AP Physics Chapters 7 & 8 Review Sheet

1. Which of the following is NOT a correct unit for work?
   A) erg
   B) ft·lb
   C) watt
   D) newton·meter
   E) joule

2. A boy holds a 40-N weight at arm's length for 10 s. His arm is 1.5 m above the ground. The work done by the force of the boy on the weight while he is holding it is:
   A) 0
   B) 6.1 J
   C) 40 J
   D) 60 J
   E) 90 J

3. An object moves in a circle at constant speed. The work done by the centripetal force is zero because:
   A) the displacement for each revolution is zero
   B) the average force for each revolution is zero
   C) there is no friction
   D) the magnitude of the acceleration is zero
   E) the centripetal force is perpendicular to the velocity

4. The work done by gravity during the descent of a projectile is:
   A) positive
   B) negative
   C) zero
   D) depends for its sign on the direction of the y axis
   E) depends for its sign on the direction of both the x and y axes

5. Aline drive to the shortstop is caught at the same height as it was originally hit. Over its entire flight the work done by gravity and the work done by air resistance, respectively, are:
   A) zero; positive
   B) zero; negative
   C) positive; negative
   D) negative; positive
   E) negative; negative

6. A sledge (including load) weighs 5000 N. It is pulled on level snow by a dog team exerting a horizontal force on it. The coefficient of kinetic friction between sledge and snow is 0.05. How much work is done by the dog team pulling the sledge 1000 m at constant speed?
   A) 2.5×10^4 J
   B) 2.5×10^5 J
   C) 5.0×10^5 J
   D) 2.5×10^6 J
   E) 5.0×10^6 J

7. Camping equipment weighing 6000 N is pulled across a frozen lake by means of a horizontal rope. The coefficient of kinetic friction is 0.05. How much work is done by the campers in pulling the equipment 1000 m if its speed is increasing at the constant rate of 0.20 m/s^2?
   A) ñ1.2×10^6 J
   B) 1.8×10^5 J
   C) 3.0×10^5 J
   D) 4.2×10^5 J
   E) 1.2×10^6 J

8. A 0.50-kg object moves in a horizontal circular track with a radius of 2.5 m. An external force of 3.0 N, always tangent to the track, causes the object to speed up as it goes around. The work done by the external force as the mass makes one revolution is:
   A) 24 J
   B) 47 J
   C) 59 J
   D) 94 J
   E) 120 J

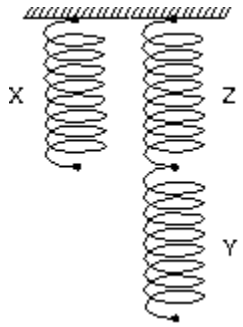
9. A man pushes an 80-N crate a distance of 5.0 m upward along a frictionless slope that makes an angle of 30° with the horizontal. His force is parallel to the slope. If the speed of the crate decreases at a rate of 1.5 m/s^2, then the work done by the mand is:
   A) ñ200 J
   B) 61 J
   C) 140 J
   D) 200 J
   E) 260 J

10. An 80-N crate slides with constant speed a distance of 5.0 m downward along a rough slope that makes an angle of 30° with the horizontal. The work done by the force of gravity is:
    A) ñ400 J
    B) ñ200 J
    C) ñ69 J
    D) 200 J
    E) 400 J

11. A man wishes to pull a crate 15 m across a rough floor by exerting a force of 100 N. The coefficient of kinetic friction is 0.25. For the man to do the least work, the angle between the force and the horizontal should be:
    A) 0
    B) 14°
    C) 43°
    D) 66°
    E) 76°

12. A block is attached to the end of an ideal spring and moved from coordinate x_i to coordinate x_f. The relaxed position is at $x = 0$. The work done by spring is positive if:
    A) x_i = 2 cm and x_f = 4 cm
    B) x_i = ñ2 cm and x_f = 4 cm
    C) x_i = ñ2 cm and x_f = ñ4 cm
    D) x_i = 2 cm and x_f = ñ4 cm
    E) x_i = ñ4 cm and x_f = ñ2 cm

13. Three identical springs (X,Y,Z) are arranged as shown. When a 4.0-kg mass is hung on X, the mass descends 3.0 cm. When a 6.0-kg mass is hung on Y, the mass descends:



