MULTIPLE CHOICE.  Choose the one alternative that best completes the statement or answers the question.  
1)  If you push for an hour against a stationary wall, you do no work   
A) on the wall. B)  at all. C)  both of these D)  none of these   
  
2)  If you push an object twice as far while applying the same force you do   
A) twice as much work.   
B) four times as much work.   
C) the same amount of work.   
  
3)  If you push an object just as far while applying twice the force you do   
A) twice as much work.   
B) four times as much work.   
C) the same amount of work.   
  
4)  If you push an object with twice the work input for twice the time, your power input is   
A) twice.   
B) four times as much.   
C) the same amount as for half the work in half the time.   
  
5)  A job is done slowly, while an identical job is done quickly. Both jobs require the same amount of work, but different amounts of   
A) energy. B)  power. C)  both of these. D)  none of these.   
  
6)  If you do work on an object in half the usual time, your power output is   
A) half the usual power output.   
B) the usual power output.   
C) twice the usual power output.   
  
7)  Exert 1 N for a distance of 1 m in 1 s and you deliver a power of   
A) 1 W.   
B) 2 W.   
C) 1/3 W.   
D) 3 W.   
E) none of these.   
  
8)  Do 100 J of work in 50 s and your power output is   
A) 1/4 W.   
B) 1/2 W.   
C) 2 W.   
D) 4 W.   
E) more than 4 W.   
  
9)  When an object is raised above the ground it gains a certain amount of potential energy.  If the same object is raised twice as high it gains   
A) four times as much potential energy.   
B) twice as much potential energy.   
C) neither of these.   
  
10)  When an object is lifted 10 meters, it gains a certain amount of potential energy. If the same object is lifted 20 meters, its potential energy gain is   
A) less.   
B) the same.   
C) twice as much.   
D) four times as much.   
E) more than 4 times as much.   
  
11)  A 1000-kg car and a 2000-kg car are hoisted the same distance in a gas station. Raising the more massive car requires   
A) less work.   
B) as much work.   
C) twice as much work.   
D) four times as much work.   
E) more than 4 times as much work.   
  
12)  An object that has kinetic energy must be   
A) moving.   
B) falling.   
C) at an elevated position.   
D) at rest.   
E) none of these.   
  
13)  An object that has potential energy may have this energy because of its   
A) speed.   
B) acceleration.   
C) momentum.   
D) location.   
E) none of these.   
  
14)  Bullets are fired from an airplane in the forward direction of motion.  The momentum of the airplane will be   
A) decreased. B)  unchanged. C)  increased.   
  
15)  A clerk can lift containers a vertical distance of 1 meter or can roll them up a 2 meter-long ramp to the same elevation. With the ramp, the applied force required is about   
A) half as much. B)  twice as much. C)  the same.   
  
16)  A bow is drawn so that it has 40 J of potential energy. When fired, the arrow will ideally have a kinetic energy of   
A) less than 40 J. B)  more than 40 J. C)  40 J.   
  
17)  When a car is braked to a stop, its kinetic energy is transformed to   
A) stopping energy.   
B) potential energy.   
C) energy of motion.   
D) energy of rest.   
E) heat.   
  
18)  A hydraulic press, like a simple lever, properly arranged is capable of multiplying energy input.   
A) sometimes true B)  always false C)  always true   
  
19)  A hydraulic press, like a simple lever, properly arranged is capable of multiplying force input.   
A) true B)  false   
  
A marble is rolling back and forth along the path shown.  
  
Figure 7-A  
   
20)  At position A, is the marble's kinetic energy less than, greater than, or the same as its kinetic energy when it is at B?   
A) less B)  greater C)  the same   
  
A small ball tied to a string swings without air resistance, beginning from rest at point A.   
The string snags on a nail at point P, causing the ball to move in a small circle.  
  
Figure 7-B  
   
21)  The ball has maximum potential energy at point   
A) A. B)  B. C)  C. D)  D. E)  E.   
  
22)  The ball has maximum kinetic energy at point   
A) A. B)  B. C)  C. D)  D. E)  E.   
  
23)  The ball has maximum speed at point   
A) A. B)  B. C)  C. D)  D. E)  E.   
  
A small bead slides without friction along the wire shown here, beginning at point A.   
The wire does not touch itself at point C, so the bead has room to slide past that point.  
  
Figure 7-C  
   
24)  The bead has maximum kinetic energy at point   
A) A. B)  B. C)  C. D)  D. E)  F.   
  
