riders is 5.0 kN. At the top of the circle the car has a speed of 5.0 m/s. What is the force toward the center, in kN, the boom exerts on the car at the top of the circle? The unit vector $\hat{\mathbf{j}}$ is directed vertically upwards.

a. $-3.7\hat{\mathbf{j}}$
b. $-1.3\hat{\mathbf{j}}$
c. $6.3\hat{\mathbf{j}}$
d. $3.7\hat{\mathbf{j}}$
e. $-5.2\hat{\mathbf{j}}$

ANS: d

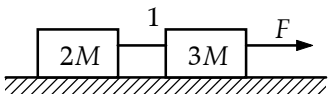
36. A highway curve has a radius of 0.14 km and is unbanked. A car weighing 12 kN goes around the curve at a speed of 24 m/s without slipping. What is the magnitude in kN of the horizontal force of the road on the car?
a. 12
b. 17
c. 13
d. 4.9
e. 5.0

ANS: e

37. A stunt pilot weighing 0.70 kN performs a vertical circular dive of radius 800 m. At the bottom of the dive, the pilot has a speed of 200 m/s. What force toward the center of the circle, in kN, does the plane exert on the pilot?
a. 3.6 up
b. 4.3 up
c. 2.9 down
d. 2.9 up
e. 5.8 down

ANS: b

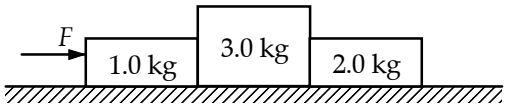
38. When $M = 2.0$ kg, the acceleration of the blocks is 1.0 m/s^2. If the coefficient of friction between each block and the surface is 0.41, determine F in N.



a. 20
b. 30
c. 40
d. 50
e. 60

ANS: d

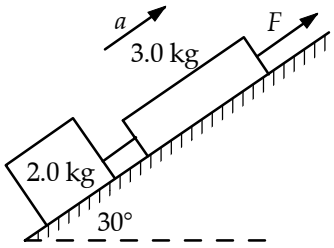
39. The coefficient of friction between each block and the surface is 0.2. When $F = 24$ N, what is the magnitude of the force exerted on the 2.0 kg block by the 3.0 kg block?



a. 6
b. 8
c. 10
d. 12
e. 14

ANS: b

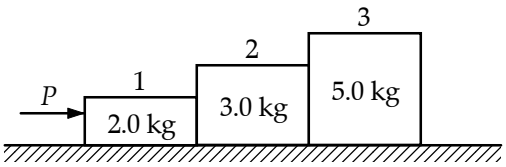
40. The coefficient of friction between each block and the plane is 0.20. If $a = 1.3$ m/s^2, what is F in N?



a. 37.5
b. 41.0
c. 35.5
d. 33.5
e. 39.5

ANS: e

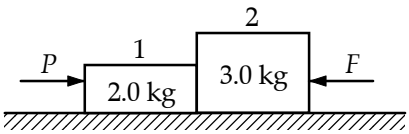
41. If $P = 6.0$ N, what is the magnitude in N of the force exerted on block 1 by block 2? (Assume the surface is frictionless.)



a. 6.4
b. 5.6
c. 4.8
d. 7.2
e. 8.4

ANS: c

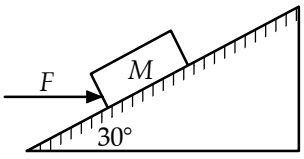
42. If $F = 5.0$ N, what is the magnitude of the force in N exerted by block 2 on block 1? (Assume the surface is frictionless.)



a. 17
b. 19
c. 21
d. 23
e. 5.0

ANS: a

43. A 14 N applied horizontal force acts on an $M = 4.0$ kg block as shown below. The block is on a frictionless 30° incline. What is the magnitude of the resulting acceleration of the block in m/s^2?



