Multiple Choice -- TEST I

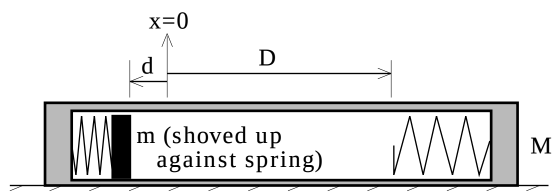
1.) The position function for an oscillating body is $x = 20 \sin (.6t - \pi/2)$. At $t = 0$, the magnitude of the body's acceleration is:

a.) 20 m/s^2.
b.) 12 m/s^2.
c.) 7.2 m/s^2.
d.) None of the above.

2.) A satellite following an elliptical path around a planet has an angular velocity ω_{far} when at its maximum distance d units from the planet's center. At its closest point, the distance between the satellite and planet's center is $d/3$. The satellite's angular velocity at that closest point is:

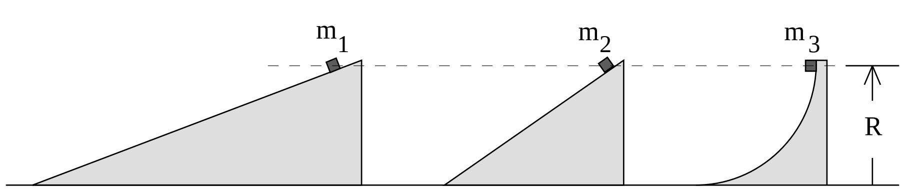
a.) $\omega_{far}/3$.
b.) ω_{far}.
c.) $3\omega_{far}$.
d.) $9\omega_{far}$.

3.) An ideal spring (spring constant k) is mounted inside a hollowed-out block whose mass is M. With M temporarily 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). Assume M is *not* fixed to the ground and can move frictionlessly. Assume also that there is no internal friction in the system. The spring is released, accelerating m.



a.) Momentum should be conserved in the system because the spring applies a conservative force.
b.) Just after it leaves the spring, m's velocity will be $(kx^2)/(m+m^2/M)$.
c.) When m reaches the second spring, it will depress it a distance d before coming to rest relative to the spring. Also at that point, M will have come to rest.
d.) All of the above.

The sketch below is for Questions #4 and #5. In the sketch, three inclines are shown. The sketches are drawn approximately to scale with the curved incline being a quarter circle. The masses are different sizes, but the distance traversed by m_2 in getting to the bottom of its incline is the same as the distance traversed by m_3 in getting to the bottom of its incline.



4.) Assuming the inclines are frictionless, the mass with the largest velocity at the bottom will be:

- **a.)** Mass m_1.
- **b.)** Mass m_2.
- **c.)** Mass m_3.
- **d.)** Masses m_2 and m_3.
- **e.)** They will all have the same velocity at the bottom.

5.) Friction is introduced into the system such that the coefficient of friction is the same for all three inclines. The mass with the largest velocity at the bottom will be:

- **a.)** Mass m_1.
- **b.)** Mass m_2.
- **c.)** Mass m_3.
- **d.)** Masses m_2 and m_3.
- **e.)** They will all have the same velocity at the bottom.

--------end of situation--------

6.) *Point A* and *Point B* on a wave are observed to be 7/4 wavelengths apart. At a particular instant, *Point A* is below the axis and moving upward toward equilibrium. At that time, *Point B* is:

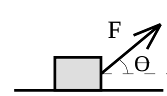
- **a.)** Below the axis and moving upward toward equilibrium.
- **b.)** Below the axis and moving downward away from equilibrium.
- **c.)** Above the axis and moving upward away from equilibrium.
- **d.)** Above the axis and moving downward toward equilibrium.

7.) A single, constant force is applied to a body. After the force does 20 joules of work, the body's velocity has changed from zero to 6 m/s. The work required to change the body's velocity from 6 m/s to 12 m/s is:

- **a.)** 20 joules.
- **b.)** 40 joules.
- **c.)** 60 joules.
- **d.)** 400 joules.

8.) A man on a unicycle pedaling northward begins to slow down. The direction of the cycle's angular acceleration vector will be:

- **a.)** North.
- **b.)** South.
- **c.)** East.
- **d.)** West.
- **e.)** Upward, relative to the ground.

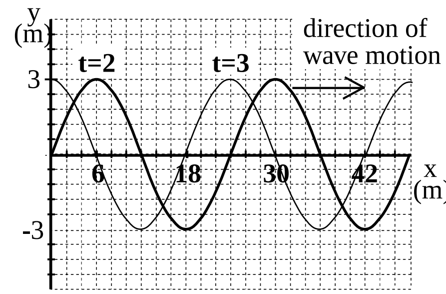


9.) A mass m has a force F applied to it as shown to the right:

- **a.)** The normal force on the block will be mg.

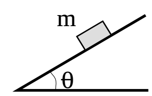
b.) The acceleration of the block will be a function of *F* only.
c.) If there was kinetic friction acting on the block, it would be directed toward the left.
d.) None of the above.

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



a.) (3/4) seconds/cycle.
b.) (4/3) second/cycle.
c.) 4 seconds/cycle.
d.) Can't tell with the information given.
e.) None of the above.

11.) A mass *m* sits on a frictionless incline plane of angle θ.



a.) The acceleration of mass *m* will be *g*.
b.) The acceleration of mass *m* will be dependent upon the size of the mass.
c.) The acceleration of mass *m* will be dependent upon θ.
d.) All of the above.

