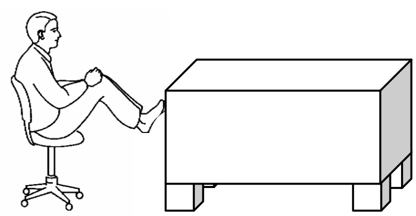
(Approximate) Final for Physics 1205, Fall 2005

In Fall 2005 we had also covered material dealing with fluid motion. I have deleted problems dealing with those subjects from this study exam. So this practice exam is a shorter than the actual final exam in 2005.

1. A rock is thrown horizontally from the top of a tower at the same instant that a ball is dropped vertically from rest from the same spot. Ignoring air resistance, which object has a greater total speed when it hits the level ground and which object hits the ground first?

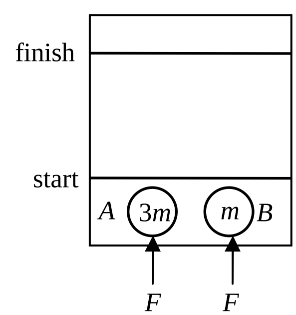
Greater Speed	Hits the Ground First
☐ Same speed	Hit at the same time
☐ The rock	Hit at the same time
☐ The ball	The rock
☐ The rock	The rock
☐ The ball	The ball

2. You sit at a desk and push against it with your feet so that you slide across the floor. The desk does not move. During the push and while you are still touching the desk.



☐ both you and the desk exert the same force on each other.
☐ neither you nor the desk are exerting any force on the each other.
☐ you exert a force on the desk, but the desk does not exert any force on you.
☐ both you and the desk exert a force on each other, but the force you exert is greater.
☐ both you and the desk exert a force on each other, but the force the desk exerts is greater.

3. Two pucks are pushed along an air hockey board (which is basically frictionless). Puck *A* has three times the mass of puck *B*. Each puck is pushed for the same distance from the start line to the finish line with the same amount of force. Consider the motion of the pucks at the finish line. Which of the following statements is true

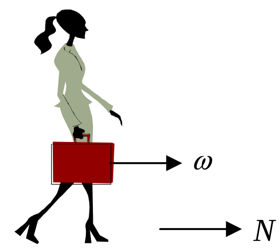


☐ The momentum and kinetic energy of the pucks are equal.
☐ Neither the momentum nor the kinetic energy of the pucks are equal.
☐ The momentum of the pucks is equal but the kinetic energy of the pucks is not equal.
☐ The momentum of the pucks is not equal but the kinetic energy of the pucks is equal.
☐ The time it takes to push the pucks from the start to the finish line is the same for *A* and *B*

4. You tie a stone to a string and twirl it in a horizontal circle above your head at a constant speed. If you double the speed of the stone without changing the length of the string what happens to the magnitude of the stone's centripetal acceleration?

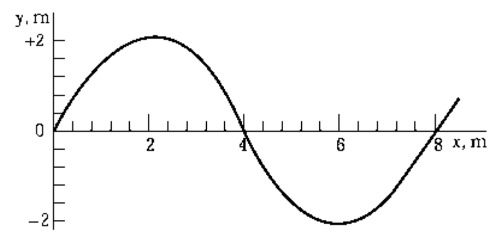
- ☐ it is half as much
- ☐ it is one-fourth as much
- ☐ it is the same
- ☐ it is two times greater
- ☐ it is four times greater

5. A spy is walking north carrying a briefcase that contains a spinning gyroscope mounted on an axle attached to the front and back of the case. The angular velocity of the gyroscope points north. The woman now begins to turn to her right to walk east. As a result, the front end of the suitcase



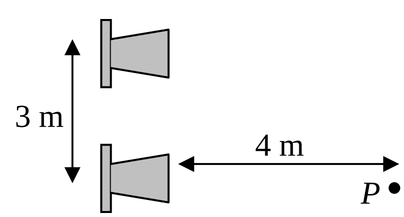
- ☐ rises upward
- ☐ dips downward
- ☐ does nothing whatever unusual
- ☐ fights her attempt to turn and pulls to the west.
- ☐ resists her attempt to turn and tries to remain pointed north.

