Physics 230 Lab #11 – Rotation and Translation in Two Dimensions

There are only two air tables available. We will have to have different starting times. Each group has 30 minutes to work on the air table. If your group is not done in 30 minutes, you will have to wait until other group finishes, but the time will keep clocking. You only have to take two good pictures – perfectly elastic collision and partially elastic collision. Once you produce two pictures, you can go back to your station to finish the lab.

This lab is probably the most challenging lab in this semester. The main topic of the lab is to study "Collision" again, but this time, the collision is between a puck and a system. You have to consider two separate motions – linear and angular independently. For the linear motion, treat them as point masses so that you have to focus on their centers of masses.

Prior to the lab

Refer to the lab #9. Lab stations 1 and 4 are equipped with cameras. Open "VP Capture" program and you should see the table on the screen. You don't need to set an air-table. Learn how to use the program, crop the video, and save the clip to your memory stick.

Actual lab

After the air-table is leveled, set a system at the center. When you record a good collision, crop and save it to your memory stick. You can go back to your station and open "Video Point" program to trace their movements. It will ask how many objects (to be traced), type "3" this time. Those three points are: center of the puck, center of the mass of the system, and center of one of the pucks in the system. Trace their movements for each flame. After you finish, hit an icon (I think it is the second from the bottom on the left-hand side on your screen) to show all the dots you have traced. Copy this and use either Photoshop or Word to make the background as light as possible, but traces (dots) and an image of one puck are still visible. Make the picture as large as possible and print out two copies for analysis.

LINEAR MOTION

Check if linear momentum has conserved. Refer the lab #9 for this. Use one picture to measure data you need for this.

ANGULAR MOTION

As you learned in the lecture, even if an object is moving in straight line, it can have an angular momentum according to the origin you choose. **CHOOSE** the origin at the center of mass of the system. Use another picture to measure necessary data to check "conservation of angular momentum". Everyone in your group should come up with an idea as to how to calculate the rotational inertia of the puck-rod system with respect to the center of mass of the system. You will learn a lot about the calculation of "rotational inertia".

Energy

This is a partially elastic collision. Thus, the kinetic energy will not conserve. Calculate % energy lost.

Conclusion

Discuss about the both types of conservation of momentum.

The next page is a sample picture for you to practice.

Puck (point 1) = 337.82 g

System: Puck 1 (point 2) = 353.34 g, Puck 2 = 353.20 g, dia. = 9.43 cm, Rod = 43.22 g, Rod length = 35.7 cm (center to center) Rod height = 2.6 cm (both)