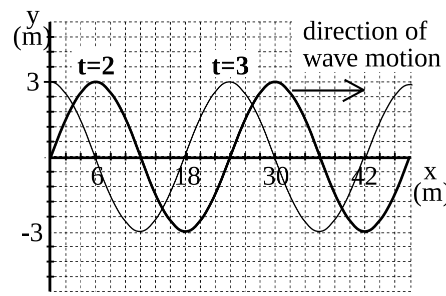
Multiple Choice -- TEST IV

1.) A graph of a traveling wave as seen at t = 2 seconds and t = 3 seconds is shown to the right. The wavelength of the wave is:

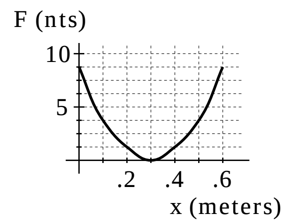


- a.) 18 meters.
- b.) 24 meters.
- c.) 30 meters.
- d.) Can't tell with the information given.
- e.) None of the above.

2.) The position function for an oscillating body is $x = 20 \sin (.6t - \pi/2)$. At t = 0, the body's velocity is:

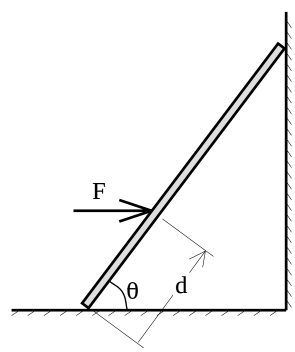
- a.) 20 m/s.
- b.) 12 m/s.
- c.) 2.0 m/s.
- d.) None of the above.

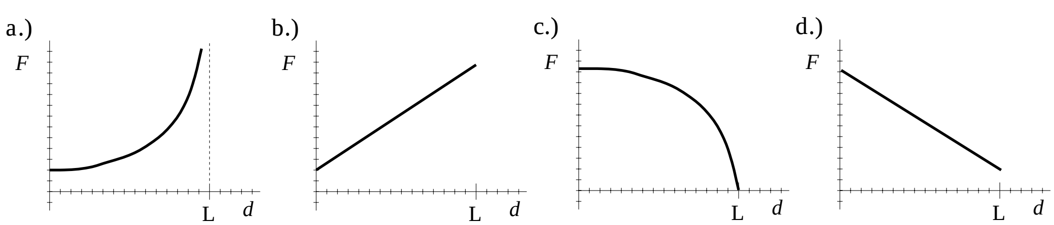
3.) A 4 kg body moves from x = 0 to x = .6 meters one-dimensionally over a frictionless surface. It takes 12 seconds to execute the trip. The single force acting on the body during the motion is graphed to the right. Ignoring the units discrepancy, the force function in this case is $F = (x - 3)^2$.



- a.) The net work done by the force over the first .3 meters is negative, whereas the work done over the final .3 meters is positive.
- b.) The net work over the entire interval is $(x^3/3) - 3x^2 + 9x$.
- c.) The work done between x = .1 meters and x = .6 meters is 3.5 joules.
- d.) None of the above.

4.) A ladder of mass m and length L sitting on a frictionless floor at an angle θ is perched against a frictionless wall. A horizontal force F acting at a distance d units up the ladder keeps the ladder from angularly accelerating. Which graph characterizes the relationship between F and d?



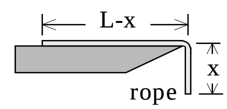


e.) None of these.

