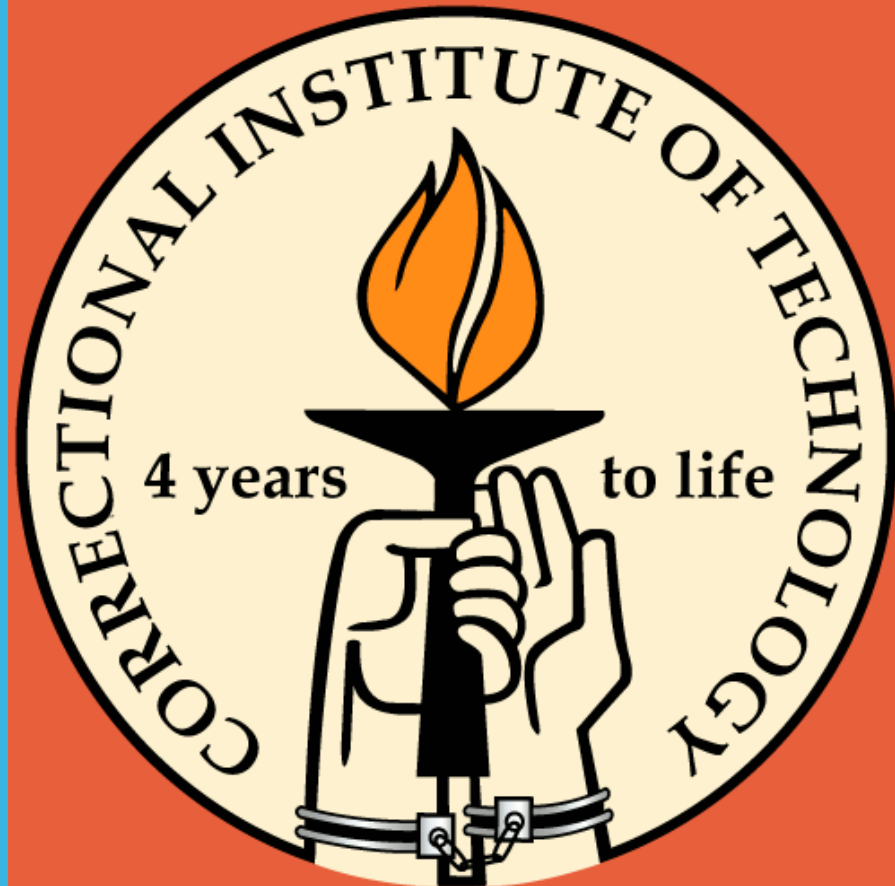



**CALTECH PHYSICS LEAGUE 2011-
2012 FALL TERM GAME SHOW**

TONY TONG, GIL REFAEL



RULES

- To make sure everyone understands what is going on, all of the questions are simple mechanics problems.
 - You should write your answer somewhere and then we show all of them together.
 - The game is between seniors and dear freshman, sophomore and juniors, who are going to bed early tomorrow.
 - We will take the average of your scores. So your choice actually matters.
 - Each question will be given the same weight.
- 

QUESTION 1

- A simple Pendulum of length 2 and a homogenous rod of length 3 pivoted at its end are released from horizontal positions. Which one of them has the longer periods?
- A. Pendulum
- B. Rod
- C. None of above



SOLUTION TO QUESTION 1

- For Pendulum, we have $\frac{1}{2} * m l^2 * \omega^2 = mgl \sin a$. For rod, we have $\frac{1}{2} * m * l^2 / 3 * \omega^2 = \frac{1}{2} mgl \sin a$. Thus the angular velocities are equal.
- A. Pendulum
- B. Rod
- C. None of above

QUESTION 2

- Soap bubbles filled with helium float in air. Which has greater mass—the wall of a bubble or the gas enclosed within?
- A. Wall of bubble
- B. Gas
- C. They are the same



