Week 16 – Shape Up (VanCleave's #189)

Prep Notes	
Materials	Table, and 2 books to prop the table at an angle 2 jar lids, same size 1 large roll of masking tape marble
Teacher Background	
Opener Ideas	Talk about tires / tire sizes – monster trucks and tractors have huge tires, is that for speed? Race cars have smaller tires, why? (Don't get too analytical – there are other reasons for tire size choices.)
Grammar	• **Center of gravity**: the "middle" of a mass, the "point" at which gravity appears to act. Also known as the "center of mass".
Scientific Method	
Observations	What happens when you put something circular at the top of a hill? (It rolls down.) Have you ever wondered, or observed, how quickly or slowly different shapes roll down a hill?
Question	How does shape (or size) effect speed? (option: does weight have anything to do with speed?)
Hypotheses	Larger diameters are naturally "faster", "smaller", or "no different" in speed *Optional:* Weight "does" (or "does not") have an effect
Experiment (Procedure)	• Create an inclined surface (e.g., by placing books under 2 legs of a table). • Place the lid tops together and tape them around, so they make a disk. • Hold all 3 objects (the marble, lid-disk, and tape roll) a "start line" at the top of the inclined table (e.g. with a yard-stick, or using the help of others). • Release all three objects at the same time. • Observe the finishing order of the three racers. • (Consider making observations about the relative weights: the tape roll was heaviest, but slowest (counter-intuitive?) - consider an experiment to test weight independently.
Results	The marble will be the fastest, followed by the lid-disk, followed by the tape
Conclusions	The "higher" an object's center of gravity, the **slower** the object will travel in response to a constant force like gravity. (Larger objects "waste" energy on centrifugal inertia.)
More	
	Discuss factors that could invert the results. Specifically, if the surface was especially ruddy/bumpy, then the largest circle (the tape roll) could perform best because it is the most resistant to the surface friction. This is why bicycle wheels are bigger, rather than smaller: even though the larger size increases their centrifugal inertia, the efficiency of the larger tire on a variety of road conditions outweighs that, and makes the tire perform better. (A larger tire also increases the contact area with the road, which is important for the "driven" tire, to minimize the chance of slippage. On special bicycle racing tracks, the front tire (which is not "driven" is often much smaller than the rear tire of a racing bicycle.)