6. The graph shows a wave traveling to the right with a velocity of 4 m/s. In SI units, the equation that best represents the wave is



- ☐ $y(x, t) = 2 \sin(\pi x/4 - \pi t)$
- ☐ $y(x, t) = 2 \sin(16\pi - 8\pi t)$
- ☐ $y(x, t) = 2 \sin(\pi x/4 + \pi t)$
- ☐ $y(x, t) = 4 \sin(\pi x/4 - \pi t)$
- ☐ $y(x, t) = 4 \sin(16\pi x - 8\pi t)$
- ☐ $y(x, t) = 4 \sin(16\pi x + 8\pi t)$

7. Two small speakers are connected in phase to the same source. The speakers are 3 meters apart and at ear level. An observer stands at the point P, 4 meters in front of one of the speakers as shown. The sound she hears will be most intense if the wavelength is



- ☐ 5 m
- ☐ 4 m
- ☐ 3 m
- ☐ 2 m
- ☐ 1 m

8. A mass-spring system is oscillating with amplitude A. The kinetic energy will equal the potential energy only when the displacement is:

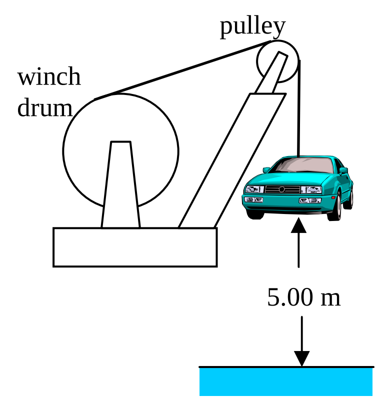
- ☐ $\pm A$
- ☐ $\pm A/2$
- ☐ zero
- ☐ $\pm A/4$
- ☐ $\pm A/\sqrt{2}$

9. You are listening to an "A" note played on a violin string. Let the subscript "s" refer to the violin string and "a" refer to the air. Which of the following is true?

- ☐ $f_s = f_a$ but $\lambda_s \neq \lambda_a$
- ☐ $f_s \neq f_a$ but $\lambda_s = \lambda_a$
- ☐ $f_s = f_a$ and $\lambda_s = \lambda_a$
- ☐ $f_s \neq f_a$ and $\lambda_s \neq \lambda_a$

10. You are pushing a 480-N crate up a ramp to load a moving van. The ramp makes an angle of 25° with respect to the horizontal direction. When you give the crate a 340-N push in the *horizontal* direction, the crate moves up the ramp at a constant velocity. What is the coefficient of kinetic friction between the crate and the ramp?

11. A 1200 kg car is being unloaded from a barge by a winch. At the moment shown in the figure, the gearbox shaft of the winch breaks and the car falls from rest. During the car's fall, there is no slipping between the massless rope, the pulley, and the winch drum. The moment of inertia of the winch drum is 320 kg·m^2 and that of the pulley is 4 kg·m^2. The radius of the winch drum is 0.80 m and that of the pulley is 0.30 m. Find the speed of the car when it hits the water.



12. Your artist friend needs advice on a new sculpture she is planning. This new work of art should not only look good, but sound good, as well. For this sculpture, your friend will attach one end of a steel wire, with a diameter of exactly three millimeters to a wall. The other end of the wire will pass over a pulley, which is one meter from the wall, and be attached to a weight hanging from the wire. Below the wire will be a one and a half meter long hollow tube that is open at one end and closed at the other. Once the sculpture is in place, air will blow through the tube, creating a sound. Your friend wants this sound to cause the steel wire to oscillate at the same resonant frequency as the tube. She asks you what the mass of the hanging weight should be so that the tube and wire will oscillate in resonance when viewed inside a building. You find in your physics book that the speed of sound in air is about 340 m/s and the density of steel is 7800 kg/m^3.

13. You are working as an intern for the local police department. Some students from Oklahoma State University have been charged with vandalism using a pellet gun. The motive seems to be their extreme jealousy of the University of Oklahoma. You have been asked to determine the speed of a pellet as it exits the gun. Since you had physics, you know how to make a ballistic pendulum. You hang a 0.15 kg ball of putty from a 1.0 m long string and shoot the 2.2 gram pellet into the putty. Unfortunately, the pellet passes completely through the putty instead of sticking in the putty. The ball of putty rises a distance of 8.5 cm. The pellet that exits from the putty travels a horizontal distance of 10.0 m in 0.31 seconds. You realize that even though the pellet did not stick in the putty you have enough information to calculate the velocity as it exited the gun.

(*You must solve this problem using the Context-Rich Problem work sheets starting on the next page. Partial credit will be given on this problem for steps performed correctly. Once a significant mistake is made, no more credit will be given.*)