A) 2.0 cm
B) 4.0 cm
C) 4.5 cm
D) 6.0 cm
E) 9.0 cm

14. When a certain rubber band is stretched a distance x, it exerts a restoring force $F = ax + bx^2$, where a and b are constants. The work done in stretching this rubber band from $x = 0$ to $x = L$ is:
A) $aL^2 + bLx^3$
B) $aL + 2bL^2$
C) $a + 2bL$
D) bL
E) $aL^2/2 + bL^3/3$

15. An ideal spring is hung vertically from the ceiling. When a 2.0-kg mass hangs at rest from it the spring is extended 6.0 cm from its relaxed length. An upward external force is then applied to the block to move it upward a distance of 16 cm. While the the block is being extended by the force, the work done by the spring is
A) ñ1.0 J
B) ñ0.52 J
C) ñ0.26 J
D) 0.52 J
E) 1.0 J

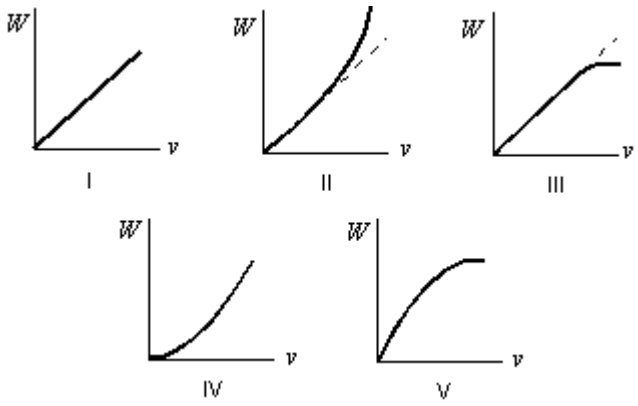
16. Two trailers, X with mass 500 kg and Y with mass 2000 kg, are being pulled at the same speed. The ratio of the kinetic energy of Y to that of X is:
    A) 1:1
    B) 2:1
    C) 4:1
    D) 9:1
    E) 1500:1

17. The velocity of a particle moving along the x axis changes from v_i to v_f. For which values of v_i and v_f is the total work done on the particle positive?
    A) v_i = 5m/s, v_f = 2m/s
    B) v_i = 5m/s, v_f = ñ2m/s
    C) v_i = ñ5m/s, v_f = ñ2m/s
    D) v_i = ñ5m/s, v_f = 2m/s
    E) v_i = ñ2m/s, v_f = ñ5m/s

18. The weight of an object on the moon is one-sixth of its weight on the Earth. The ratio of the kinetic energy of a body on the Earth moving with speed V to that of the same body moving with speed V on the moon is:
    A) 6:1
    B) 36:1
    C) 1:1
    D) 1:6
    E) 1:36

19. The amount of work required to stop a moving object is equal to the:
    A) velocity of the object
    B) kinetic energy of the object
    C) mass of the object times its acceleration
    D) mass of the object times its velocity
    E) square of the velocity of the object

20. A crate is initially at rest on a horizontal frictionless table. A constant horizontal force *F* *is* applied. Which of the following five graphs is a correct plot of work W as a function of crate speed *v*?



A) I
B) II
C) III
D) IV
E) V

21. A 4-kg cart starts up an incline with a speed of 3 m/s and comes to rest 2 m up the incline. The total work done on the cart is:
A) 6 J
B) 8 J
C) 12 J
D) 18 J
E) impossible to calculate without more information

22. A Boston Red Sox baseball player catches a ball of mass *m* that is moving toward him with speed *v*. While bringing the ball to rest, his hand moves back a distance *d*. Assuming constant deceleration, the horizontal force exerted on the ball by his hand is:
A) mv/d
B) mvd
C) mv^2/d
D) $2mv/d$
E) $mv^2/(2d)$

23. A 0.50-kg object moves on a horizontal frictionless circular track with a radius of 2.5 m. An external force of 3.0 N, always tangent to the track, causes the object to speed up as it goes around. If it starts from rest, then at the end of one revolution the radial component of the force of the track on it is:
    A) 19 N
    B) 38 N
    C) 47 N
    D) 75 N
    E) 96 N

24. At time $t = 0$ a particle starts moving along the x axis. If its kinetic energy increases uniformly with t the net force acting on it must be:
    A) constant
    B) proportional to t
    C) inversely proportional to t
    D) proportional to $\sqrt{t}$
    E) proportional to $1/\sqrt{t}$

25. A particle starts from rest at time $t = 0$ and moves along the x axis. If the net force on it is proportional to t, its kinetic energy is proportional to:
    A) t
    B) t^2
    C) t^4
    D) $1/t^2$
    E) none of the above

