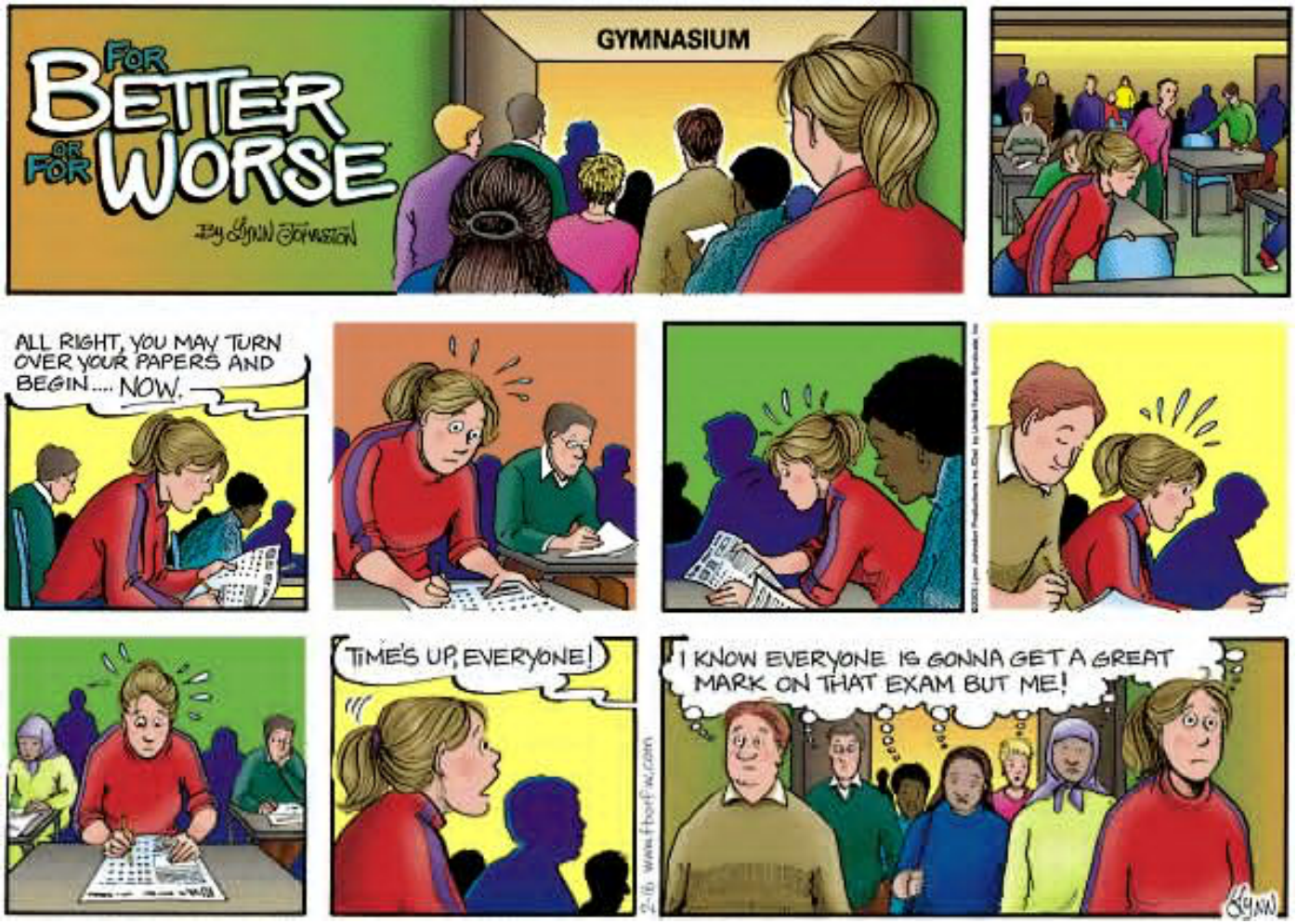
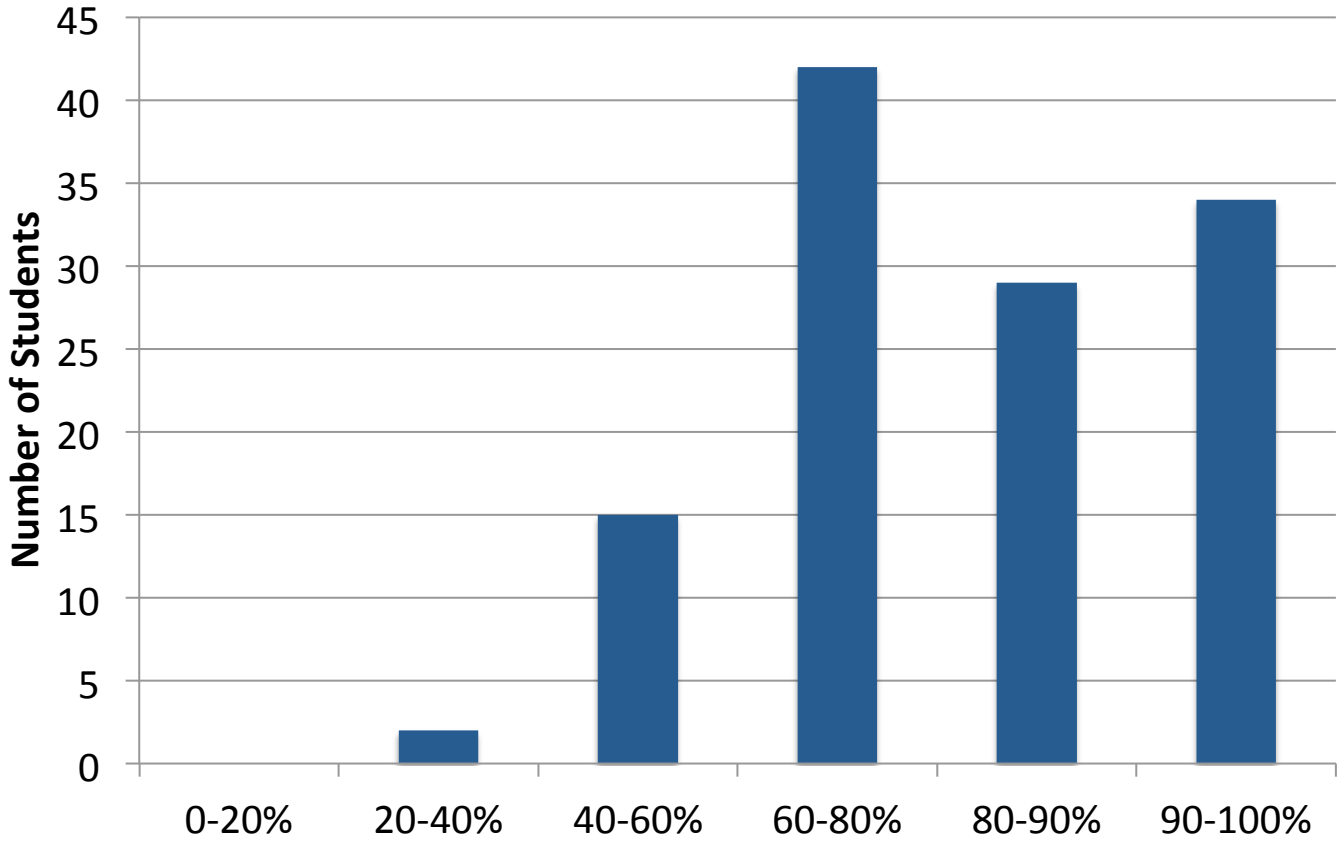
Exams are arranged in alphabetical order by last name