25)  The bead has maximum potential energy at point   
A) A. B)  B. C)  C. D)  D. E)  F.   
  
26)  The bead has maximum speed at point   
A) A. B)  B. C)  C. D)  D. E)  F.   
  
27)  No work is done by gravity on a bowling ball that rolls along a bowling alley because   
A) no force acts on the ball.   
B) no distance is covered by the ball.   
C) the force on the ball is at right angles to the ball's motion.   
D) no potential energy is being converted to kinetic energy.   
E) its kinetic energy remains constant.   
  
28)  Which requires more work: lifting a 50-kg sack vertically 2 meters or lifting a 25-kg sack vertically 4 meters?   
A) lifting the 50-kg sack   
B) lifting the 25-kg sack   
C) Both require the same amount of work.   
  
29)  A 50-kg sack is lifted 2 meters in the same time as a 25-kg sack is lifted 4 meters.  The power expended in raising the 50-kg sack compared to the power used to lift the 25-kg sack is   
A) twice as much. B)  half as much. C)  the same.   
  
30)  A TV set is pushed a distance of 2 m with a force of 20 N that is in the same direction as the set moves.  How much work is done on the set?   
A) 2 J B)  10 J C)  20 J D)  40 J E)  80 J   
  
31)  It takes 40 J to push a large box 4 m across a floor. Assuming the push is in the same direction as the move, what is the magnitude of the force on the box?   
A) 4 N   
B) 10 N   
C) 40 N   
D) 160 N   
E) none of these   
  
32)  A 2-kg mass is held 4 m above the ground.  What is the approximate potential energy of the mass with respect to the ground?   
A) 20 J   
B) 40 J   
C) 60 J   
D) 80 J   
E) none of these.   
  
33)  A 2-kg mass has 40 J of potential energy with respect to the ground. Approximately how far is it located above the ground?   
A) 1 m   
B) 2 m   
C) 3 m   
D) 4 m   
E) none of these   
  
34)  A heavy pile driver starting from rest falls on a pile with a force that depends on   
A) the original height of the driver.   
B) the original potential energy of the driver.   
C) the distance the pile is moved.   
D) all of these.   
E) none of these.   
  
35)  Using 1000 J of work, a toy elevator is raised from the ground floor to the second floor in 20 seconds.  How much power does the elevator use?   
A) 20 W B)  50 W C)  100 W D)  1000 W E)  20,000 W   
  
36)  One end of a long, uniform log is raised to shoulder level. Another identical log is raised at its center to the same level. Raising the second log requires about   
A) the same amount of work.   
B) twice as much work.   
C) more than twice as much work.   
  
37)  Two identical arrows, one with twice the kinetic energy of the other, are fired into a hay bale.  The faster arrow will penetrate   
A) the same distance as the slower arrow.   
B) twice as far as the slower arrow.   
C) four times as far as the slower arrow.   
D) more than four times as far as the slower arrow.   
E) none of these.   
  
38)  A car moves 4 times as fast as another identical car.  Compared to the slower car, the faster car has   
A) 4 times the KE. B)  8 times the KE.   
C) 12 times the KE. D)  16 times the KE.   
  
39)  A ball is projected into the air with 100 J of kinetic energy which is transformed to gravitational potential energy at the top of its trajectory. When it returns to its original level after encountering air resistance, its kinetic energy is   
A) less than 100 J. B)  more than 100 J.   
C) 100 J. D)  not enough information given.   
  
40)  Strictly speaking, if any electrical device in your car is turned on (such as an [air conditioner](http://www.bizrate.com/search__af_assettype_id--4__af_creative_id--3__af_id--foo__af_placement_id--bar__keyword--air+conditioner__rf--af1.html), headlights, or even a radio) more gasoline is burned by the engine.  This statement is   
A) totally false.   
B) true only if the car's engine is running.   
C) true only if the car's engine is stopped.   
D) almost always true.   
E) none of these.   
  
41)  A machine puts out 100 Watts of power for every 1000 Watts put into it.  The efficiency of the machine is   
A) 10%.   
B) 50%.   
C) 90%.   
D) 110%.   
E) none of these.   
  
42)  An ungloved fist will do more damage to a jaw than a gloved fist.  The reason for this is that the ungloved fist   
A) delivers a larger impulse to the jaw. B)  exerts a larger force on the jaw.   
C) has less air resistance on it. D)  none of these.   
  