26. A particle moving along the x axis is acted upon by a single force $F = F_0 e^{-kx}$, where F_0 and k are constants. The particle is released from rest at $x = 0$. It will attain a maximum kinetic energy of:
    A) F_0/k
    B) F_0/e^k
    C) kF_0
    D) $1/2(kF_0)^2$
    E) ke^kF_0

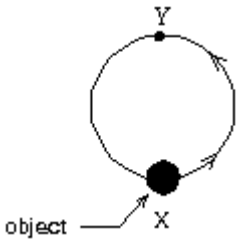
27. In raising an object to a given height by means of an inclined plane, as compared with raising the object vertically, there is a reduction in:
    A) work required
    B) distance pushed
    C) friction
    D) force required
    E) value of the acceleration due to gravity

28. Power has the dimensions of:
    A) ML^2/T^2
    B) MT/L^2
    C) ML/T^2
    D) ML^2/T^3
    E) none of these

29. Which of the following five quantities is NOT an expression for energy? Here m is a mass, g is the acceleration due to gravity, h and d are distances, F is a force, v is a speed, a is an acceleration, P is power, and t is time.
    A) mgh
    B) Fd
    C) $1/2mv^2$
    D) ma
    E) Pt

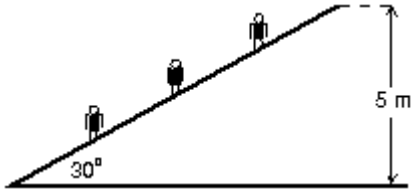
30. A watt per hour is a unit of:
    A) energy
    B) power
    C) force
    D) acceleration
    E) none of these

31. A man moves the 10-g object shown in a vertical plane from position X to position Y along a circular track of radius 20 m. The process takes 0.75 min. The work done by the man is about:



A) 1 J
B) 2 J
C) 4 J
D) 6 J
E) 12 J

32. An escalator is used to move 20 people (60 kg each) per minute from the first floor of a department store to the second floor, 5 m above. The power required is approximately:



A) 100 W
B) 200 W
C) 1000 W
D) 2000 W
E) 60,000 W

33. A 50-N force acts on a 2-kg crate that starts from rest. When the force has been acting for 2 s the rate at which it is doing work is:
A) 75 W
B) 100 W
C) 1000 W
D) 2500 W
E) 5000 W

34. A particle starts from rest and is acted on by a net force that does work at a rate that is proportional to the time t. The speed of the particle is proportional to:
    A) $\sqrt{t}$
    B) t
    C) t^2
    D) $1/\sqrt{t}$
    E) $1/t$

35. Only if a force on a particle is conservative:
    A) is particle is conservative when the particle moves exactly once around any closed path
    B) is it work equals the change in the kinetic energy of the particle
    C) it obeys Newton's second law
    D) it obeys Newton's third law
    E) it is not a frictional force

36. The sum of the kinetic and potential energies of a system of objects is conserved:
    A) only when no external force acts on the objects
    B) only when the objects move along closed paths
    C) only when the work done by the resultant external force is zero
    D) always
    E) none of the above

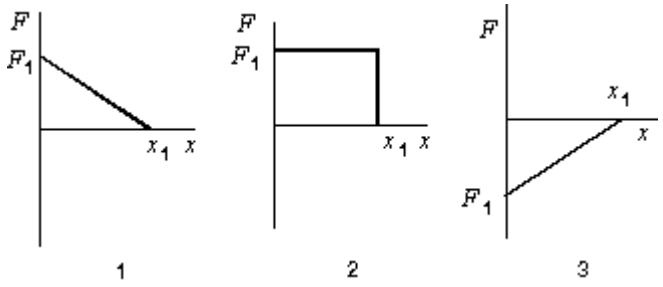
37. Two particles interact by conservative forces. This addition, an external force acts on each particle.. They complete round trips, ending at the points where they started. Which of the following must have the same values at the beginning and end of this trip?
    A) a total kinetic energy of the two-particle system
    B) the potential energy of the two-particle system
    C) the mechanical energy of the two-particle system
    D) the total linear momentum of the two-particle system
    E) none of the above

38. A good example of kinetic energy is provided by:
    A) a wound-up clock spring
    B) the raised weights of a grandfather's clock
    C) a tornado
    D) a gallon of gasoline
    E) an automobile storage battery