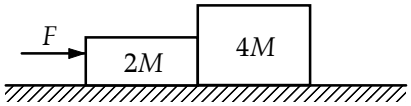
a. 1.9
b. 1.4
c. 3.5
d. 3.2
e. 1.1

ANS: a

44. An astronaut who weighs 800 N on the surface of the earth lifts off from planet "Zuton" in a spaceship. The free-fall acceleration on Zuton is 3.0 m/s^2 down. At the moment of lift off the acceleration of the spaceship is 0.50 m/s^2 (up). What is the magnitude of the force in N of the spaceship on the astronaut?
a. 41
b. 0.29×10^3
c. 0.24×10^3
d. 0.20×10^3
e. 0.37×10^3

ANS: b

45. The horizontal surface on which the objects slide is frictionless. If $M = 1.0$ kg and the magnitude of the force of the small block on the large block is 5.2 N, determine F in N.



a. 6.0
b. 9.0
c. 7.8
d. 4.8
e. 4.1

ANS: c

46. Fred and Sue are 16 m from each other. If the gravitational force between them is F, what would the gravitational force between them be if they were 8 m apart?
a. F
b. $2F$
c. $3F$
d. $4F$
e. $8F$

ANS: d

47. A proton and electron have charges of the same magnitude and opposite sign. The charge is 1.60×10^{-19} C. The mass of the electron is 9.11×10^{-31} kg and the mass of the proton is 1.67×10^{-27} kg. What is the ratio of the gravitational force to the electric force between the electron and the proton when separated by 10^{-5} meter? $\left(k_e = 9.89 \times 10^9 \ \text{N} \cdot \text{m}^2/\text{C}^2 ; \ G = 6.67 \times 10^{-11} \ \text{N} \cdot \text{m}^2/\text{C}^2\right)$
a. 7.80×10^{-22}
b. 4.30×10^{-39}
c. 4.80×10^{-21}
d. 7.60×10^{-21}
e. 4.40×10^{-40}

ANS: e

48. Estimate a value in $\mathrm{N \cdot m^2/kg^2}$ for G from the following moon data: radius $= 1.70 \times 10^6$ m, mass $= 7.40 \times 10^{22}$ kg, and gravitational acceleration at the surface $= 1.60$ $\mathrm{m/s^2}$.
a. 6.02×10^{-11}
b. 6.25×10^{-11}
c. 5.90×10^{-11}
d. 8.84×10^{-11}
e. 8.52×10^{-11}

ANS: b

49. Two identical suitcases, an empty one weighing 25 N, and a full one weighing 100 N, fall off a loading dock. The ratio of their accelerations due to gravity is
a. 1:1.
b. 1:4.
c. 1:8.
d. 1:16.
e. 1:32.

ANS: a

50. The SI units of G, the universal gravitational constant, are
a. $\mathrm{kg^2 \cdot N/m^2}$
b. $\mathrm{m \cdot kg/s^2}$
c. $\mathrm{N \cdot m^2/kg^2}$
d. $\mathrm{N \cdot s^2/m^2}$
e. $\mathrm{N \cdot m^2/s^2}$

ANS: c

51. The SI units of k_e, the Coulomb's law constant, are
a. $\mathrm{N \cdot m^2/s^2}$
b. $\mathrm{N \cdot m^2/C^2}$
c. $\mathrm{N \cdot C^2/m^2}$
d. $\mathrm{N \cdot C^2/s^2}$
e. $\mathrm{N \cdot s^2/C^2}$

ANS: b

52. What is the magnitude of the gravitational force in N between two spherical bodies of masses $M = 4.0$ kg and $m = 2.00$ kg when their centers are separated by 2.00 m? $\left(G = 6.67 \times 10^{-11} \ \mathrm{N \cdot m^2/kg^2}\right)$
a. 2.67×10^{-10}
b. 8.84×10^{-8}
c. 1.73×10^{-8}
d. 1.33×10^{-10}
e. 7.40×10^{-11}

ANS: d

53. What is the Earth's gravitational force on a 4000 kg body orbiting 2800 km above the surface in N? The Earth's radius is 6.37×10^6 m.
a. 5.9×10^6
b. 3.9×10^4
c. 2.0×10^4
d. 1.9×10^4
e. 5.3×10^6

ANS: d

54. The Earth's gravitational force must be included when calculating the centripetal force on
a. a spaceship in an equatorial orbit.
b. the moon.
c. a stone at the end of a string, when it is whirled in a horizontal circle.
d. a stone at the end of a string when I is whirled in a vertical circle.
e. all of the above.

