Physics 20 Lessons 1 to 28 Review

1. An airplane in a steep dive moves with a speed of 570 km/h. What is the speed in m/s? (158 m/s)

2. A circular racetrack is 1500 m in diameter. A car makes 100 laps around the track in 56 min. What is the average speed in m/s? (140 m/s)

3. How long will it take a ship travelling at 25 km/h to go 2200 km? (88 h)

4. A bird flies 300 m SOUTH in 3 minutes and then heads 1200 m NORTH in 12 minutes.
   a. What is the total distance traveled by the object? (1500 m)
   b. What is the displacement of the object? (900 m north)
   c. What was the average speed of the object in m/min? (100 m/min)

5. A train starting from rest accelerates to 90 km/h in 1.2 minutes. What is the acceleration in m/s^2? (0.347 m/s^2)

6. A car travelling at 30 m/s WEST accelerates at 5.0 m/s^2 EAST for 3.0 s. What is the resulting velocity? (15 m/s WEST)

7. A plane flying WEST at 300 km/h slows down to 180 km/h. If the deceleration of the plane was 600 km/h^2 EAST, how long was the deceleration period. (12 minutes)

8. A train starting from rest acquires a speed of 30 m/s after two minutes of acceleration. How far did the train travel? (1800 m)

9. A car traveling west at 90 km/h comes to a stop after traveling 500 m west. What was the acceleration of the car? (0.625 m/s^2 east)

10. An object starting from rest travels 243 m west while accelerating at 6.0 m/s^2 west. How long did the object accelerate? (9.0 s)

11. A moving object accelerates at 8.0 m/s^2 eastward for 5.0 s. If the object ravels 340 m east in that time interval, what was the original velocity of the object? (48 m/s east)

12. An object traveling at 80 m/s accelerates at 2.0 m/s^2 for 12 s. How far did the object travel in the <u>last</u> five seconds? (305 m)

13. A stone dropped down a well reaches the bottom after 2.5 s. How deep is the well? (30.7 m)

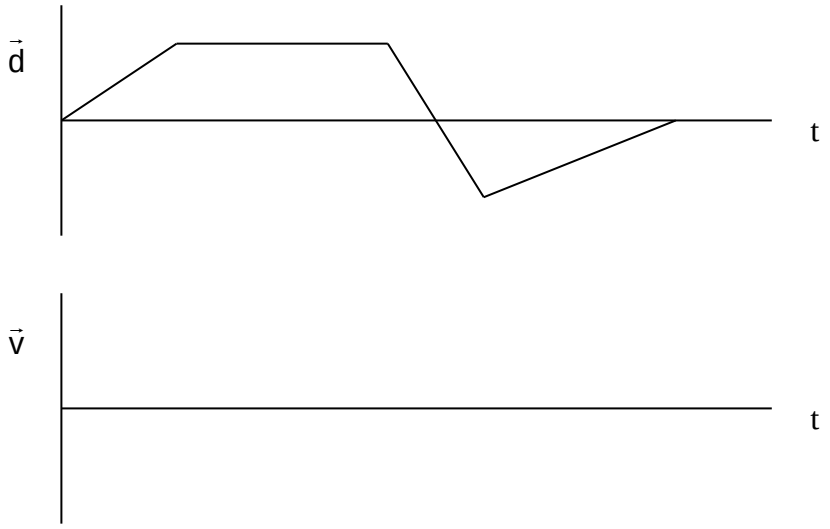
14. An object dropped 5.0 m on the planet PHYSICS20ISGREAT takes 1.2 s to reach the ground. What is the acceleration due to gravity on the planet? (6.94 m/s^2 DOWN)

15. An object is thrown downward at 4.0 m/s reaches the ground after 6.0 s. What is the displacement of the object? (200.58 m DOWN)

