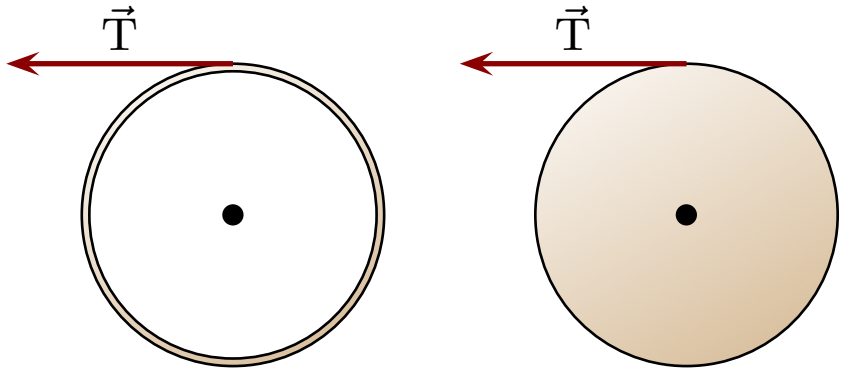
Question 1

A disk and a hoop have the same mass and radius and can rotate about a frictionless axle at their centers. A string is connected to the rim of each and pulled with the same constant tension. Both are initially at rest.



Let ω_{disk} be the angular velocity of the disk $3\,\mathrm{s}$ after it started to move. Let ω_{hoop} be the angular velocity of the disk $3\,\mathrm{s}$ after it started to move. Which of the following is true?

1. $\omega_{\mathrm{disk}} = 4\,\omega_{\mathrm{hoop}}$
2. $\omega_{\mathrm{disk}} = 2\,\omega_{\mathrm{hoop}}$
3. $\omega_{\mathrm{disk}} = \omega_{\mathrm{hoop}}$
4. $\omega_{\mathrm{disk}} = \dfrac{1}{2}\,\omega_{\mathrm{hoop}}$
5. $\omega_{\mathrm{disk}} = \dfrac{1}{4}\,\omega_{\mathrm{hoop}}$

Question 2

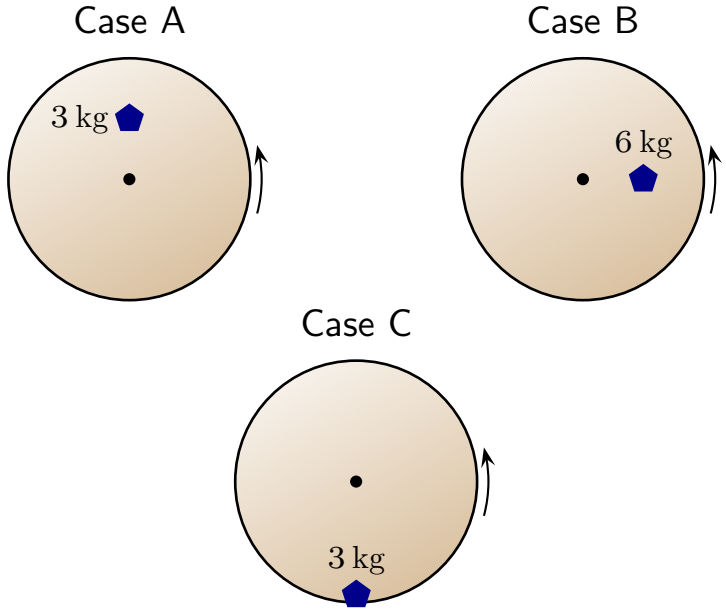
Two balls with the same radius and mass are each placed at the top of the same ramp. One of the balls rolls without slipping but the other is coated with a lubricant so that it slides down the ramp with negligible friction.

Which of the following is true regarding the speed of the balls at the bottom of the ramp?

1. Both balls have the same speed.
2. The ball which slides has a higher speed.
3. The ball which rolls has a higher speed.

Question 3

Three identical disks each initially rotate with the same angular velocity about frictionless axles through their centers. A brick with indicated mass is dropped gently on each disk. These bricks eventually settle at the illustrated locations (either the edge or half way to the edge).



Consider the angular velocities of the disks after the balls land and stick. Which of the following is the correct ranking?

1. $\omega_{\mathrm{C}} < \omega_{\mathrm{A}} = \omega_{\mathrm{B}}$
2. $\omega_{\mathrm{A}} = \omega_{\mathrm{B}} < \omega_{\mathrm{C}}$
3. $\omega_{\mathrm{B}} < \omega_{\mathrm{A}} = \omega_{\mathrm{C}}$
4. $\omega_{\mathrm{A}} = \omega_{\mathrm{C}} < \omega_{\mathrm{B}}$
5. $\omega_{\mathrm{C}} < \omega_{\mathrm{B}} < \omega_{\mathrm{A}}$
6. $\omega_{\mathrm{B}} < \omega_{\mathrm{A}} < \omega_{\mathrm{C}}$