39. The wound spring of a clock possesses:
    A) kinetic but no potential energy
    B) potential but no kinetic energy
    C) both potential and kinetic energy in equal amonts
    D) neither potential nor kinetic energy
    E) both potential and kinetic energy, but more kinetic energy than potential energy

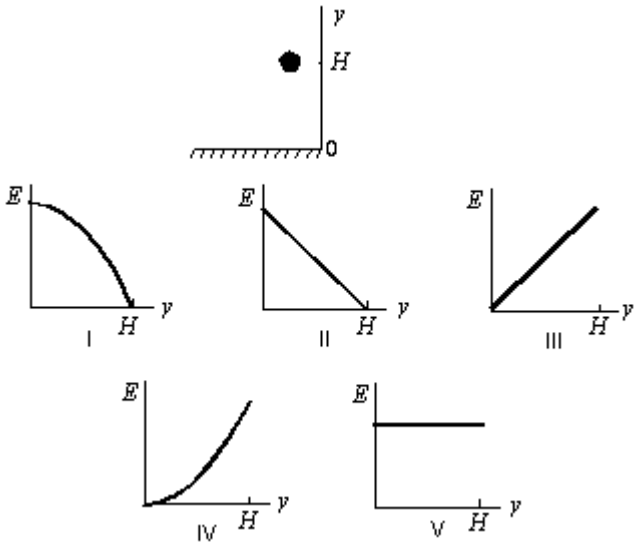
40. Which one of the following five quantities CANNOT be used as a unit of potential energy?
    A) watt·second
    B) gram·cm/s^2
    C) joule
    D) kg·m^2/s^2
    E) ft·lb

41. The graphs below show the magnitude of the force on a particle as the particle moves along the positive x axis from the origin to $x = x_1$. The force is parallel to the x axis and is conservative. The maxium magnitude F_1 has the same value for all graphs. Rank the situations according to the change in the potential energy associated with the force, least (or most negative) to greatest (or most positive).



    A) 1, 2, 3
    B) 1, 3, 2
    C) 2, 3, 1
    D) 3, 2, 1
    E) 2, 1, 3

42. A ball is held at a height H above a floor. It is then released and falls to the floor. If air resistance can be ignored, which of the five graphs below correctly gives the mechanical energy E of the Earth-ball system as a function of the altitude *y* of the ball?



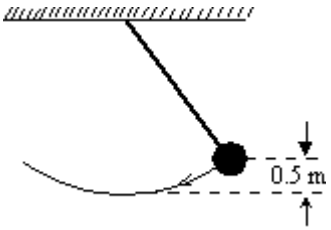
A) I
B) II
C) III
D) IV
E) V

43. A 2-kg block is thrown upward from a point 20 m above the Earth's surface. At what height above Earth's surface will the gravitational potential energy of the Earth-block system have increased by 500 J?
A) 5 m
B) 25 m
C) 46 m
D) 70 m
E) 270 m

44. A projectile of mass 0.50 kg is fired with an initial speed of 10 m/s at an angle of 60° above the horizontal. The potential energy of the projectile-Earth system (relative to the potential energy when the projectile is at ground level) is:
A) 25 J
B) 18.75 J
C) 12.5 J
D) 6.25 J
E) none of these

45. A 2.2-kg block starts from rest on a rough inclined plane that makes an angle of 25° with the horizontal. The coefficient of kinetic friction is 0.25. As the block goes 2.0 m down the plane, the mechanical energy of the Earth-block system changes by:
A) 0
B) ñ9.8 J
C) 9.8 J
D) ñ18 J
E) 18 J

46. The long pendulum shown is drawn aside until the ball has risen 0.5 m. It is then given an initial speed of 3.0 m/s.. The speed of the ball at its lowest position is:



A) zero
B) 0.89 m/s
C) 3.1 m/s
D) 3.7 m/s
E) 4.3 m/s

47. A 0.20-kg particle moves along the x axis under the influence of a stationary object. The potential energy is given by $U(x) = 8x^2 + 2x^4$, where U is in joules and x is in meters. If the particle has a speed of 5.0 m/s when it is at $x = 1.0$ m, its speed when it is at the origin is:
A) 0
B) 2.5 m/s
C) 5.7 m/s
D) 7.9 m/s
E) 11 m/s

