

## Physics 100: Homework Problems

### Chapter 8: due Oct 6

1) A bowling ball, a hula-hoop, and a frisbee, initially at rest, roll down a hill. In which order do they reach the bottom? Explain the reasoning behind your answer.

The bowling ball reaches first, then the frisbee, and finally the hula-hoop. This is because objects with the least rotational inertia resist rotational acceleration, or changes in rotational state, more than objects with more rotational inertia. Rotational inertia is least when the mass is distributed closest to the axis of rotation, hence is least for the ball, second-least for the Frisbee, and most for the hula-hoop. Interestingly, the result is independent of the size and mass of the objects, as stated in class (but not proven there).

2) Why must you bend forward when carrying a heavy load on your back? (hint: consider stability)

You bend forward when carrying a heavy load on your back to shift the center of gravity of you and your load above the area bounded by your feet—otherwise you topple backward. The condition for stability is that a vertical line dropped down from the center of gravity meets a point in the base of the object.

3) If the polar ice caps of the Earth were to melt, the oceans would be deeper by about 30 m. What effect would this have on the Earth's rotation?

The mass contained in the ice would spread more evenly around the world instead of being localized near the poles. In accord with the conservation of angular momentum, since mass is moving farther from the axis of rotation (this goes through the poles), the rotational speed decreases. So Earth would slow in its daily rotation and the day would become longer.

4) Your own clicker question.