

Question:

You are riding on the edge of a spinning playground merry-go-round. If you pull yourself to the center of the merry-go-round, what will happen to its rotation?

1. It will spin faster.
2. It will spin slower.
3. It will spin at the same rate.

Friction

- Opposes the relative motion of two surfaces

Friction

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- Acts to bring two surfaces to one velocity

Friction

- Opposes the relative motion of two surfaces
- Acts to bring two surfaces to one velocity
- Consists of a matched pair of forces:
 - Object one pushes on object two
 - Object two pushes on object one
 - Forces have equal magnitudes, opposite directions

Friction

- Opposes the relative motion of two surfaces
- Acts to bring two surfaces to one velocity
- Consists of a matched pair of forces
- Comes in two types: static and sliding

Static Friction

- Acts to prevent objects from starting to slide

Static Friction

- Acts to prevent objects from starting to slide
- Forces can vary from zero to an upper limit

Sliding Friction

- Acts to stop objects that are already sliding

Sliding Friction

- Acts to stop objects that are already sliding
- Forces have fixed magnitudes

Frictional Forces

- increase when you push the surfaces harder together

Frictional Forces

- Increase when you push the surfaces harder together
- Increase when you roughen the surfaces

Energy

- Capacity to do work

Energy

- Capacity to do work
- Conserved quantity:
 - Can't be created nor destroyed
 - Can be transferred between objects
 - Can be converted from one form to another

Forms of Energy

- Kinetic energy
 - Energy of motion

Forms of Energy

- Kinetic energy
- Potential energy
 - Energy stored in the forces between objects

Potential Energies

- Gravitational
- Elastic
- Magnetic
- Electric
- Electrochemical
- Chemical
- Nuclear

Energy

- Ordered is more useful
 - Energy that is organized in large chunks

Energy

- Ordered is more useful
- Disordered is less useful
 - Thermal energy

Energy

- Ordered is more useful
- Disordered is less useful
- Sliding friction converts ordered energy (work) into disordered energy (thermal energy)

Newton's Third Law of Rotational Motion

For every torque that one object exerts on a second object, there is an equal but oppositely directed torque that the second object exerts on the first object.

Conserved Quantities

- Energy
 - A directionless (scalar) quantity
 - Can be transferred between objects
 - Can be converted from one form to another

Conserved Quantities

- Energy
- Momentum
 - A directed (vector) quantity
 - Can only be transferred between objects

$$\text{Momentum} = \text{Mass} \cdot \text{Velocity}$$

Conserved Quantities

- Energy
 - Momentum
 - Angular Momentum
 - A directed (vector) quantity
 - Can only be transferred between objects
- Angular Momentum =
Moment of Inertia · Angular Velocity

Physics Concept

- Acceleration always occurs toward the direction that reduces an object's potential energy as rapidly as possible.

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