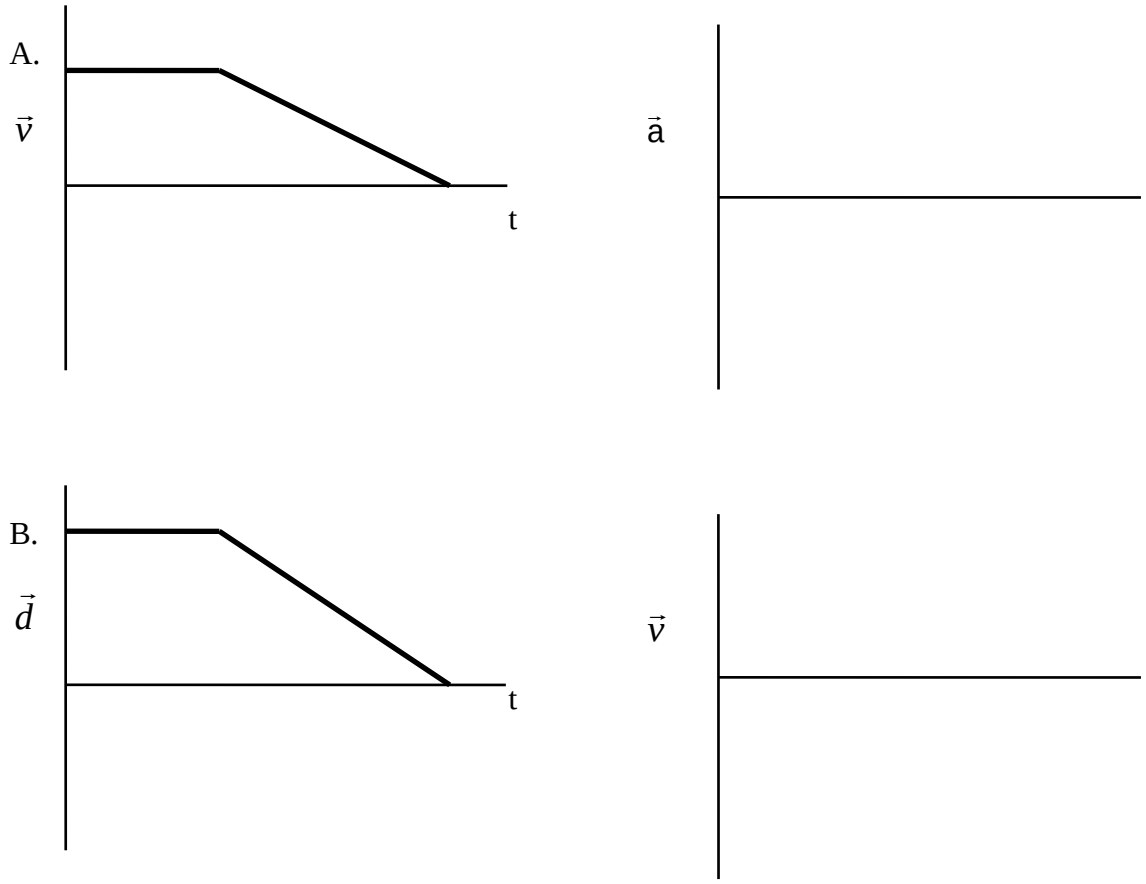
16. An object thrown upward reaches the ground after 8.0 s. If the displacement of the object is 153.93 m downward after 8.0 s, what was the original velocity of the object? (20 m/s up)

17. An object is thrown upward at 19.62 m/s from the top of a roof of a building that is 400 m high. How long does it take for the object to reach the ground? (11.25 s)

18. Given the following displacement—time graph, sketch the corresponding velocity—time graph.



19. For each of the following graphs, <u>sketch</u> the missing graph.



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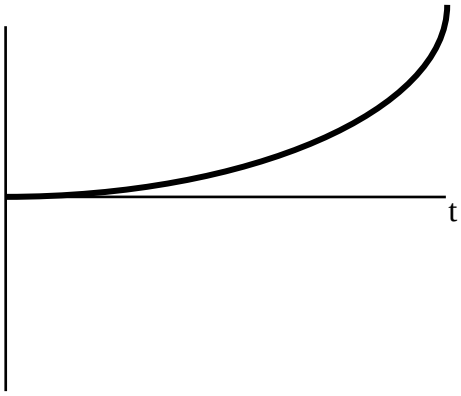

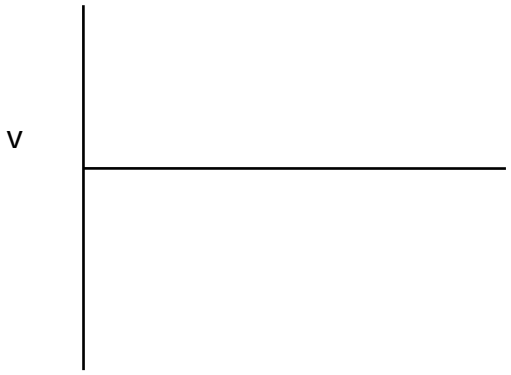

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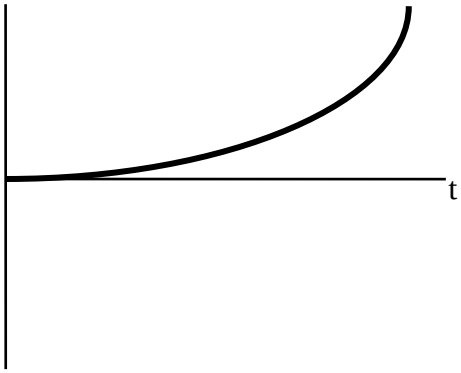