ANS: e

55. If you were located on the equator and measured the weight of a gold bar with a very sensitive scale,
a. the weight would be greater at midnight.
b. the mass would be greater at midnight.
c. the weight would be greater at noon.
d. the mass would be greater at noon.
e. it would have the same weight at midnight and at noon."

ANS: a

56. The mass of the sun is 3.30×10^5 times the mass of the earth and the radius of the sun is 1.09×10^2 times the radius of the earth. What is the gravitational acceleration at the surface of the sun in m/s^2?
a. 222
b. 210
c. 327
d. 297
e. 272

ANS: e

57. A 1.00 kg body on the surface of a sphere of mass 5.00×10^8 kg has a weight of 10.1 N. What is the radius of the sphere in m if $G = 6.67 \times 10^{-11}$ $\text{N} \cdot \text{m}^2/\text{kg}^2$?
a. 0.183
b. 0.0283
c. 0.0575
d. 0.267
e. 0.106

ANS: c

58. A sphere of radius 6.00×10^8 m has an acceleration due to gravity of 20.0 m/s^2 at its surface. What is its mass in kg if $G = 6.67 \times 10^{-11}$ $\text{N} \cdot \text{m}^2/\text{kg}^2$?
a. 2.14×10^{29}
b. 1.08×10^{29}
c. 9.83×10^{27}
d. 3.24×10^{29}
e. 5.82×10^{29}

ANS: b

59. Steven sees a book sitting on a table. He then pushes it across the table in a straight line at constant velocity. Compare the total force, $\vec{\mathbf{F}}_R$, the table exerts on the book at rest with the total force, $\vec{\mathbf{F}}_V$, the table exerts on the book when it moves at constant velocity.
a. $\vec{\mathbf{F}}_R = 0$; $\vec{\mathbf{F}}_V$ is the force of friction.
b. $|\vec{\mathbf{F}}_R| = |\vec{\mathbf{F}}_V|$, but their directions are different.
c. $|\vec{\mathbf{F}}_V| > |\vec{\mathbf{F}}_R|$ and their directions are different.
d. $|\vec{\mathbf{F}}_V| < |\vec{\mathbf{F}}_R|$ and their directions are different.
e. $\vec{\mathbf{F}}_V = \vec{\mathbf{F}}_R$.

ANS: c

60. Marie first pushes a book with the largest force $\vec{\mathbf{F}}_S$ it can sustain without moving. She then pushes the book across the table at constant velocity with force $\vec{\mathbf{F}}_V$. Compare the force $\vec{\mathbf{F}}_S$ with the force $\vec{\mathbf{F}}_V$.
a. $\vec{\mathbf{F}}_S = 0$; $\vec{\mathbf{F}}_V$ is the force of friction.
b. $|\vec{\mathbf{F}}_S| = |\vec{\mathbf{F}}_V|$, but their directions are different.
c. $|\vec{\mathbf{F}}_V| > |\vec{\mathbf{F}}_S|$
d. $|\vec{\mathbf{F}}_V| < |\vec{\mathbf{F}}_S|$
e. $\vec{\mathbf{F}}_V = \vec{\mathbf{F}}_S$.

ANS: d

61. When Robin throws a book down on the table, it slides about 20 cm before stopping. Once the book has stopped moving
a. there is no frictional force on the book.
b. a kinetic frictional force continues to act on it to resist its forward motion.
c. there no longer is a force of kinetic friction on the book, but a force of static friction resists any further forward motion.
d. the only force acting on the book is the force of gravity.
e. the only force it exerts is a normal force on the table.

ANS: a

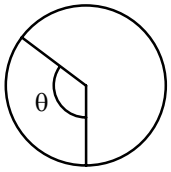
62. Katie has packed a steamer trunk and wants to move it down the hall to the elevator. Which method will require the least total force to move the trunk at constant velocity?
a. Push on the back of the trunk at an angle 25° below the horizontal.
b. Push on the back of the trunk at an angle 75° below the horizontal.
c. Pull the trunk with a rope attached to the front of the trunk at an angle 25° above the horizontal.
d. Pull the trunk with a rope attached to the front of the trunk at an angle 75° above the horizontal.
e. Sit on the trunk with your feet on the trunk and push on the back of the trunk.