43)  A woman lifts a box from the floor.  She then moves with constant speed to the other side of the room, where she puts the box down.  How much work does she do on the box while walking across the floor at constant speed?   
A) zero J   
B) more than zero J   
C) more information needed to determine   
  
44)  A car moving at 50 km/hr skids 20 m with locked brakes. How far will the car skid with locked brakes if it is traveling at 150 km/hr?   
A) 20 m B)  60 m C)  90 m D)  120 m E)  180 m   
  
45)  Which has greater kinetic energy, a car traveling at 30 km/hr or a car of half the mass traveling at 60 km/hr?   
A) the 30 km/hr car   
B) the 60 km/hr car   
C) Both have the same kinetic energy.   
  
46)  A diver who weighs 500 N steps off a diving board that is 10 m above the water. The diver hits the water with kinetic energy of   
A) 10 J.   
B) 500 J.   
C) 510 J.   
D) 5000 J.   
E) more than 5000 J.   
  
47)  Consider a hydraulic press.  When the input piston is depressed 20 cm, the output piston is observed to move 1 cm.  On the same press, an input force of 1 N can raise no more than   
A) 1 N. B)  10 N. C)  20 N. D)  21 N.   
  
48)  A 2500-N pile-driver ram falls 10 m and drives a post 0.1 m into the ground. The average impact force on the ram is   
A) 2,500 N. B)  25,000 N. C)  250,000 N. D)  2,500,000 N.   
  
49)  A pulley system raises a 1000-N load with 100 N of input force. The efficiency of the system is   
A) 10%.   
B) 90%.   
C) 100%.   
D) 1000%.   
E) not enough information given.   
  
50)  A jack system will increase the potential energy of a heavy load by no more than 1000 J with a work input of 2000 J.  The efficiency of the jack system is no more than   
A) 10%.   
B) 20%.   
C) 50%.   
D) 80%.   
E) not enough information given.   
  
51)  Which requires the most amount of work on the brakes of a car?   
A) slowing down from 100 km/h to 70 km/h   
B) slowing down from 70 km/h to a stop   
C) equal amounts for either   
  
52)  A car that travels twice as fast as another when braking to a stop will skid   
A) twice as far.   
B) four times as far.   
C) depends on the mass of the cars.   
  
53)  Two identical arrows, one with twice the speed of the other, are fired into a hay bale.  The faster arrow will penetrate   
A) the same distance as the slower arrow.   
B) twice as far as the slower arrow.   
C) four times as far as the slower arrow.   
D) more than four times as far as the slower arrow.   
E) none of these.   
  
54)  A person on the edge of a roof throws a ball downward. It strikes the ground with 100 J of kinetic energy.  The person throws another identical ball upward with the same initial speed, and this too falls to the ground.  Neglecting air resistance, the second ball hits the ground with a kinetic energy of   
A) 100 J.   
B) 200 J.   
C) less than 100 J.   
D) more than 200 J.   
E) none of these.   
  
55)  If a power plant is 30% efficient, and the transmission system that delivers power to consumers is 60% efficient, then the overall efficiency is   
A) 90%.   
B) 60%.   
C) 30%.   
D) 18%.   
E) none of these.   
  
56)  How many Joules of energy are in one kilowatt-hour?   
A) 1    
B) 60    
C) 60,000   
D) 3.6 million   
E) none of these   
  
57)  A car's engine is 20% efficient.  When cruising, the car encounters an average retarding force of 1000 N.  If the energy content of gasoline is 40 megajoules per liter, how many kilometers per liter does the car get?   
A) 14    
B) 12    
C) 10    
D) 8    
E) none of these   
  
58)  Suppose a miracle car has a 100% efficient engine and burns fuel that has a 40-megajoules-per-liter energy content.  If the air drag and overall frictional forces on this car traveling at highway speeds total 1000 N, what is the overall limit in distance per liter it could be driven on the highway?   
A) 30 km   
B) 40 km   
C) 50 km   
D) more than 50 km   
E) not enough information   
  
59)  On a sunny day about 500 watts of solar power strikes each square meter of the earth's surface.  If a solar automobile has 4 square meters of collector area and 100% efficient collectors and motor, its power output is about   
A) 0.27 hp. B)  2.7 hp. C)  27 hp. D)  270 hp.   
  
60)  A flower pot of mass m falls from rest to the ground below, a distance h. Which statement is correct?   
A) The speed of the pot when it hits the ground is proportional to h.   
B) The KE of the pot when it hits the ground is proportional to h.   
C) The KE of the pot when it hits the ground does not depend on m.   
D) The speed of the pot when it hits the ground depends on m.   
E) None of these is correct.   
  