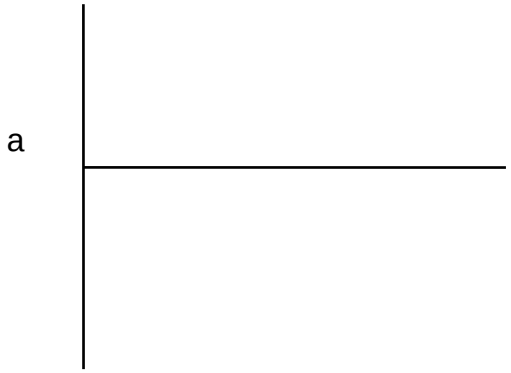

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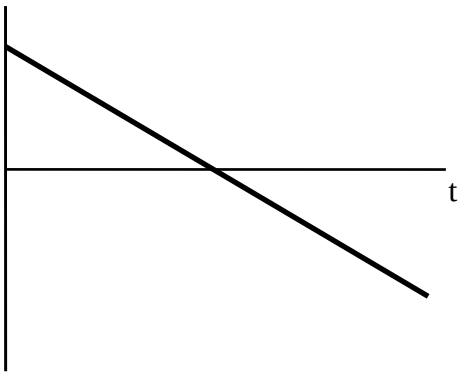

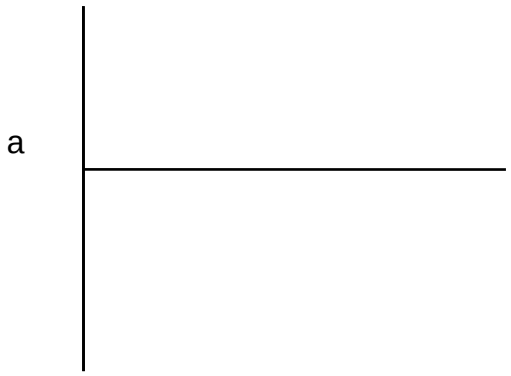

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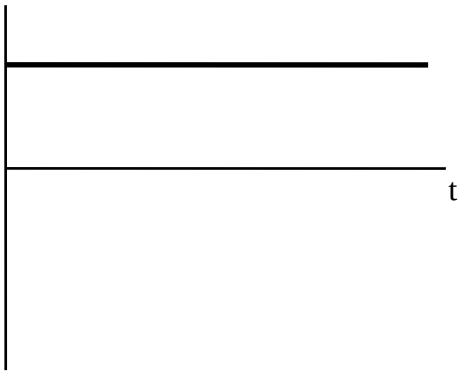
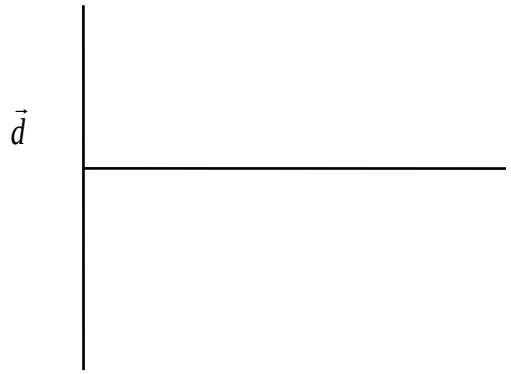




20. A man walks 400 m north, 275 m west, 150 m south and then 650 m east. The trip required 15 minutes.
    a. What was the distance traveled by the man? (1475 m)
    b. What was the displacement of the man? (410 m @ 52.4^o E of N)
    c. What was the average speed of the man? (98.3 m/s)

21. A soccer player runs 75 m @ 30^o N of E. Then she runs 75 m straight west. Finally she runs 65 m @ 60^o S of E. The whole activity required 3.0 minutes.
    a. What was the final displacement of the girl? (29.6 m @ 40.7° S of E)
    b. What was the average speed of the girl? (71.7 m/min)