ANS: c

63. A light ball with a fuzzy covering is thrown straight up in the air. The travel time to the highest point is t_{up}; the return travel time down to the starting point is t_{down}. Which statement is correct?
a. $t_{up} = t_{down}$
b. $t_{up} < t_{down}$
c. $t_{up} > t_{down}$
d. Any of the above may be correct. It depends on the initial speed of the ball.
e. $t_{up} \geq t_{down}$

ANS: b

64. An airplane of mass m travels in a vertical circle of radius r at constant speed v. At what angle θ, measured from the lowest point in the circle, is the net force on the airplane horizontal?



a. 0°
b. 30°
c. 60°
d. 90°
e. 180°

ANS: d

65. A giant on planet Gulliver drops an astronaut into a column filled with a liquid of density 16 times the density of air. Assume g has the same value as on Earth. If the terminal velocity of a skydiver in air on Earth is 60 m/s, what is the terminal velocity of the astronaut in the liquid?
a. 0 m/s
b. 3.75 m/s
c. 15 m/s
d. 240 m/s
e. 960 m/s

ANS: c

66. A body can move in a circle at constant speed if
a. inward and outward forces are equal in magnitude.
b. net radial forces equal net tangential forces.
c. there is an unbalanced radial force directed inwards.
d. all the statements above are correct.
e. none of the statements above are correct.

ANS: c

67. A body of mass m is placed at point A on the surface of the earth. The gravitational field of the earth at point A
a. has magnitude g and points radially outward.
b. has magnitude g and points radially inward.
c. has magnitude mg and points radially outward.
d. has magnitude mg and points radially inward.
e. has magnitude $\frac{g}{m}$ and points radially outward.

ANS: b

68. When an object moving at speed v_o drops into a medium that exerts a resistive force $\vec{\mathbf{R}} = -b\vec{\mathbf{v}}$, its terminal velocity is
a. 0 s.
b. $\frac{1}{bg}$.
c. $\frac{mg}{b}$.
d. $\frac{m}{b}$.
e. infinite.

ANS: c

69. A 4.0 kg block sits on a surface with $\mu_s = 0.30$ and $\mu_k = 0.25$. The block is attached to a cord that goes over a massless, frictionless pulley to a 2.0 kg block. What is the acceleration in $\mathrm{m/s^2}$ of the 2.0 kg block when it is released?
a. –3.3
b. 0
c. 1.6
d. 3.3
e. 9.8

ANS: c

70. A 4.0 kg block sits on a surface with $\mu_s = 0.55$ and $\mu_k = 0.25$. The block is attached to a cord that goes over a massless, frictionless pulley to a 2.0 kg block. What is the acceleration in m/s^2 of the 2.0 kg block when it is released?
a. –3.3
b. 0
c. 1.6
d. 3.3
e. 9.8

ANS: b

71. An 80 kg skier sliding across a flat smooth ice surface at 20 m/s reaches a flat muddy surface with $\mu_k = 1.2$. How far in m does she travel before stopping?
a. 0
b. 1.7
c. 17
d. 3
e. 41

ANS: c

72. A car enters a level, unbanked semi-circular hairpin turn of 300 m radius at a speed of 40 m/s. The coefficient of friction between the tires and the road is $\mu = 0.544$. If the car maintains a constant speed of 40 m/s, it will
a. attempt to dig into the road surface.
b. tend to veer toward the center of the semi-circle.
c. arrive safely at the end of the semi-circle.
d. tend to veer toward the outside of the circle.
e. first veer toward the center for the first quarter-circle, then veer toward the outside for the second quarter-circle.