5.) An ideal spring is hung free in the vertical. A 5 kg mass is attached without elongating the spring, and the mass is released from that point to oscillate up and down. If the mass had been gently lowered (it wasn't, but if it had been), it would have moved 2.5 meters downward before coming to equilibrium. Approximate g to equal 10 m/s^2:

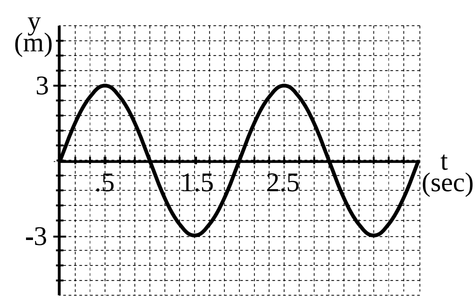
a.) The spring constant is 2 nts/meter, the angular frequency of the motion will be 2 radians/second, and the maximum velocity will be 5 m/s.
b.) The spring constant is 20 nts/meter, the angular frequency of the motion will be 4 radians/second, and the maximum velocity will be 2 m/s.
c.) The spring constant is 2 nts/meter, and neither the angular frequency nor the maximum velocity can be calculated as there is not enough information to do so as the problem stands.
d.) The spring constant is 20 nts/meter, the angular frequency of the motion will be 2 radians/second, and the maximum velocity will be 5 m/s.
e.) None of the above.

6.) At a given instant, a fat rope of length L and mass density λ (note: mass density is the mass per unit length of rope) is as shown hanging over the edge of a table. Assume the normal force is constant over the table's length, and that N goes to ZERO at the table's edge (versus increasing in magnitude as it would do in real life).



a.) Assuming the table is frictionless, the rope's acceleration will be dependent only upon λ.
b.) Assuming the table is frictional and the rope is stationary and not accelerating, the coefficient of static friction between the rope and the table will be y/(L-y).
c.) Back to the frictionless situation, the acceleration will be a constant.
d.) Both b and c.

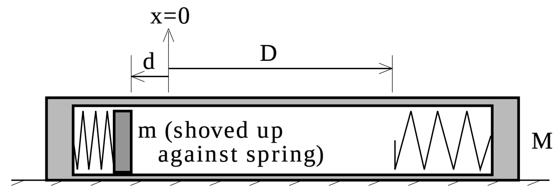
7.) At a particular position, the displacement vs. time graph for a wave is shown to the right.



a.) The amplitude of the wave is 3 meters, its wavelength is 2 meters, and its frequency is .5 Hz.
b.) The amplitude of the wave is 6 meters, it is impossible to tell what the wavelength is from the information given, and its frequency is 2 Hz.
c.) The amplitude of the wave is 3 meters, it is impossible to tell what the wavelength is from the information given, and its frequency is .5 Hz.
d.) None of the above.

8.) A mass m is released 6R meters from the surface of a moon whose radius is R and whose mass is M. If released from rest, how fast will the mass be traveling just before it hits the surface of the planet?

a.) $[2GM/(6R)]^{1/2}$.
b.) $[-2GM/(7R)]^{1/2}$
c.) $[12GM/(7R)]^{1/2}$.
d.) None of the above.



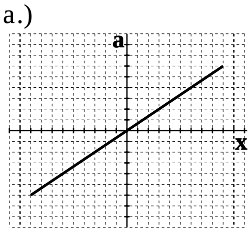
9.) An ideal spring (spring constant k) is mounted inside a hollowed out block whose mass is M. With M held stationary, a second mass m is pushed up against the spring until the spring's displacement is d. A second spring with the same spring constant is positioned at the end of the hollow. The net distance between the ends of the two unsprung springs is D (see sketch). The shaft applies a constant frictional force f on m only over the distance marked D in the sketch. Assume M is fixed to the ground so that it cannot move. The spring is released accelerating m.

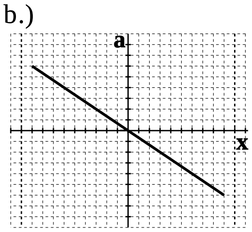
a.) Just after leaving the spring, m's velocity will be $(k/m)^{1/2}d$.
b.) The impulse provided to m by the spring will equal $(km)^{1/2}d$.
c.) If m = .1 kg, D = 1 meter, f = 1 nt, and m's velocity just as it leaves the spring is 7 m/s, the time it takes m to reach the second spring will be approximately .16 seconds.
d.) Both a and b but not c.
e.) Responses a, b, and c..