22. A pilot heads her plane with a velocity of 255 km/h north. If there is a strong wind of 112 km/h blowing east, what is the actual velocity of the plane? (279 km/h @ 23.7^o E of N)

23. A boat heads directly north across a river with a speed of 1.0 m/s. If the river flows with a velocity of 0.50 m/s east, in what direction is boat actually headed? (27^o E of N)

24. A boat that can travel on still water at 3.0 m/s WANTS to travel NORTH perpendicular to the river current. If the river current is 1.2 m/s EAST, in what direction must the boat head? (24^o W of N)

25. A pilot WANTS to fly WEST. If the plane has an air-speed of 95 m/s and there is a 25 m/s wind blowing NORTH, in what direction must she head the plane? (15^o S of W)

26. A boat that can travel 4.0 m/s on still water heads directly NORTH across a river that is 125 m wide. If the river current is 2.1 m/s EAST:
    a. What is the velocity of the boat with respect to the shore? (4.5 m/s @ 28^o E of N)
    b. How long does it take the boat to reach the opposite shore? (31 s)
    c. How far downstream is the boat when it reaches the opposite shore? (66 m)

27. An object is thrown horizontally with a velocity of 18 m/s from the top of a cliff. If the object hits the ground 100 m from the base of the cliff, how high is the cliff? (151 m)

28. An object is thrown from the ground into the air at an angle of 40^o up from the horizontal with a speed of 18 m/s.
    a. What is the maximum height of the projectile? (6.82 m)
    b. What is the maximum range? (32.5 m)

29. A student is standing 10.0 m from a tall building. If the student throws a ball with a velocity of 12 m/s at an angle of 35^o up from the horizontal, at what height will the ball hit the building? (1 .92 m)

30. A student is standing on the top of a building and he throws an object into the air with a speed of 16 m/s at an angle of 25^o above the horizontal. If the building is 75 m tall, how far from the base of the building will the object hit the ground? (67.6 m)

31. A 30 N force acts north and a 50 N force acts at 80^o east of south on the same object. What is the net force on the object? (53.7 N at 23.4^o N of E)

32. A northward force of 50 N acts on a 5.0 kg mass for 3.0 s. If the mass started at rest, what is the resulting displacement? (45 N north)

33. A westward force of 20 N acts on a 2.0 kg object moving eastward at 60 m/s for 2.0 s. What is the resulting velocity? (40 m/s west)

34. A 50 N southward horizontal force pulls on a 12 kg object at rest on a surface with a frictional force of 14 N. What is the resulting acceleration? (3.0 m/s^2 south)

35. An object has a mass of 30 kg. What is the weight of the object on Jupiter where the acceleration due to gravity is 26.1 m/s^2? (783 N)

36. What is the mass of an object that weighs 490 N? (50 kg)

37. An object has a weight of 210 N on the surface of planet X. If the mass of the object is 20 kg, what is the acceleration due to gravity for planet X? (10.5 m/s^2)

38. A 7.6 kg object is pulled along a horizontal surface. If the coefficient of friction between the surface is 0.20.
    a. What is the force of friction? (15 N)
    b. If the object is moving at a constant speed, what is the horizontal force applied to pull the object? (15 N)
    c. If the object is accelerating at 0.25 m/s^2, what is the horizontal force applied to pull the object? (16.9 N)

39. A 7.6 kg object is pulled up an inclined plane set at an angle of 33° to the horizontal. If the coefficient of friction for the surface is 0.20:
    a. What is the force of friction? (13 N)
    b. If the object is moving up the plane at a constant speed, what is the force applied to pull the object up the plane? (53. 8 N)
    c. If the object is accelerating up the plane at 0.25 m/s^2 what is the force applied to pull the object up the plane? (55.7 N)

40. An object that has a mass of 25 kg is pushed along a horizontal surface with a force of 95 N. If the force of friction is 50 N, what is the acceleration of the object? (1.8 m/s^2)

41. An object that has a mass of 45 kg is pulled along a horizontal surface by a rope that makes an angle of 32^o above the horizontal. If the coefficient of friction for the surface is 0.13 and the tension in the rope is 95 N, what is the acceleration of the object along the horizontal? (0.66 m/s^2)

42. An object is pulled west along a horizontal frictionless surface with a steady horizontal force of 12.0 N. If the object accelerates from rest to a speed of 4.0 m/s while moving 5.0 m west, what is the mass of the object? (7.5 kg)