Overall

Scored out of 85 (the exam was about 15% too long)

Average: 80% +/- 17%



Some Noticings

- The football player problem was rough for most people – major issue was using the "range equation" without making sure it actually made sense in this problem
- Most people did pretty well on the roller coaster & the car crash -> still some issues with fully explaining your reasoning
- The energy question created a lot of confusion

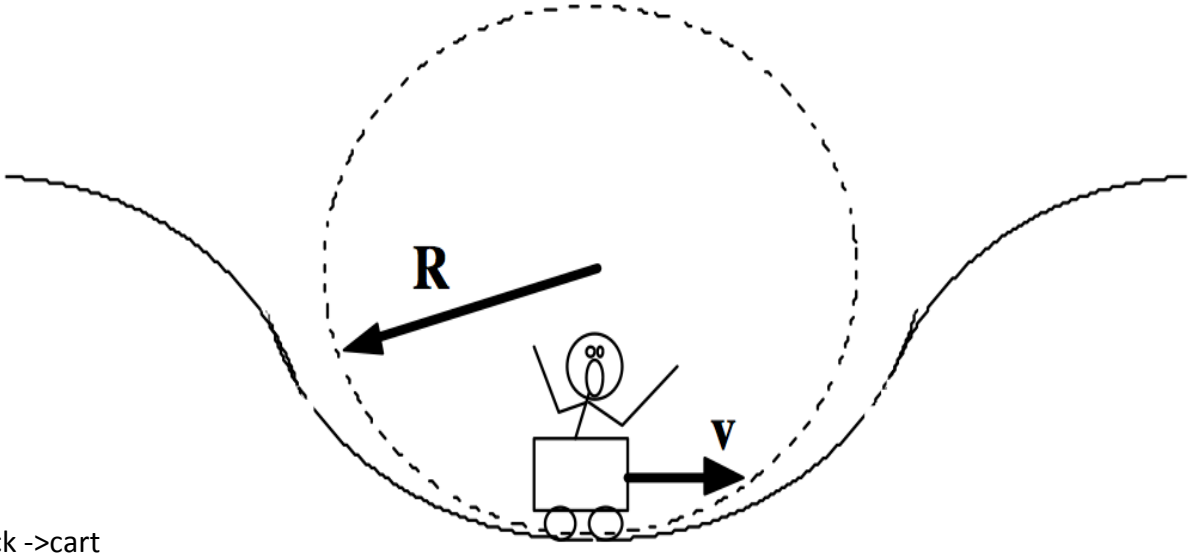
Sleds – Evaluate the Solution

$F \Delta t = p \longrightarrow \Delta t = \frac{v_i}{F}$

Two main issues:

- $F \Delta t = \Delta p$
- $p = mv$; $\Delta p = m\Delta v$
- Follow-on issue is that $v_f \neq 0$

Roller Coaster



$F^{c}_{track \rightarrow cart}$

$F^{g}_{earth \rightarrow cart}$

$$F^{net} = F^{c}_{track \rightarrow cart} - F^{g}_{earth \rightarrow cart}$$

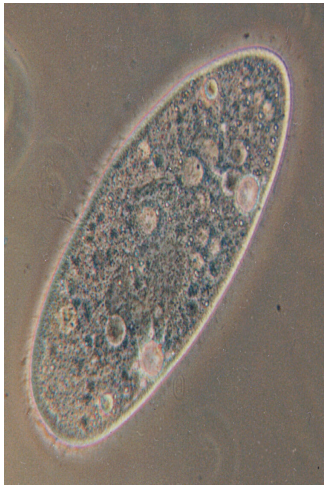
$$\frac{mv^2}{r} = F^{c}_{track \rightarrow cart} - F^{g}_{earth \rightarrow cart}$$

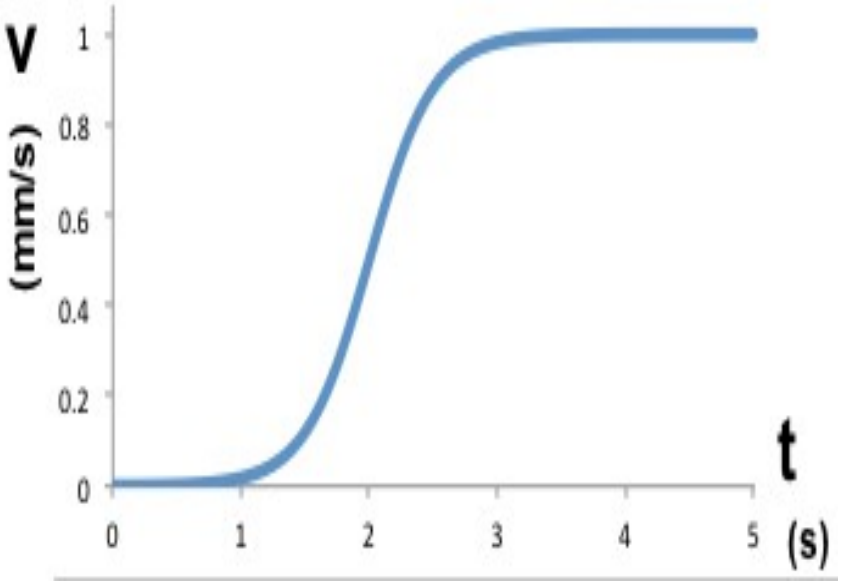
Masses are all the same, so F^{g} won't affect the ranking