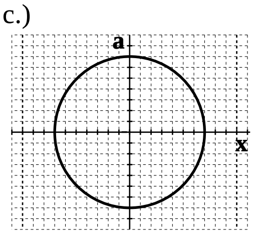
10.) Moving under the influence of gravity, a body's kinetic energy is KE_o. If, due to its natural motion in the gravitational field, the body's velocity changes to one-third of its original value, the change of the body's potential energy will equal:

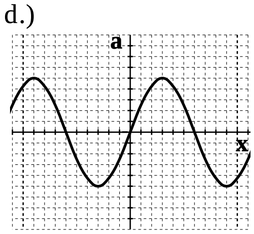
a.) $(1/3)KE_o$.
b.) $(1/9)KE_o$.
c.) $(8/9)KE_o$.
d.) $(3)KE_o$.
e.) $(9)KE_o$.

11.) The graph of the acceleration vs. position of a body oscillating in simple harmonic motion is:

a.)


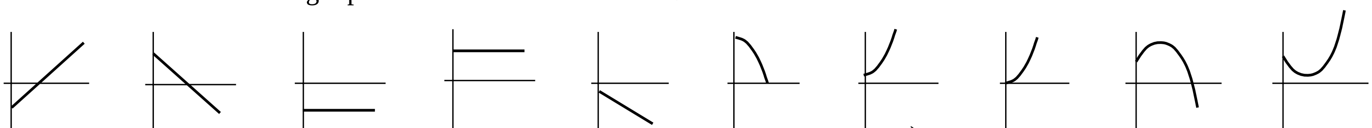
b.)


c.)


d.)


e.) None of these.

--Consider these graphs in Problems 12 and 13:



a.) b.) c.) d.) e.) f.) g.) h.) i.) j.)

12.) If all of the graphs were that of Position vs. Time, the only graphs listed below that would fit a kinematic situation would be:

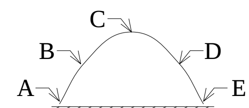
a.) Graphs a, b, and e.
b.) Graphs a, b, c, d, and e.
c.) Graph f, g, h, i, and j.
d.) All of the graphs.
e.) None of the graphs.

13.) If all of the graphs were that of Velocity vs. Time, the only graphs listed below that would fit a kinematic situation would be:

a.) Graphs a, b, and e.
b.) Graphs a, b, c, d, and e.
c.) Graphs f, g, h, i, and j.
d.) All of the graphs.
e.) None of the graphs.

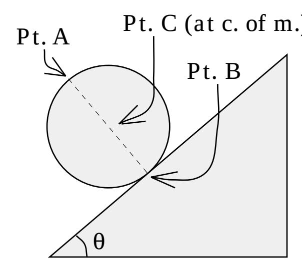
--end of section--

14.) A projectile is fired in a frictionless environment as shown to the right.



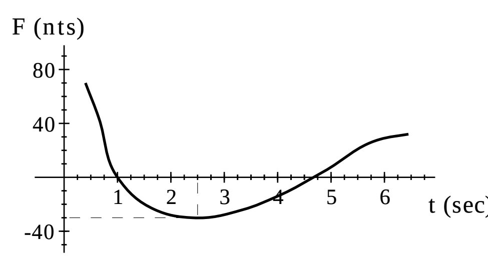
a.) The work gravity does while the body moves from Point B to Point D is zero.
b.) The work gravity does while the body moves in its downward arc between Point C and Point D is negative.
c.) The amount of work gravity does as the body moves from Point A to Point E is twice the amount of work done between Point A and Point C.
d.) Both a and b.
e.) Both a and c.

