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Physics 1313 Examination 1

Prof. T.E. Coan

Please PRINT your name so that we can read it.

Name: ______________________________

Some useful equations and other information.

$v = v_0 + at$	$v^2 = v_0^2 + 2ax$	$x = v_0 t + \frac{1}{2}at^2$
$\bar{v} = (v + v_0)/2$	$\vec{F_n} = m\vec{a_n}$	$\vec{F}_{12} = -\vec{F}_{21}$
$g = 9.8\,\mathrm{m/s^2}$	$1\,\mathrm{N} = 1\,\mathrm{kg\text{-}m/s^2}$	

BOX your final answers!

5 pts. Suppose you are throwing snowballs during Winter break. You throw a particular snowball so that just as it leaves your hand it is at shoulder height and is traveling horizontally only. The snow ball then travels through the air and lands on the ground 15 m in front of you. You throw another snowball in the same way but this one lands 30 m in front of you. Which snowball is in the air for a longer period of time? Circle your answer.

- Snowball 1
- Snowball 2
- Both snowballs are in the air for an equal period of time.

5 pts. Now you start throwing snowballs at your best friend's car, located 20 m in front of you. See the figure. Which one statement is correct? Circle your answer.

- The snowball's velocity $\vec{v}$ is constant as it travels through the air;
- The snowball's acceleration $\vec{a}$ is constant as it travels through the air;
- Neither one of these statements is true.

5 pts. Suppose a particular basketball has exactly twice as much mass as some baseball. You now apply the *same* force to both balls. What can you say about the subsequent motion of the two balls? Circle your answer.

- The basketball will move at a constant velocity;
- The baseball will accelerate at twice the rate of the basketball;
- The two balls will have the same acceleration.

5 pts. You are driving your car along a stretch of highway at a constant speed, say, 20 m/s. You make a gentle turn to the left, all the time maintaining your speed. *During* the time you were making the turn, which one of the following statements is true? Circle your answer.

- The car did not accelerate.
- The car did accelerate.
- The velocity of the car remained constant.

5 pts. The Prudential building in Boston had at one time the feature that the wind would pop out its windows from their frames. The windows would then fall to the ground, covering a horizontal distance of many meters. Suppose a window is popped out with a horizontal velocity $v_H = 10\,\mathrm{m/s}$. The window's initial vertical velocity is zero. Also, suppose the window is popped out a distance $H = 122.5$ meters above the ground. What is the horizontal distance L covered by the window before it strikes the ground? Ignore the effects of air resistance.

5 pts. Two forces are exerted by different people on a table as shown. The mass of the table is $10\,\mathrm{kg}$. What is the magnitude of the table's acceleration a? Ignore the effects of friction.

20 pts total. You are in a diving competition and dive off of a board located 7 m above the surface of the water. On a particular dive you spring vertically off the diving board, travel upwards and then descend straight down into the water. Just as you strike the water, your final velocity $v = 14\,\mathrm{m/s}$, straight downwards. See the figure for a sketch of your trajectory.

10 pts. What was your maximum height h above the diving board during your trajectory? Hint: Concentrate on the downward motion.

10 pts. What was the magnitude of your initial vertical velocity v_0 as you left the diving board? If you could not solve the previous part, assume your maximum height h above the diving board was $h = 5\,\mathrm{m}$.

5 pts. Venezuela has an impressive waterfall called Angel Falls. A segment of this waterfall has a vertical drop of 810 meters. Assuming that the water has zero velocity just as its crests the waterfall, what is the magnitude of the velocity v of the water when it strikes the bottom of this part of the waterfall? (Ignore the effects of air resistance.)

5 pts. You are on a rotating amusement ride shaped liked a merry go-'round or a horizontal ferris wheel. You rotate with an angular velocity $\omega = 10\,\mathrm{rad/s}$. Suddenly, without a change in the angular momentum L, the radius of the rotating wheel is halved. What is the magnitude of your new angular velocity ω_{new}?

20 pts total. Two planes are traveling horizontally with a *constant* velocity and pulling a banner through the air. The force f of air friction on the banner points as shown in the figure and has a magnitude $f = 200\,\mathrm{N}$. The tension T in the two cables is the same and each cable makes an angle of $\theta = 60^\circ$ with the direction of motion. What is this tension T in each cable?