Football Kicker

A football kicker lines up to kick a game-winning field goal. The goalpost is 30m away and the ball must clear the 3.3m high cross-bar. The kick leaves his foot at ground level at an angle of 35 degrees with an initial speed v_0. (Ignore air resistance for this situation.)

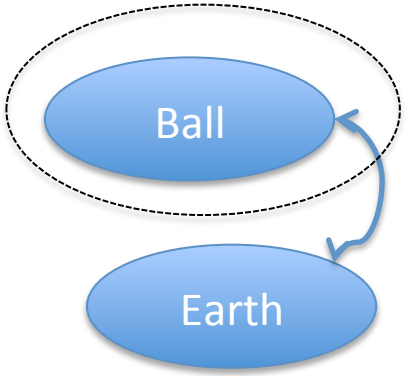
Paramecium





Crash

A 75.0-kg person is riding in a car moving at 30.0 m/s when the car runs into a bridge abutment. A padded dashboard will compress an average of 1.00cm in bringing him/her to a stop, while an airbag will compress an average of 15.0cm.



Batter & Baseball

Since the earth is not in the system, it will do work on the ball to transfer energy in/out of the system.

$$W = \Delta KE$$

The force of gravity is down, but the ball moves up so $W < 0$; telling me that gravity is transferring energy out of the system

The ball begins with some amount of KE and as it moves up, gravity does negative work on the ball – decreasing the KE

The ball will continue to move up until the work has transferred all of the energy out of the system; at which point the KE = 0 and therefore v = 0; the ball will stop moving up

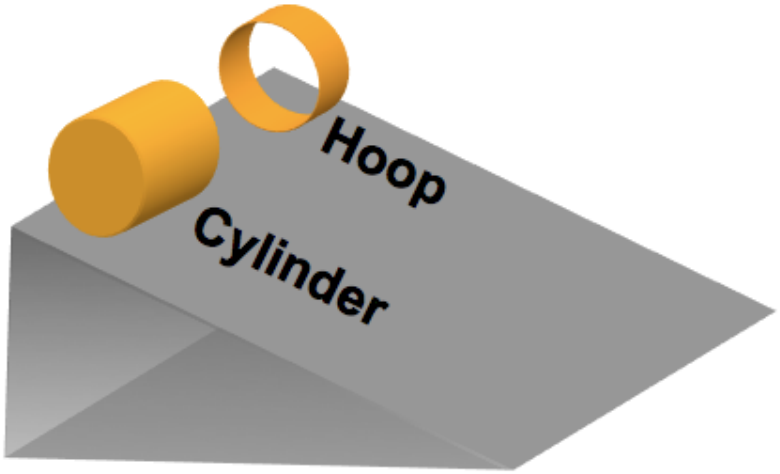
Gravity continues to pull down on the ball, so the ball will start to come back down; now gravity will do positive work transferring energy into the system

Angular Energy

- Kinetic energy is energy stored in motion; things that rotate have two kinds of motion
  - Linear $KE_{Linear} = \frac{1}{2} mv^2$
  - Rotation $KE_{rot} = \frac{1}{2} I\omega^2$