15.) A ball rolls down an incline. Its angular acceleration is:



a.) $mg(R\cos\theta)/I_{cm}$, where I_{cm} is the moment of inertia about the ball's center of mass.
b.) fR/I_B, where f is the frictional force (equal to $mg\sin\theta - ma_{cm}$) and I_B is the moment of inertia about Point B.
c.) $a_A/(2R)$, where a_A is the acceleration of Point A.
d.) Both a and c.
e.) Both b and c.

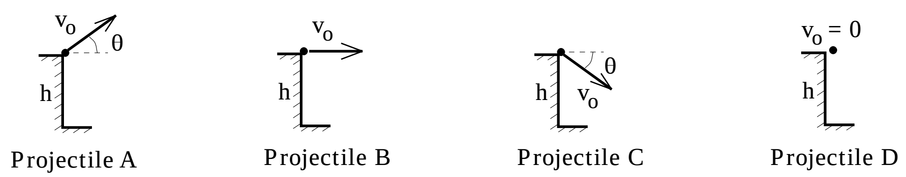
16.) A non-linear frictional force in the x direction is graphed to the right. If it is the only force acting on a body, and if the body's mass is 3 kg:



a.) At t = 2.5 seconds, the mass is moving in the -x direction.
b.) At t = 2.5 seconds, the mass's velocity will be approximately zero.
c.) The acceleration of the mass at t = 2.5 seconds is approximately $-10\ m/s^2$.

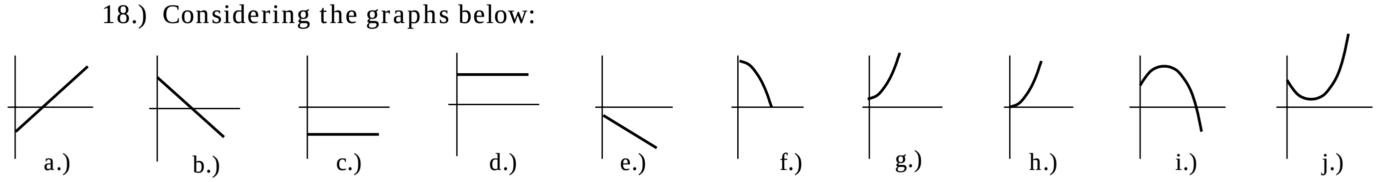
d.) The velocity of the body would either have been positive until t = 1 second, whereupon it would have changed, or vice versa.
e.) None of the above.

--The following information pertains to Problems 17 through 20: Projectiles A, B, C, and D are fired at the same time from a height h meters above the ground. With the exception of Projectile D, which is dropped from rest, all the projectiles (i.e., Projectiles A, B, and C) have the same muzzle velocity v_o, (though each is fired at a different angle--see the sketches below and note that the angle defined as θ is the same in all cases). It takes t_1 seconds for Projectile A to get to the top of its flight. It takes t_2 seconds for Projectile D to reach the ground.



17.) The initial velocity of Projectile C will be:
a.) The same as the initial velocity of Projectile B. The two will also have the same acceleration.
b.) The same as Projectile B after time t_1. The two will also have different accelerations.
c.) The same as Projectile A after time $2t_1$. The two will also have the same acceleration.
d.) None of the above.

18.) Considering the graphs below:



Projectile C's:
a.) Y-component of Position vs. Time graph looks like graph e.
b.) X-component of Position vs. Time graph looks like graph a.
c.) Y-component of Velocity vs. Time graph looks like graph e.
d.) X-component of Velocity vs. Time graph looks like graph c.
e.) Y-component of Acceleration vs. Time graph looks like graph b.

19.) The time t_2:
a.) Depends only on h and constant(s).
b.) Is the same time it takes Projectile B to hit the ground.
c.) Is more than the time it takes Projectile C to hit the ground, but less than the time it takes Projectile A to hit.
d.) Both a and b, but not c.
e.) All of the above except d.

20.) If h were doubled, Projectile D's:

a.) Time to touch down would double.