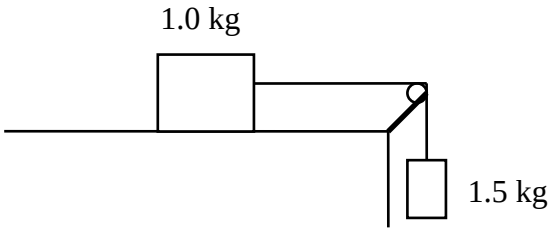
43. An elevator with a mass of 900 kg is moving upward at a constant speed of 2.0 m/s. What is the tension in the cable? (8830 N)

44. An elevator with a mass of 900 kg is accelerating downward at 1.30 m/s^2. What is the tension in the cable? (7660 N)

45. A 6.3 kg object is thrown upward with an acceleration of 0.45 m/s^2. What is the force required to accelerate the object? (65 N upward)

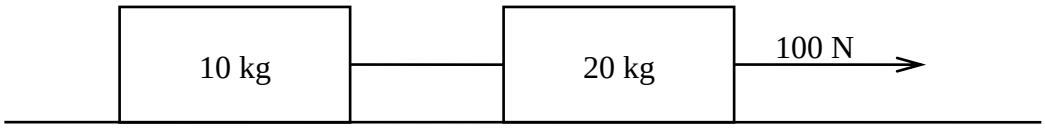
46. Two masses (6.0 kg and 4.0 kg) are hung over a frictionless pulley.
    a. What is the acceleration of the system? (1.96 m/s^2 toward the 6.0 kg mass)
    b. What is the tension in the rope when the masses are released? (70.6 N)

47. A 1.0 kg box is on a horizontal surface is accelerated by attaching a 1.5 kg mass as shown below.



    a. i. What is the acceleration of the box if the surface is frictionless? (5.9 m/s^2 towards the pulley)
       ii. What is the tension in the rope? (5.9 N)
    b. i. What is the acceleration of the box if the surface has a coefficient of friction equal to 0.50? (3.9 m/s^2 toward the pulley)
       ii. What is the tension in the rope? (8.81 N)

48. Given the diagram below where the surface has a coefficient of friction of 0.30



    a. Find the acceleration of the system. (0.39 m/s^2)
    b. Find the tension in the rope connecting the 10 kg block to the 20 kg block. (33.3 N)

49. A car travels around a curved path that has a radius of 195 m at a constant speed of 22 m/s. What is the centripetal acceleration of the car? (2.5 m/s^2)

50. An amusement park ride has a radius of 2.5 m. If the time of one revolution of a rider is 0.75 s, what is the speed of the rider? (21 m/s)

51. Calculate the speed and acceleration of a point on the circumference of an 33 1/3 rotation per minute phonograph record. The diameter of the record is 30.0 cm.
(1.83 m/s, 22.3 m/s^2)

52. An athlete whirls a 3.7 kg shot-put in a horizontal circle with a radius of 0.90 m. If the period of rotation is 0.30 s:
    a. What is the speed of the shot-put when released? (19 m/s)
    b. What is the centripetal force acting on the shot put while it is rotated? (1500 N)
    c. How far would the shot-put travel if it is released 1.2 m above the ground? (9.3 m)

53. A 2700 kg satellite orbits the Earth at a distance of 18000 km from the Earth's center at a speed of 4700 m/s. What is the force acting on the satellite? (3300 N)

54. How fast can a 1200 kg car round an unbanked curve of radius 62 m if the coefficient of friction between the tires and the road is 0.44? (16 m/s)

55. A 925 kg car rounds an unbanked curve at a speed of 25 m/s. If the radius of the curve is 72 m, what is the minimum coefficient of friction between the tires and the road required so that the car does not skid? (0.88)

56. A 2.2 kg object is whirled in a vertical circle whose radius is 1.0 m. If the time for one revolution is 0.97 s, what is the tension in the string
    a. When it is at the top ? (70.7 N)
    b. When it is at the bottom ? (114 N)

57. A 2.0 kg mass is swung in a vertical circle of radius 1.2 m using a cord that will break if it is subjected to a force greater than 252 N. What is the maximum speed that this mass can travel as it passes through the bottom of the circle? (12 m/s)

58. Given the mass of Venus (4.83×10^{24} kg), the mass of the Earth (5.98×10^{24} kg), the distance from the Sun to Venus (1.08×10^{11} m), and the distance from the Sun to Earth (1.49×10^{11} m), determine the maximum force of gravitational attraction between Venus and Earth. (1.15×10^{18} N)