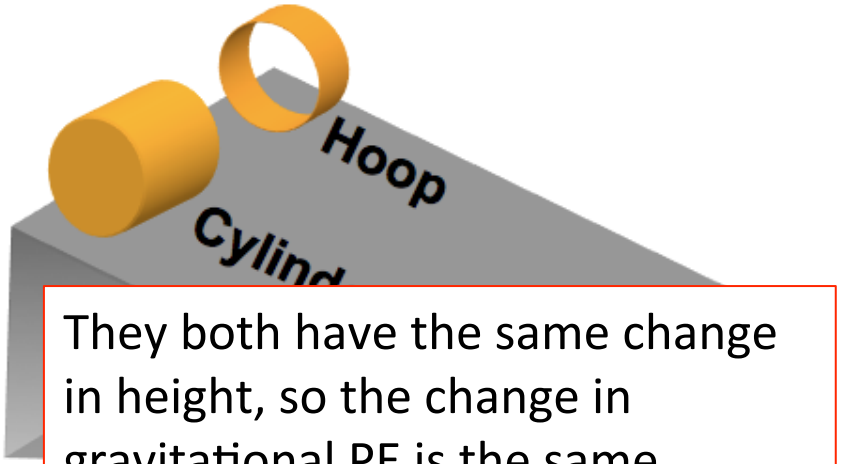
$KE_{tot} = \frac{1}{2} I\omega^2 + \frac{1}{2} mv^2$

Two objects, a cylinder and a hoop, roll down without slipping from the top of a frictional ramp at the same time. They are made of different materials, but have the same mass and radius. Which has the largest change in gravitational potential energy?



A. Cylinder
B. Hoop
C. Both have the same change in gravitational potential energy
D. Not enough information to determine

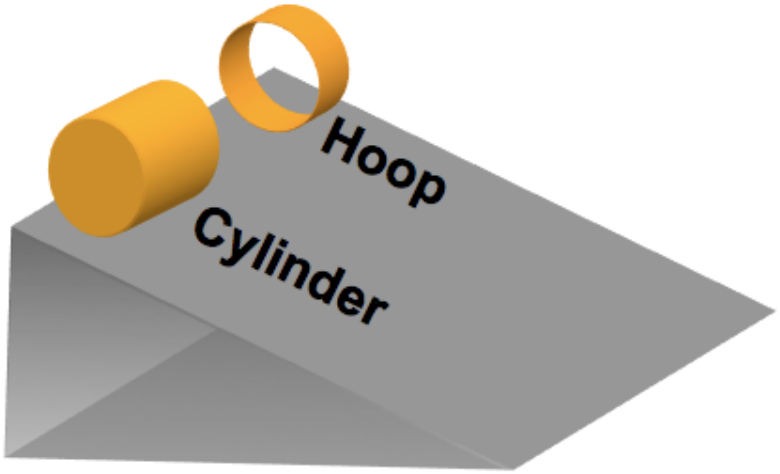
Two objects, a cylinder and a hoop, roll down without slipping from the top of a frictional ramp at the same time. They are made of different materials, but have the same mass and radius. Which has the largest change in gravitational potential energy?



They both have the same change in height, so the change in gravitational PE is the same.

A. Cylinder
B. Hoop
C. Both have the same change in gravitational potential energy
D. Not enough information to determine

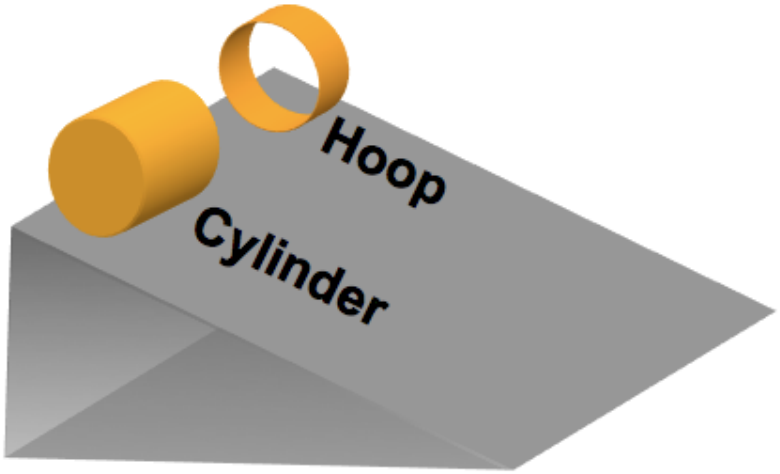
Two objects, a cylinder and a hoop, roll down without slipping from the top of a frictional ramp at the same time. They are made of different materials, but have the same mass and radius. Which has the largest change in kinetic energy?



