

Quiz.

1. Where would you want to sit on a merry-go-round in order to experience the greatest linear speed?
 - a) the outermost edge, holding onto the rails so you don't fly off
 - b) the very center of the merry-go-round
 - c) the linear speed is the same for all riders, regardless of position
2. Which part of a vinyl record has the greatest rotational speed?
 - a) the outer edge of the record rotates faster than the circle in the center
 - b) the innermost circle of the record rotates faster than the outer edge of the record
 - c) all parts of the record rotate at the same rate
3. Rotational inertia (also called the moment of inertia) remains constant unless acted upon by a net external _____.
 - a) force
 - b) torque
 - c) does not change
4. A pile of bricks is stacked so that some of them extend over the edge of a table! If they do not fall, you know _____.
 - a) at least half of the width of the stack is directly over the table
 - b) that the center of gravity of the stack is directly over the table
 - c) at least half of the height of the stack is directly over the table
5. Torque depends on (Circle all that apply.)
 - a) mass
 - b) force
 - c) radius
 - d) angle between force and radius
6. Our Moon _____ about its axis and _____ around the Earth.
 - a) revolves, rotates
 - b) rotates, revolves
7. An object whose mass is distributed _____ will have less rotational inertia.
 - a) farther from the center of rotation
 - b) closer to the center of rotation
 - c) trick question, it does not depend on the mass distribution
8. A hoop and a disk of the same mass and radius roll down an incline.
 - a) the solid disk will take less time rolling down
 - b) the hoop will take less time rolling down
 - c) the two will take the same amount of time rolling down

9. If a figure skater is spinning and wants to slow down, he should _____.
- a) spread his arms and/or legs
 - b) pull his arms and/or legs in tighter

Answer Key.

1. a)

The linear speed in this question refers to the tangential speed of the rider. Tangential speed is equal to radial speed times the radius of the object, so the greater the radius the greater the tangential (linear) speed.

2. c)

Angular speed does not depend on radius; all points parallel to the radius sweep out the same angle in the same amount of time.

3. b)

Rotational inertia is similar to linear inertia, but a torque is necessary to change rotation, not just force.

4. b)

At every point in the stacking process, as long as the combined center of mass is supported, the bricks will not tip over. We saw this in class with the stack of wooden blocks.

5. b), c), d)

Torque does not depend on mass. It is like a rotational force, and it depends on both the length of the lever arm and the force applied, but it also depends on the angle between the lever arm and the force. Remember, if you push on a wrench with a force that is parallel to the wrench it will not turn.

6. b)

Rotation is motion about an axis within a body, and revolution is motion about an axis external to a body.

7. b)

Rotational inertia is like linear inertia, only the distribution of the mass from the center of rotation changes its inertia. A bench press bar and weights (placed at each end) with a combined weight of 50 pounds has more rotational inertia than a 50-pound dumbbell.

8. a)

Objects with less rotational inertia are easier to rotate than objects with more rotational inertia. Since a hoop's mass is all located at its radius, it has more rotational inertia than a

disk of the same mass and radius, which distributes its mass throughout, and so the hoop will have a more difficult time getting started than the disk.

9. a)

By spreading his arms and/or legs the skater will extend his mass over a larger radius and increase his rotational inertia. Since angular momentum must be conserved, an increase in rotational inertia must be compensated by a decrease in angular speed. Another way to look at the conservation of angular momentum here is that the radial distribution of his mass has increased, therefore his tangential velocity must decrease.