61)  Whereas impulse involves the time that a force acts, work involves the   
A) distance that a force acts.   
B) time and distance that a force acts.   
C) acceleration that a force produces.   
  
62)  When a rifle is fired it recoils so both the bullet and rifle are set in motion.  The rifle and bullet ideally acquire equal   
A) but opposite amounts of momentum. B)  amounts of kinetic energy.   
C) both of these. D)  none of these.   
  
63)  A moving object has   
A) speed.   
B) velocity.   
C) momentum.   
D) energy.   
E) all of these.   
  
64)  What does an object have when moving that it never has when at rest?   
A) momentum   
B) energy   
C) mass   
D) inertia   
E) none of these   
  
65)  If an object has kinetic energy, then it also must have   
A) impulse.   
B) momentum.   
C) acceleration.   
D) force.   
E) none of these.   
  
66)  If the speed of a moving object doubles, then what else doubles?   
A) momentum   
B) kinetic energy   
C) acceleration   
D) all of these   
E) none of these   
  
67)  An object at rest may have   
A) speed.   
B) velocity.   
C) energy.   
D) momentum.   
E) none of these.   
  
68)  A feather and a coin dropped in a vacuum fall with equal   
A) forces.   
B) momenta.   
C) accelerations.   
D) kinetic energies.   
E) none of these.   
  
69)  A heavy and a light object released from the same height in a vacuum have equal   
A) weights.   
B) momenta.   
C) energies.   
D) all of these.   
E) none of these.   
  
70)  Two pool balls, each moving at 2 m/s, roll toward each other and collide. Suppose after bouncing apart, each moves at 4 m/s. This collision violates conservation of   
A) momentum. B)  kinetic energy. C)  both of these. D)  none of these.   
  
71)  Compared to a recoiling rifle, the bullet fired has a greater   
A) momentum. B)  kinetic energy. C)  none of these. D)  both of these.   
  
72)  A bullet has more kinetic energy than the recoiling rifle from which it is fired is because the force on the bullet acts over a longer   
A) time. B)  distance.   
C) both of these. D)  neither of these.   
  
73)  An open freight car rolls friction free along a horizontal track in a pouring rain that falls vertically.  As water accumulates in the car, the car's speed   
A) increases. B)  decreases. C)  doesn't change.   
  
74)  A car has a head-on collision with another car with the same magnitude of momentum.  An identical car driving with the same speed as the first car runs into an enormously massive wall.  The greater impulse will occur on the car that is in the collision with the   
A) approaching car.   
B) the wall.   
C) both impulses will be the same.   
  
A popular swinging-balls apparatus (shown below) consists of an aligned row of identical elastic balls suspended by strings so that the balls barely touch each other. When two balls are lifted from one end and released, they strike the row and two balls pop out from the other end.  
  
Figure 7-D  
   
75)  If instead one ball popped out with twice the velocity of the two, this would be a violation of conservation of   
A) momentum. B)  energy. C)  both of these. D)  none of these.   
  
76)  If instead one ball popped out with kinetic energy equal to the combined kinetic energy of the two, this would be a violation of conservation of   
A) momentum. B)  energy.   
C) both of these. D)  neither of these.   
  
77)  A golf ball is thrown at and bounces backward from a massive bowling ball that is initially at rest.  After the collision, compared to the golf ball, the bowling ball has more   
A) momentum, but less kinetic energy.   
B) kinetic energy, but less momentum.   
C) momentum and more kinetic energy.   
D) but it has less momentum and less kinetic energy.   
E) not enough information is given to say.   
  
78)  A piece of taffy slams into and sticks to another identical piece of taffy that is at rest.  The momentum of the two pieces stuck together after the collision is the same as it was before the collision, but this is not true of the kinetic energy, which is partly turned into heat.  What percentage of the kinetic energy is turned into heat?   
A) 0%   
B) 25%   
C) 50%   
D) 75%   
E) not enough information given   
  
79)  Two identical freight cars roll without friction (one at 1 m/s, the other at 2 m/s) toward one another on a level track.  They collide, couple together, and roll away in the direction that   
A) the slower car was initially going.   
B) the faster car was initially going.   
C) neither of these -- they stop.   
  