A. Cylinder
B. Hoop
C. Both have the same change in kinetic energy
D. Not enough information to determine

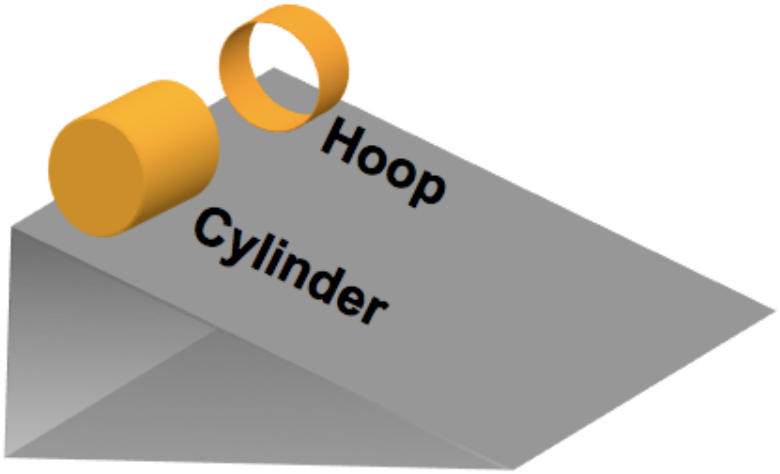
Two objects, a cylinder and a hoop, roll down without slipping from the top of a frictional ramp at the same time. They are made of different materials, but have the same mass and radius. Which has the largest change in kinetic energy?

All of the gravitational energy must go to kinetic energy (as long as the friction is low enough to keep them rolling without slipping) so the change in kinetic energy is the same. (NOTE: the change in ROTATIONAL kinetic energy is not the same.)



A. Cylinder
B. Hoop
C. Both have the same change in kinetic energy
D. Not enough information to determine

Two objects, a cylinder and a hoop, roll down without slipping from the top of a frictional ramp at the same time. They are made of different materials, but have the same mass and radius. Which reaches the bottom first?

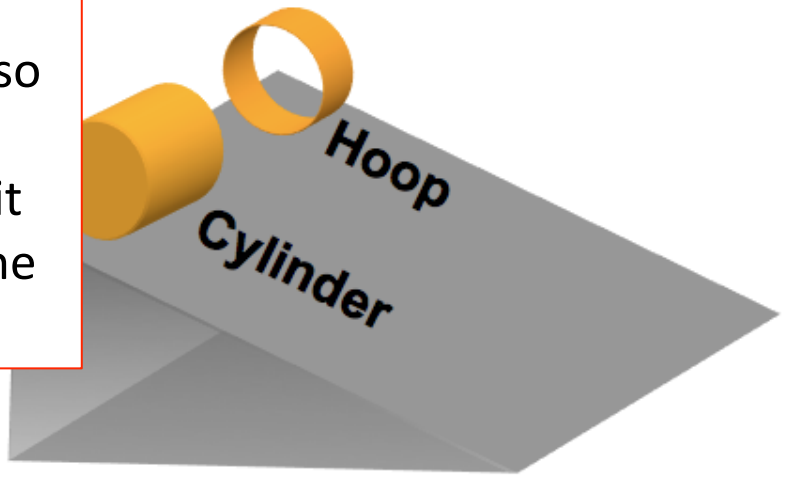


A. Cylinder
B. Hoop
C. Both reach the bottom at the same time
D. Not enough information to determine

Two objects, a cylinder and a hoop, roll down without slipping from the top of a frictional ramp at the same time. They are made of different materials, but have the same

eaches the bottom first?

If the KE total is the same, the distribution of energy to rotational and linear is different. The cylinder has a lower momentum of inertia (I) than the hoop, so it has less rotational kinetic energy and more linear kinetic energy. As a result – it reaches the bottom more quickly than the hoop.



A. Cylinder
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