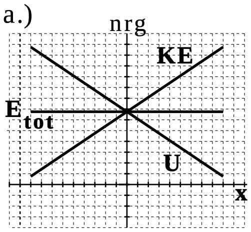
b.) Velocity just before touch down would double.

c.) Acceleration just before touch down would double.

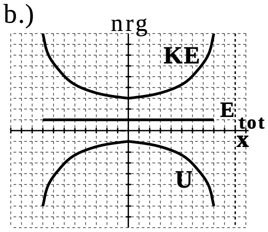
d.) None of the above.

----------end of section----------

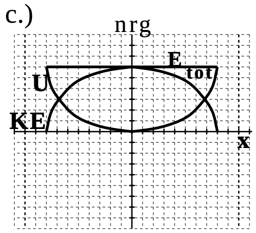
a.)



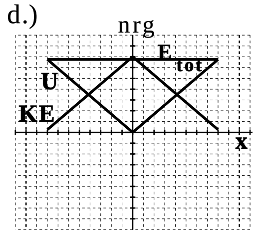
b.)



c.)



d.)



e.) None of these.

21.) Which graph combination depicts the potential energy, the kinetic energy, and the total energy of an ideal vibrating spring?

22.) <u>In theory</u>, a mass must travel how fast to escape the earth's gravitational field?

a.) It is not possible to tell for this situation because the mass of the object was not given.

b.) A mass can never escape the earth's gravitational field.

c.) $(2GM/R_e{}^2)^{1/2}$.

d.) None of the above.

23.) When a 10 kg body is .5 meters up a 30^o incline plane, its velocity is observed to be 20 m/s. A constant 50 newton frictional force acts on the body. Over the next 4 meters (note that a 4 meter run at 30^o will produce a rise of 2 meters):

a.) The work gravity does on the body will be greater than the work friction does. Also, when the body finally gets to the top of its run, it will stop momentarily, then begin to accelerate back down the incline.

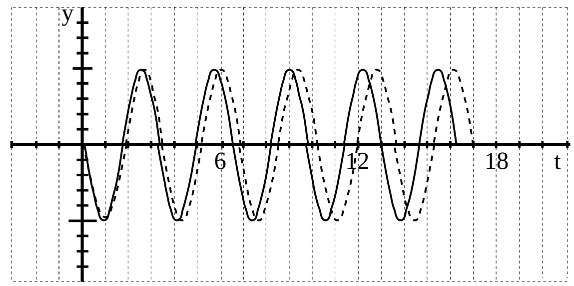
b.) The work gravity does on the body will equal the work fric tion does. Also, when the body finally gets to the top of its run, it will stop and remain there (i.e., it won't be accelerated down the incline).

c.) The work gravity does on the body will be the same as the work friction does. Also, when the body finally gets to the top of its run, it will stop momentarily, then begin to accelerate back down the incline.

d.) The work gravity does on the body will be less than the work friction does. Also, when the body finally gets to the top of its run, it will stop and remain there (i.e., it won't be accelerated down the incline).

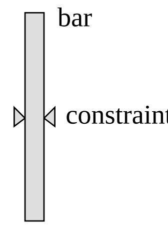
24.) Newton's Second Law is applied to a system. After a free body diagram is drawn and the forces summed, the equation $-32x^3 = 2a$ emerges, where x is the position and a is the acceleration of the body.

a.) This equation does not characterize an oscillatory system.
b.) This equation does characterize an oscillatory system and the motion is simple harmonic in nature.
c.) This equation does characterize an oscillatory system and the motion's frequency is 4 radians per second.
d.) Both Response b and c.
e.) None of the above.



25.) Two waves exist simultaneously in the same medium (they are graphed on the same axis). The beat frequency for the situation is approximately:

a.) (2/13) - (2/17).
b.) (4/13) - (4/17).
c.) (8/13) - (8/17).
d.) None of the above.