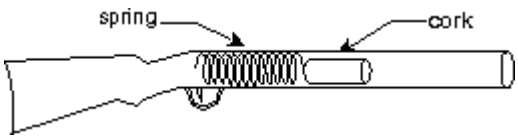
48. A force of 10 N holds an ideal spring with a 20-N/m spring constant in compression. The potential energy stored in the spring is:
A) 0.5 J
B) 2.5 J
C) 5 J
D) 10 J
E) 200 J

49. A 0.50-kg block attached to an ideal spring with a spring constant of 80 N/m oscillates on a horizontal frictionless surface. The total mechanical energy is 0.12 J. The greatest extension of the spring from its equilibrium length is:
    A) 1.5×10^{-3} m
    B) 3.0×10^{-3} m
    C) 0.039 m
    D) 0.054 m
    E) 18 m

50. A 0.50-kg block attached to an ideal spring with a spring constant of 80 N/m oscillates on a horizontal frictionless surface. When the spring is 4.0 cm longer than its equilibrium length, the speed of the block is 0.50 m/s. The greatest speed of the block is:
    A) 0.23 m/s
    B) 0.32 m/s
    C) 0.55 m/s
    D) 0.78 m/s
    E) 0.93 m/s

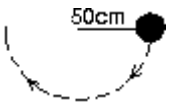
51. A block of mass m is initially moving to the right on a horizontal frictionless surface at a speed v. It then compresses a spring of spring constant k. At the instant when the kinetic energy of the block is equal to the potential energy of the spring, the spring is compressed a distance of:
    A) $v\sqrt{m/2k}$
    B) $(1/2)mv^2$
    C) $(1/4)mv^2$
    D) $mv^2/4k$
    E) $(1/4)\sqrt{mv/k}$

52. A toy cork gun contains a spring whose spring constant is 10.0 N/m. The spring is compressed 5.00 cm and then used to propel a 6.00-g cork. The cork, however, sticks to the spring for 1.00 cm beyond its unstretched length before separation occurs. The muzzle velocity of this cork is:



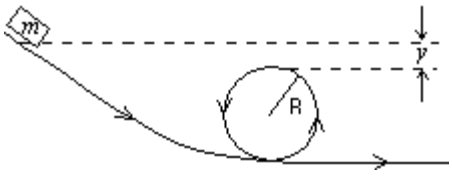
    A) 1.02 m/s
    B) 1.41 m/s
    C) 2.00 m/s
    D) 2.04 m/s
    E) 4.00 m/s

53. The string in the figure is 50 cm long. When the ball is released from rest, it swings along the dotted arc. How fast is it going at the lowest point in its swing?



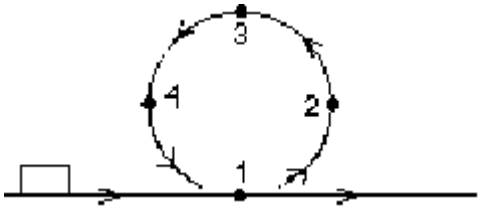
A) 2.0 m/s
B) 2.2 m/s
C) 3.1 m/s
D) 4.4 m/s
E) 6.0 m/s

54. A small object of mass *m* starts at rest at the position shown and slides along the frictionless loop-the-loop track of radius *R*. What is the smallest value of *y* such that the object will slide without losing contact with the track?



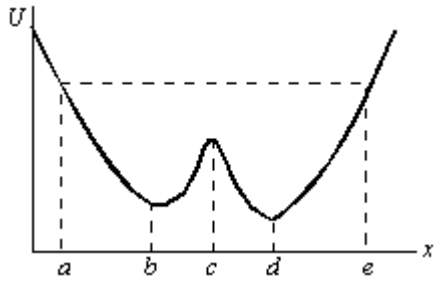
A) *R*/4
B) *R*/2
C) *R*
D) 2*R*
E) zero

55. A rectangular block is moving along a frictionless path when it encounters the circular loop as shown. The block passes points 1,2,3,4,1 before returning to the horizontal track. At point 3:



A) its mechanical energy is a minimum
B) the forces on it are balanced
C) it is not accelerating
D) its speed is a minimum
E) it experiences a net upward force

56. A particle is released from rest at the point $x = a$ and moves along the x axis subject to the potential energy function $U(x)$ shown. The particle:



A) moves to a point to the left of $x = e$, stops and remains at rest
B) moves to a point to $x = e$, then moves to the left
C) moves to infinity at varying speed
D) moves to $x = b$ where it remains at rest
E) moves to $x = e$ and then to $x = d$, where it remains at rest