80)  Two 5000-kg freight cars roll without friction (one at 1 m/s, the other at 2 m/s) toward one another on a level track.  They collide, couple, and roll away together with a combined momentum of   
A) zero. B)  5000 kg m/s. C)  10,000 kg m/s. D)  15,000 kg m/s.   
  
81)  Two identical freight cars roll without friction towards each other on a level track. One rolls at 2 m/s and the other rolls at 1 m/s.  After the cars collide, they couple and roll together with a speed of   
A) 0.5 m/s.   
B) 0.33 m/s.   
C) 0.67 m/s.   
D) 1.0 m/s.   
E) none of these.   
  
82)  Two 5000-kg freight cars roll without friction (one at 1 m/s, the other at 2 m/s) toward each other on a level track.  Thus one car's kinetic energy is 2500 J and the other's is 10,000 J.  Before they collide their total kinetic energy is   
A) 1250 J. B)  2500 J. C)  7500 J. D)  10,000 J. E)  12,500 J.   
  
83)  Two 5000-kg freight cars roll toward each other (one at 1 m/s, the other at 2 m/s) on a level track.  Thus before they collide one car's kinetic energy is 2500 J and the other's is 10,000 J.  After they collide (and couple together) their total kinetic energy is   
A) 1250 J. B)  2500 J. C)  7500 J. D)  10,000 J. E)  12,500 J.   
  
84)  Two 5000-kg freight cars roll toward one another (one at 1 m/s and the other at 2 m/s) on a level track.  Thus before they collide one car's kinetic energy is 2500 J and the other's is 10,000 J.  They collide and couple together.  The amount of kinetic energy turned into heat (mostly warming the couplers) in the collision is   
A) 1250 J. B)  2500 J. C)  7500 J. D)  10,000 J. E)  11,250 J.   
  
85)  A 1-kg ball dropped from a height of 2 m rebounds only 1.5 m after hitting the ground.  The amount of energy converted to heat is about   
A) 0.5 J.   
B) 1.0 J.   
C) 1.5 J.   
D) 2.0 J.   
E) more than 2.0 J.   
  
86)  A sandbag in outer space moves at 3 m/s and collides and sticks to a half-as-massive sandbag initially at rest. Compared to the kinetic energy of the moving bag before collision, the kinetic energy of the coupled bags after collision is   
A) one third. B)  two thirds.   
C) three quarters. D)  not enough information to say.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 1)  Answer:  A  2)  Answer:  A  3)  Answer:  A  4)  Answer:  C  5)  Answer:  B  6)  Answer:  C  7)  Answer:  A  8)  Answer:  C  9)  Answer:  B  10)  Answer:  C  11)  Answer:  C  12)  Answer:  A  13)  Answer:  D  14)  Answer:  A  15)  Answer:  A  16)  Answer:  C  17)  Answer:  E  18)  Answer:  B  19)  Answer:  A  20)  Answer:  A | 21)  Answer:  A  22)  Answer:  B  23)  Answer:  B  24)  Answer:  E  25)  Answer:  A  26)  Answer:  E  27)  Answer:  C  28)  Answer:  C  29)  Answer:  C  30)  Answer:  D  31)  Answer:  B  32)  Answer:  D  33)  Answer:  B  34)  Answer:  D  35)  Answer:  B  36)  Answer:  B  37)  Answer:  B  38)  Answer:  D  39)  Answer:  A  40)  Answer:  D | 41)  Answer:  A  42)  Answer:  B  43)  Answer:  A  44)  Answer:  E  45)  Answer:  B  46)  Answer:  D  47)  Answer:  C  48)  Answer:  C  49)  Answer:  E  50)  Answer:  C  51)  Answer:  A  52)  Answer:  B  53)  Answer:  C  54)  Answer:  A  55)  Answer:  D  56)  Answer:  D  57)  Answer:  D  58)  Answer:  B  59)  Answer:  B  60)  Answer:  B | 61)  Answer:  A  62)  Answer:  A  63)  Answer:  E  64)  Answer:  A  65)  Answer:  B  66)  Answer:  A  67)  Answer:  C  68)  Answer:  C  69)  Answer:  E  70)  Answer:  B  71)  Answer:  B  72)  Answer:  B  73)  Answer:  B  74)  Answer:  C  75)  Answer:  B  76)  Answer:  A  77)  Answer:  A  78)  Answer:  C  79)  Answer:  B  80)  Answer:  B | 81)  Answer:  A  82)  Answer:  E  83)  Answer:  A  84)  Answer:  E  85)  Answer:  E  86)  Answer:  B |