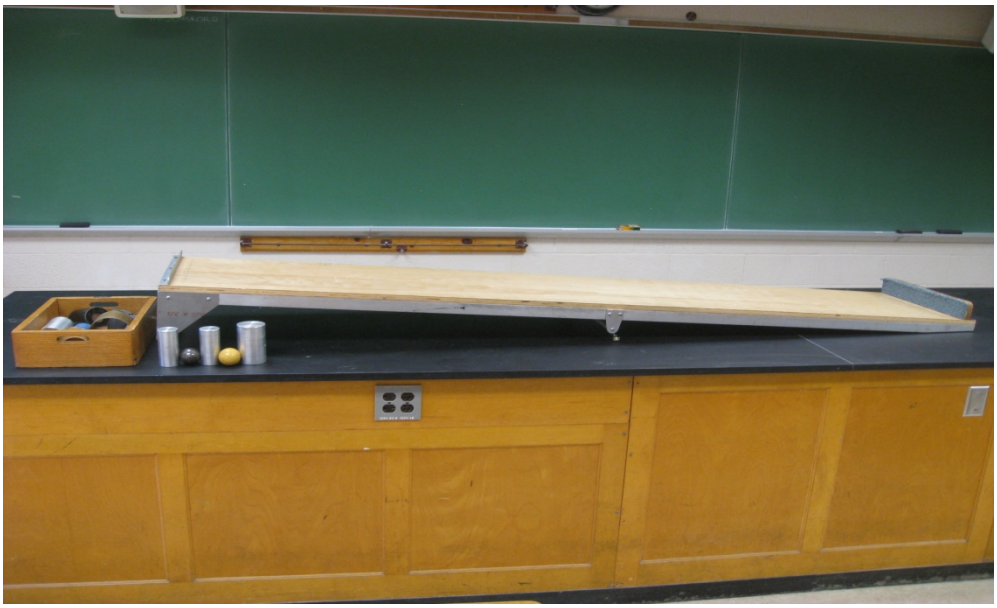
MM-3

Spheres and Cylinders
Rolling on Incline Plane
Driving of Kinetic
Energy Between Translation
And Rotation
Plane: 3077
All else: M-4 S-1



Adjust leveling screws at raised end of plane, if necessary, to cause sphere to roll straight down the incline. By comparing the relative times required by various pieces to roll down the incline for which the vertical drop is h, demonstrate each of the following and bring out analytically why each is true.

1. The large and the small solid steel spheres acquire the same velocity. The large solid steel sphere and the solid billiard ball acquire the same velocity. Thus all solid spheres acquire the same velocity, regardless of size or material. A body sliding without friction would acquire a velocity $v^2 = (5/7) \times 2gh = 0.714 \times 2gh$.
2. The large and the small solid aluminum cylinders acquire the same velocity. The large solid aluminum cylinder and the solid wooden cylinder acquire the same velocity. Thus all solid cylinders acquire the same velocity, regardless of size or material. Solid cylinders acquire a velocity $v^2 = (2/3) \times 2gh = 0.667 \times 2gh$.
3. The billiard ball, or any other solid sphere, acquires a higher velocity than the large solid aluminum cylinder, or any other solid cylinder. Compare expressions given in parts 1 and 2.
4. The large solid aluminum cylinder acquires a higher velocity than the hollow aluminum cylinder which has a relatively thin wall. The hollow wooden cylinder (with brass core removed), which has a relatively thick wall, acquires an intermediate velocity. Why?
5. The hollow wooden cylinder with brass core in place acquires a high velocity than the large aluminum solid cylinder. Why?
6. The hollow spherical tennis ball acquires a smaller velocity than the solid spherical billiard ball. Why?