26.) A 1.2 meter long bar is clamped at its center is tapped gently once at one end. The bar rings with a frequency equal to 200 hertz. The wave velocity of the disturbance as it moves through the bar will be:

a.) 960 m/s.
b.) 480 m/s.
c.) 240 m/s.
d.) None of the above.

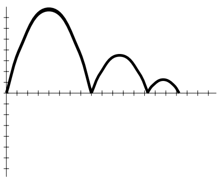
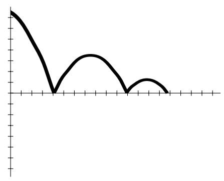
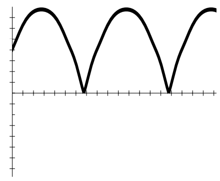
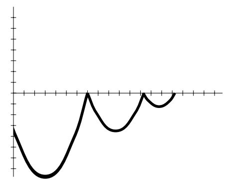
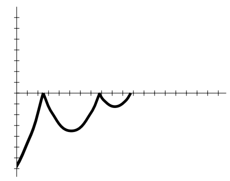
27.) During a 10 second time interval, the power provided to a body by a constant force is 375 watts. If the body was initially at rest:

a.) The amount of work done during the interval is 3750 joules.
b.) Doubling the time over which the power-producing force is applied will quadruple the distance traveled.
c.) Doubling the time over which the power-producing force is applied will double the power provided to the body.
d.) All of the above.

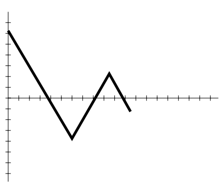
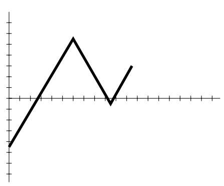
28.) A rotating disk has moment of inertia I and kinetic energy K. The body's angular momentum will be:

a.) K^2I.
b.) $2K^2/I$.
c.) $(K^2I)^{1/2}$.
d.) $(2KI)^{1/2}$.

29.) A mass m is fired downward (i.e., vertically) with velocity v_o off a building that is h meters high. The mass hits the ground and bounces inelastically. Which graph shown below best depicts the body's position as a function of time?

a.)

b.)

c.)

d.)

e.)


30.) A mass m is fired downward (i.e., vertically) with velocity v_o off a building that is h meters high. The mass hits the ground and bounces inelastically. Which graph shown below best depicts the body's velocity as a function of time?

a.)

b.)

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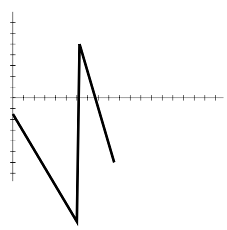
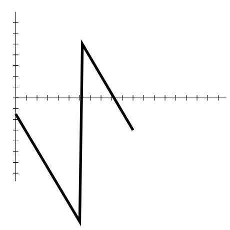
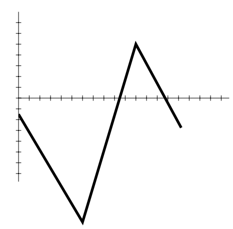
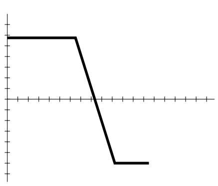
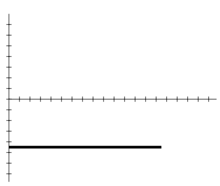
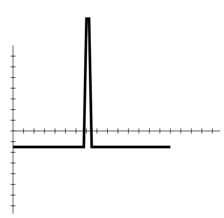
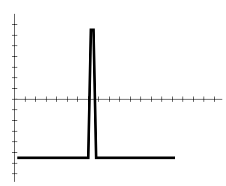
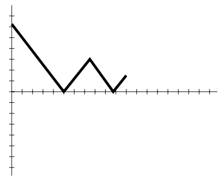

d.)

e.)


31.) A mass m is fired downward (i.e., vertically) with velocity v_o off a building that is h meters high. The mass hits the ground and bounces inelastically. Which graph shown below best depicts the body's acceleration as a function of time?

a.)

b.)

c.)

d.)

e.) None of these graphs.