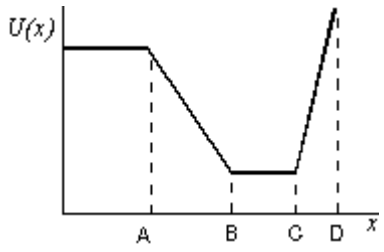
57. The potential energy of a 0.20-kg particle moving along the x axis is given by

$$U(x) = (8.0\text{J/m}^2)x^2 + (2.0\text{J/m}^4)x^4.$$

When the particle is at $x = 1.0$ m it is traveling in the positive x direction with a speed of 5.0 m/s. It next stops momentarily to turn around at $x =$

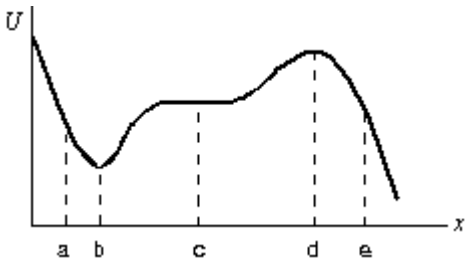
A) 0
B) ñ1.1 m
C) 1.1 m
D) ñ2.3 m
E) 2.3 m

58. As a particle moves along the *x* axis it is acted by a conservative force. The potential energy is shown below as a function of the coordinate *x* of the particle. Rank the labeled regions according to the magnitude of the force, least to greatest.



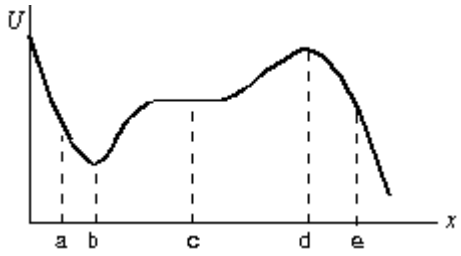
A) AB, BC, CD
B) AB, CD, BC
C) BC, CD, AB
D) BC, AB, CD
E) CD, BC, AB

59. The diagram shows a plot of the potential energy as a function of *x* for a particle moving along the *x* axis. The points of stable equilibrium are:



A) only a
B) only b
C) only c
D) only d
E) b and d

60. The diagram shows a plot of the potential energy as a function of x for a particle moving along the x axis. The points of neutral equilibrium are:



A) only a
B) only b
C) only c
D) only d
E) b and d

61. The potential energy of a 0.20-kg particle moving along the x axis is given by

$U(x) = (8.0\text{J/m}^2)x^2 + (2.0\text{J/m}^4)x^4$.

When the particle is at $x = 1.0$ m its magnituede of its acceleration is:
A) 0
B) ñ8 m/s^2
C) 8 m/s^2
D) ñ40 m/s^2
E) 40 m/s^2

62. The thermal energy of a system consisting of a thrown ball, Earth, and the air is most closely associated with:
A) the gravitational interaction of the Earth and the ball
B) the kinetic energy of the ball as a whole
C) motions of the individual particles within the ball
D) motions of individual particles within the ball and the air
E) the kinetic energy of Earth as a whole

63. Objects A and B interact with each other via both conservative and nonconservative forces. Let K_A and K_B be the kinetic energies, U be the potential energy, and E_{int} be the internal energy. If no external agent does work on the objects then:
    A) $K_A + U$ is conserved
    B) $K_A + U + E_{\text{int}}$ is conserved
    C) $K_A + K_B + E_{\text{int}}$ is conserved
    D) $K_A + K_B + U$ is conserved
    E) $K_A + K_B + U + E_{\text{int}}$ is conserved

64. A 25-g ball is released from rest 80 m above the surface of the Earth. During the fall the total internal energy of the ball and air increases by15 J: Just before it hits the surface its speed is
    A) 19 m/s
    B) 36 m/s
    C) 40 m/s
    D) 45 m/s
    E) 53 m/s

65. A 0.75-kg block slides on a rough horizontal table top. Just before it hits a horizontal ideal spring its speed is 3.5 m/s. It hits the spring and compresses it 5.7 cm before coming to rest. If the spring constant is 1200 N/m, the internal energy of the block and the table top must have increased by:
    A) 0
    B) 1.9 J
    C) 2.6 J
    D) 4.6 J
    E) 6.5 J

Answer Key

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

45. B
46. E
47. E
48. B
49. D
50. D
51. A
52. C
53. C
54. B
55. D
56. B
57. C
58. D
59. B
60. C
61. D
62. D
63. E
64. A
65. C