59. If you weigh 445 N on Earth, what will you weigh on Venus? The radius of Venus is 6.31×10^{6} m. (367 N)

60. If you were placed on a line between Earth and Venus. At what point measured from Earth would you experience equal gravitational pull from each planet?(2.16×10^{10} m)

61. If you weigh 890 N on Earth, what is the gravitational pull at a distance of 19320 km above the surface of the Earth? (55.6 N)

62. If you weigh 667.5 N on Earth, what will you weigh on a planet that has 5 times the mass of Earth but only twice the diameter of Earth? (834 N)

63. What is the gravitational field strength on the surface of the moon if the radius of the moon is 1.764×10^{6} m and the mass of the moon is 7.24×10^{22} kg. (1.62 N/kg or 1.62 m/s^2)

64. What is the gravitational field strength 1.27×10^{7} m above the surface of the Earth? (1.09 N/kg)

65. On the surface of Planet X an object has a weight of 63.5 N and a mass of 22.5 kg. What is the gravitational field strength on the surface of Planet X? (2.82 N/kg)

66. At what distance from the Earth' s surface is the gravitational field strength equal to 7.33 N/kg? (1.01×10^{6} m)

67. What is the speed of an artificial 625 kg satellite which is placed in an orbit 1.00×10^{6} m above the surface of planet Z which has a mass of 3.18×10^{23} kg and a radius of 2.43×10^{6} m. (2.49×10^{3} m/s)

68. An artificial 572 kg satellite is placed into a circular orbit around the Earth with a radius of the orbit of 1.2×10^{7} m. How long will it take to make one revolution? (1.3×10^{4} s)

69. Calculate Kepler's constant for objects rotating around the sun given that the Earth has a period of 3.16×10^{7} s and an orbital radius of 1.49×10^{11} m. (3.3×10^{18} m^3/s^2)

70. Knowing that the Earth's orbital radius is 1.49×10^{11} m and its period of revolution is 365 days, calculate the period of revolution of the planet Mercury whose orbital radius is 5.79×10^{11} m? (88.3 days)

71. If a pendulum has a period of 2.75 minutes, what is its frequency? (0.006 Hz)

72. What is the period of a pendulum that has a length of 3.75 m on Earth? (3.88 s)

73. What is the length of a pendulum that will swing 80 times in two minutes on Earth? (0.56 m)

74. On the planet IHATEPHYSICS a pendulum that is 16 cm long has a frequency of 0.637 Hz. What is the gravitational field strength of this planet? (2.56 N/kg)

75. How many bounces will a spring make in 4 minutes when a 520 gram mass is attached to it if it has a force constant of 10 N/m? (165.5)

76. A 5.04 kg mass attached to a spring causes a stretch of 24.7 cm. How long would it take for this spring with its attached mass to vibrate 500 times? (499 s)

77. A 5.0 kg mass hung from a spring vibrates with a frequency of 0.80 Hz. What is the spring constant? (1.3×10^2 N/m)

78. If the period of vibration for a pendulum is measured to be 2.75 s, how long is the pendulum? (1.88 m)

79. A 500 g mass is hung from a spring. The mass caused the spring to stretch by 45.0 cm. What is the spring constant for the spring? (10.9 N/m)

80. An object travelling EAST at 50 m/s and having a mass of 50 kg collides with a wall. If the object drives 0.25 m into the wall what is the braking force applied by the wall? (250 kN west)

81. What is the kinetic energy of a 50 kg object that has fallen 176.4 m? (86.4 kJ)

82. What work is done in dragging a 50 kg mass 40 m across a surface with a coefficient of friction equal to 0.85? (16.66 kJ)

83. An archer puts a 0.30 kg arrow to the bowstring. An average force of 201 N is exerted to draw the string back 1.3 m.
    a) With what speed will the arrow leave the bow? (42 m/s)
    b) If the arrow is shot straight up, how high does it go? (90 m)

84. A 28 kg child climbs the ladder to a 4.8 m high slide and after sliding down reaches a speed of 3.2 m/s at the bottom. How much work was done by friction on the child? (1.2 kJ)

85. An object is located 2 m above a table top that is 1.5 m above the floor. If the mass of the object is 40 kg;
    a) What is the gravitational potential energy of the object with respect to the table top? (784 J)
    b) What is the gravitational potential energy of the object with respect to the floor? (1372 J)