32.) A mass m is fired downward (i.e., vertically) with velocity v_o off a building that is h meters high. The mass hits the ground and bounces inelastically. Which graph shown below best depicts the body's potential energy as a function of time, assuming $U_{grav} = 0$ at ground level?

a.)

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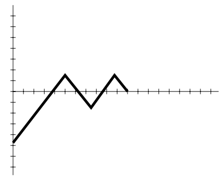
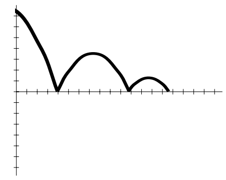
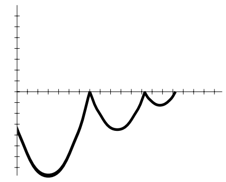
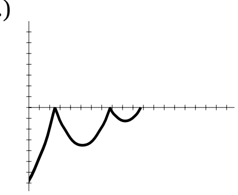
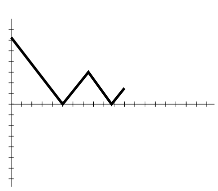
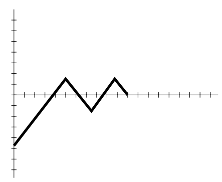
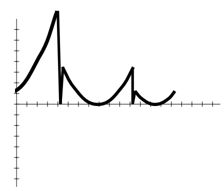
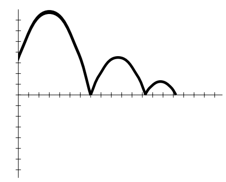
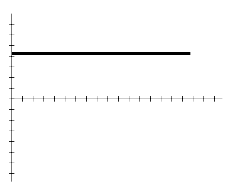
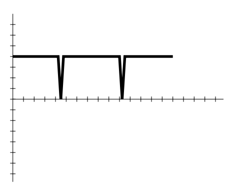
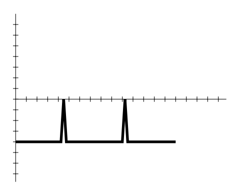
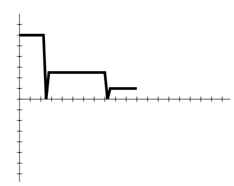
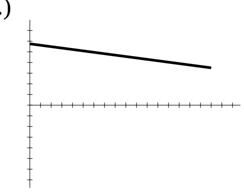

c.)

d.)

e.)


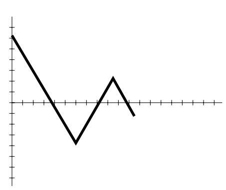
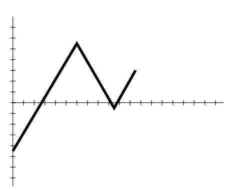
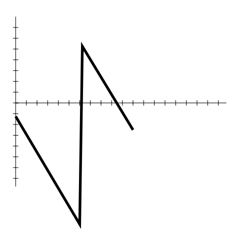
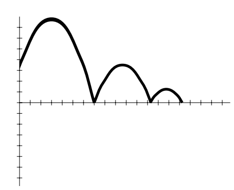
33.) A mass m is fired downward (i.e., vertically) with velocity v_o off a building that is h meters high. The mass hits the ground and bounces inelastically. Which graph shown below best depicts the body's kinetic energy as a function of time?

a.)

b.)

c.)

d.)

e.) None of the graphs.

34.) A mass m is fired downward (i.e., vertically) with velocity v_o off a building that is h meters high. The mass hits the ground and bounces inelastically. Which graph shown below best depicts the body's total energy as a function of time?

a.)

b.)

c.)

d.)

e.)


35.) A mass m is fired downward (i.e., vertically) with velocity v_o off a building that is h meters high. The mass hits the ground and bounces inelastically. Which graph shown below best depicts the body's momentum as a function of time?

a.)

b.)

c.)

d.)

e.)