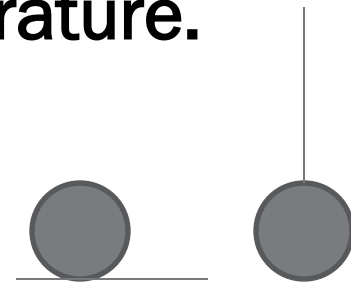
SOLUTION TO QUESTION 2

- Soap bubbles filled with helium float in air. Which has greater mass—the wall of a bubble or the gas enclosed within?
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QUESTION 3

- Consider two identical iron spheres, one lies on a thermally insulating plate, the other hangs from an insulating thread. Equal amounts of heat are given to the two spheres. Which will have the higher temperature.

- A. One on the plate
- B. One hangs from the thread
- C. They are the same



SOLUTION TO QUESTION 3

- Consider two identical iron spheres, one lies on a thermally insulating plate, the other hangs from an insulating thread. Equal amounts of heat are given to the two spheres. Which will have the higher temperature.
 - A. One on the plate
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- 

QUESTION 4

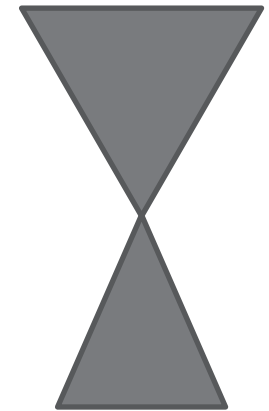
- A table and a large jug are placed on the platform of a weighing machine and a barrel of beer is placed on the table with its tap above the jug. If we open the tap and the beer runs into the jug, how will the reading of the weight change?
- A. Increase, then decrease.
- B. Decrease, then increase.
- C. Stays the same.

SOLUTION TO QUESTION 4

- A table and a large jug are placed on the platform of a weighing machine and a barrel of beer is placed on the table with its tap above the jug. If we open the tap and the beer runs into the jug, how will the reading of the weight change?
- A. Increase, then decrease.
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QUESTION 5

- Estimate the time it takes for this egg -timer.
- Given height of the sand is 1 cm.
- The diameter of the hole is 1mm.
- You need to get the order of magnitude right.



SOLUTION TO QUESTION 5

- T proportional to the volume of the sand.
- The only parameter gives time is g, acceleration.
- To get a time unit, we take the square root of g times 5th power of the diameter of the whole.
- This give us the time is 100 seconds.
- Watch this demo!

QUESTION 6

- Two cobwebs each of length l and under a tension F are contained in a glass case at temperature T . Because they are struck by air molecules, they undergo random vibrations. What is the ratio of the amplitudes of these motions if cobweb A has twice the mass of cobweb B?



SOLUTION TO QUESTION 6

- The same.
- Since the amplitudes is going to be of $(KT/F)^{(1-x)} * l^x$, which is independent of mass.

QUESTION 7

- A full bucket of water is suspended from a fixed point by a rope. The bucket is set in motion and the system swings as a pendulum. However, the bucket leaks and the water slowly flows out of the bottom of it. How does the period of the swinging motion change as the water is lost?

- A. Decreases with time
- B. Increases with time
- C. None of the above



SOLUTION TO QUESTION 7

- The center of mass moves down first(due to water), then it moves back to the middle of the bucket. Hence the period increases first, and then decrease.
- A. Decreases with time
- B. Increases with time
- C. None of the above

QUESTION 8

- You are at formal dinner, with a glass of ice water as shown below. Now you rotate the glass counter-clockwise. What is the motion of the ice inside?
- A. counter clockwise.
- B. clockwise.
- C. None of the above.



SOLUTION TO QUESTION 8

- You can understand it will go counter clockwise at first. But then some magic happens! What do you think is the reason?
- A. counter clockwise.
- B. clockwise.
- C. None of the above.
- <http://www.youtube.com/watch?v=7lhtjPQet2g>

THE END

THANK YOU