ANS: c

73. A car enters a level, unbanked semi-circular hairpin turn of 300 m radius at a speed of 40 m/s. The coefficient of friction between the tires and the road is $\mu = 0.85$. If the car maintains a constant speed of 40 m/s, it will
a. attempt to dig into the road surface.
b. tend to veer toward the center of the semi-circle.
c. arrive safely at the end of the semi-circle.
d. tend to veer toward the outside of the circle.
e. first veer toward the center for the first quarter-circle, then veer toward the outside for the second quarter-circle.

ANS: b

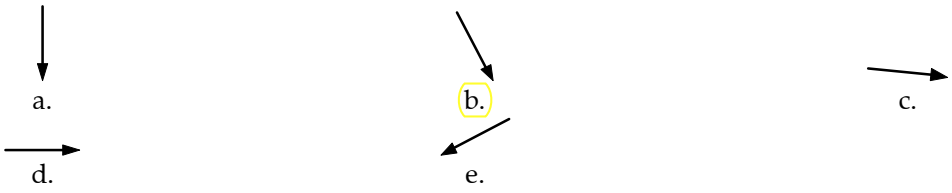
74. A car enters a level, unbanked semi-circular hairpin turn of 300 m radius at a speed of 40 m/s. The coefficient of friction between the tires and the road is $\mu = 0.25$. If the car maintains a constant speed of 40 m/s, it will
a. attempt to dig into the road surface.
b. tend to veer toward the center of the semi-circle.
c. arrive safely at the end of the semi-circle.
d. tend to veer toward the outside of the circle.
e. first veer toward the center for the first quarter-circle, then veer toward the outside for the second quarter-circle.

ANS: d

75. A car enters a semicircular hairpin turn of 400 m radius at a speed of 30 m/s. The curve is banked at a 20° angle, and ice has reduced friction to the point where it can be neglected. In order to stay on the road, the driver must
a. keep the wheels tangent to the direction of the road.
b. turn the front wheels partially in the direction of the center of the circle.
c. turn the front wheels partially toward the outside of the circle.
d. turn the front wheels toward the center in the first half of the turn, outward in the second half of the turn.
e. turn the front wheels toward the center in the first half of the turn, outward in the second half of the turn.

ANS: b

76. While flying east at 5.00 m/s, a bird drops a sunflower seed. If we ignore air resistance, the diagram that best shows the direction of the seed's velocity one second later is



ANS: b

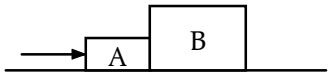
77. Two bodies have masses m_1 and m_2 with charges q_1 and q_2. The ratio of the electrostatic force they exert on one another to the gravitational force they exert on one another is
a. $\frac{Gm_1m_2}{k_eq_1q_2}$.
b. $\frac{k_eq_1q_2}{Gm_1m_2}$.
c. $\frac{Gm_1m_2}{k_eq_1q_2}r^4$.
d. $\frac{k_eq_1q_2}{Gm_1m_2}r^4$.
e. $\frac{k_eq_1q_2}{Gm_1m_2}\frac{1}{r^4}$.

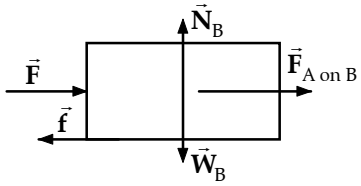
ANS: b

78. When a sky diver is falling at terminal speed,
a. there are no forces acting on her.
b. the only force acting on her is air resistance.
c. the only force acting on her is gravity.
d. the forces on her are air resistance and gravity.
e. the forces on her are air resistance, gravity, and a residual normal force from the airplane.

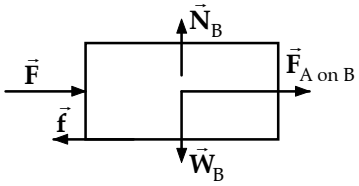
ANS: **AU: Please provide missing information**

79. A force $\vec{F}$ acts on a body A as shown. The correct force diagram for body B is

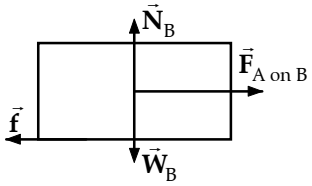




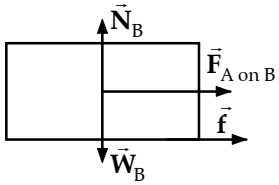
a.