12.) It is known that a single, conservative force that runs along the *x axis* does -25 joules of work on a body moving in the *negative x direction*.
a.) The force is in the negative direction, and the body's change of potential energy is -25 joules.
b.) The force is in the negative direction, and the body's change of potential energy is 25 joules.
c.) The force is in the positive direction, and the body's change of potential energy is -25 joules.
d.) The force is in the positive direction, and the body's change of potential energy is 25 joules.
e.) None of the responses make any sense as gravity is not oriented along the *x axis*.

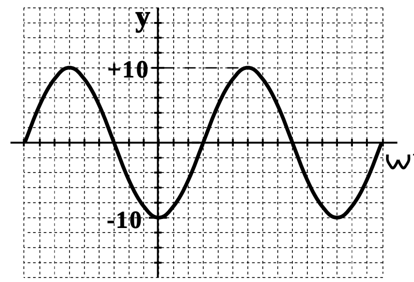
13.) A satellite following an elliptical path around a planet has a velocity v_{far} when at its maximum distance *d* units from the planet's center. At its closest point, the distance between the satellite and planet's center is *d/3*. The satellite's velocity at that closest point is:
a.) $v_{far}/3$.
b.) v_{far}.
c.) $3v_{far}$.
d.) $9v_{far}$.

14.) A turntable has an angular velocity of .8 rad/sec. It is accelerated at a rate of -4 rad/sec^2.
a.) After 5 seconds, its angular velocity is -19.2 rad/sec, and it will have rotated through a net angular displacement of -46 radians.
b.) It will take twice as long to go from .8 rad/sec to 0 rad/sec as it takes to go from .8 rad/sec to .4 rad/sec.

c.) It will have moved through a greater net angular displacement after the first .2 seconds than after the first .4 seconds.
d.) Both *a* and *b*.
e.) All of the above.

15.) A resting wheel has a constant torque applied to it. After the first 10 seconds, the wheel has turned through an angular displacement of 1.2 radians. After the first 20 seconds, the angular displacement will be:
a.) 2.4 radians.
b.) 4.8 radians.
c.) 7.2 radians.
d.) None of the above.

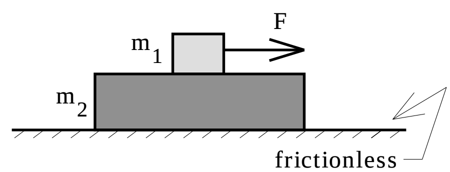
16.) A graph of the position function for a body oscillating with a frequency of 1/(4π) radians per second in *simple harmonic motion* is shown to the right. The equation that best describes the motion is:



a.) y = 20 sin (.5t - π/2).
b.) y = 10 sin ([1/(4π)]t - 5).
c.) y = 10 sin (.5t + 3π/2).
d.) y = 20 sin ([1/(4π)]t - π/2).
e.) None of the above.

17.) A sound wave moving at 330 m/s has a frequency of 220 Hz. Its wavelength is:
a.) 2/3 meter.
b.) 1.5 meters.
c.) 66,000 meters.
d.) None of the above.

18.) A mass m_1 sits on top of a second mass m_2 which sits on a frictionless surface. The coefficient of static friction between the two is .7. A force *F* is applied to the top mass (m_1).



a.) The maximum force *F* that m_1 can experience without slipping over m_2 is $\mu_s m_1 g$.
b.) The maximum force m_1 can experience without slipping over m_2 is $2\mu_s m_1 g$.
c.) The maximum force m_2 can experience without slipping relative to m_1 is $\mu_s m_1 g$.
d.) Both *b* and *c*.
e.) None of the above.

19.) A spinning skater's angular speed is 2 rad/sec when her kinetic energy is 20 joules. If the skater's moment of inertia changes by half during the spin, what is her new angular speed?
a.) .5 rad/sec.
b.) 2 rad/sec.
c.) $(8)^{1/2}$ rad/sec.
d.) 4 rad/sec.

20.) A mass m is attached to a string of length L that is, itself, attached to the ceiling. The mass is drawn to the side and released so that it swings back and forth. At the bottom of its arc, the mass's velocity is v_o.

a.) The acceleration of the mass when at the bottom of the arc is *zero*.

b.) The acceleration of the body when at the bottom of the arc is a function of the body's mass.

c.) The magnitude of the force on the mass when at the bottom of the arc is mg.

d.) The net force on the mass when at the bottom of the arc is $(mv_o^2/L)(\boldsymbol{j})$, where $\boldsymbol{j}$ is a unit vector in the *y-direction*.

21.) A flatbed truck coasts forward frictionlessly along on a flat surface. The surface between the truck bed and a large, massive crate sitting on the bed is *frictional*. At $t = 0$, you begin to push the crate toward the rear of the bed. At $t = 1$ *second*, the crate leaves the truck.

a.) Between $t = 0$ and $t = 1$ *second*, the momentum of the truck is conserved.

b.) Between $t = 0$ and $t = 1$ *second*, the momentum of the truck/crate system is conserved, and the truck will have slowed by the time the crate leaves it.

c.) Between $t = 0$ and $t = 1$ *second*, the momentum of the truck/crate system is conserved, and the truck will have sped up by the time the crate leaves it.

d.) Between $t = 0$ and $t = 1$ *second*, the momentum of the truck/crate system is not conserved as *you* are applying an external force to the crate.

e.) None of the above.