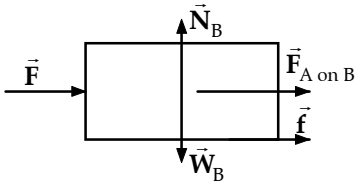
b.



c.



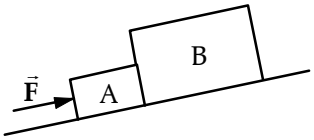
d.

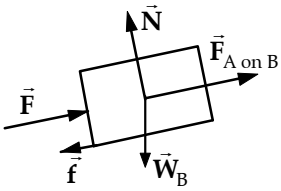


e.

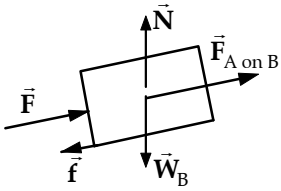
ANS: c

80. A force $\vec{\mathbf{F}}$ acts on body A as shown. The surface is not frictionless. The correct force diagram for body B is

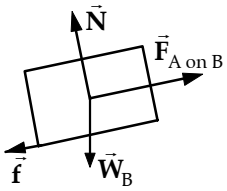




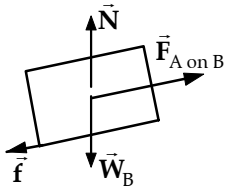
a.



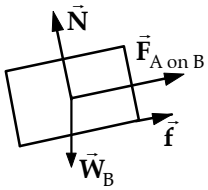
b.



c.



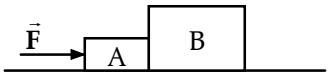
d.



e.

ANS: c

81. A force $\vec{\mathbf{F}}$ acts on body A as shown. The coefficients of static and kinetic friction are the same for bodies A and B. Given the following set of equations,

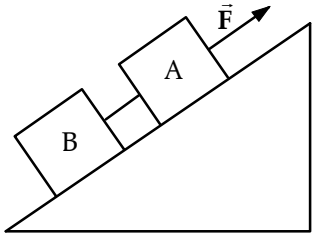


I. $m_A a = F$
II. $m_A a = F - \mu_k m_A g$
III. $m_A a = F - \mu_k m_A g - N_{B\text{ on }A}$
IV. $m_B a = N_{A\text{ on }B} - \mu_k m_B g$
V. $m_B a = N_{A\text{ on }B} - \mu_k (m_A + m_B) g$

the correct set of equations to solve to find the horizontal acceleration of B is
a. I and III.
b. Ii and III.
c. II and IV.
d. III and IV.
e. I and V.

ANS: d

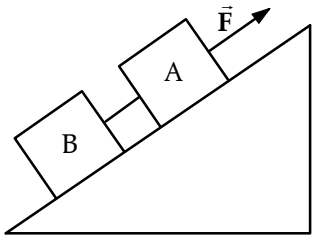
82. Two masses, connected as shown, are pulled up a plane inclined at an angle θ by a string exerting a force of magnitude F. The tension in the string connecting A and B has magnitude T. The correct equation for calculating the acceleration of A is



a. $m_A a = F$.
b. $m_A a = F - m_A g \sin\theta$.
c. $m_A a = F - m_A g \sin\theta - \mu_k m_A g \cos\theta$.
d. $m_A a = F - m_A g \sin\theta - \mu_k m_A g \cos\theta - T$.
e. $m_A a = F - m_A g \sin\theta - \mu_k m_A g \cos\theta - T - \mu_k m_B g \cos\theta$.

ANS: d

83. Two masses, connected as shown, are pulled up a plane inclined at an angle θ by a string exerting a force of magnitude F. The tension in the string connecting A and B has magnitude T. The correct equation for calculating the acceleration of B is



a. $m_B a = T$.
b. $m_B a = T - m_B g \sin\theta$.
c. $m_B a = T - m_B g \sin\theta - \mu_k m_B g \cos\theta$.
d. $m_B a = F - m_B g \sin\theta$.
e. $m_B a = F - m_B g \sin\theta - \mu_k m_B g \cos\theta$.

ANS: c