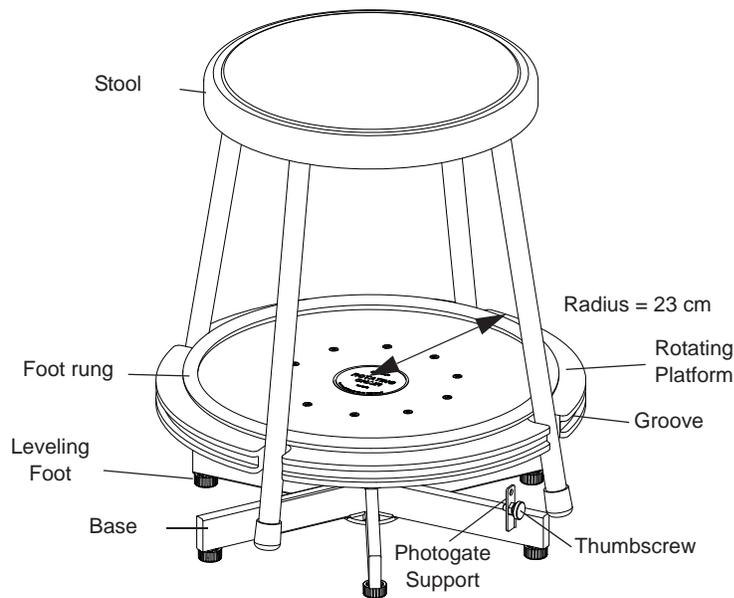


# Rotating Chair

Model No. ME-6856

## Equipment

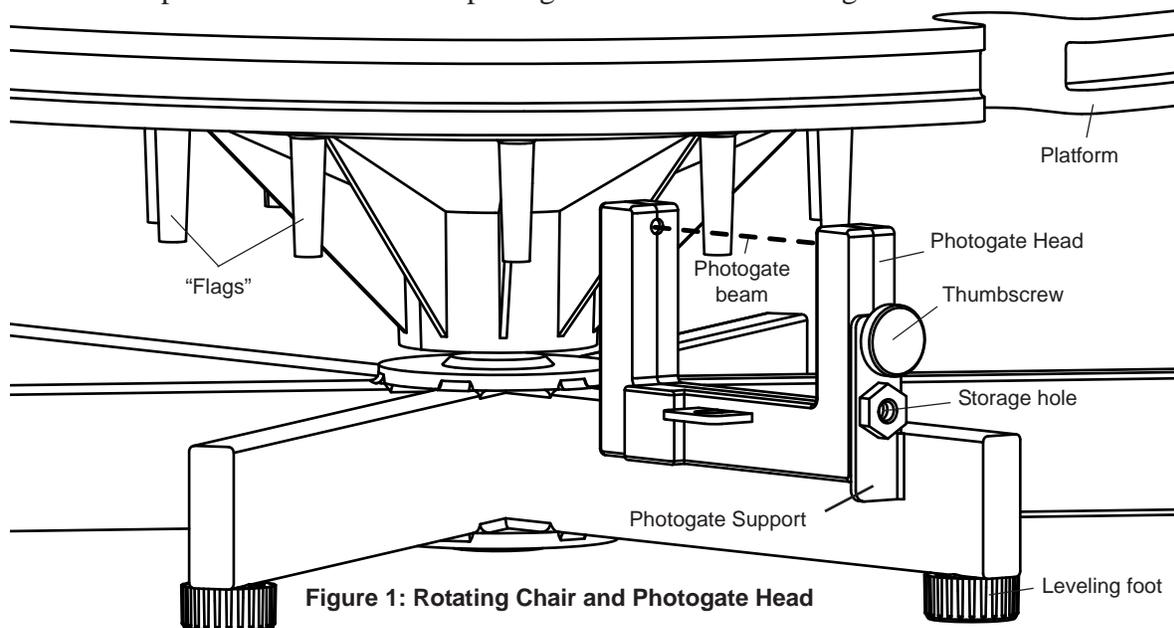


Included Items
1. Stool (ME-6857)
2. Rotating Platform with Photogate Support (ME-6797)

Additional Equipment Suggested	Model Number
PASCO interface and data collection software	See PASCO catalog or web site
Accessory Photogate or Photogate Head	ME-9204B or ME-9498A
Smart Timer	ME-8930
Digital Adapter (for use with a PASPORT interface)	PS-2159
Force Sensor	CI-6746 or PS-2104
Bicycle Gyroscope	ME-6836
Large Slotted Mass Set (5 kg)	ME-7566
Rope or Cord	n.a.

## Features

- The base includes a photogate support with a 1/4"-20 thumbscrew for attaching a photogate head to the support. The thumbscrew goes into a threaded hole on the photogate support for storage when it is not being used.
- The rotating platform has ten evenly spaced “flags” (spokes) on its underside. These “flags” will interrupt the invisible infrared photogate beam as the rotating chair turns.



- The radius of the rotating platform is 23 cm (0.23 m). The overall height of the rotating chair is approximately 52 cm (0.52 m).
- The groove on the perimeter of the rotating platform allows the rotating chair to be accelerated by pulling a cord wrapped around the groove.
- The base and rotating platform can be leveled by turning the six rubber feet on the base.
- The spindle of the rotating platform rotates inside two 20 mm low friction ball bearings.
- The legs of the stool are capped by rubber tips at the ends.
- Note: The stool from the ME-6856 Rotating Chair can be used with the platform of the ME-6834 Discover Rotation Platform, and the stool from the ME-6834 Discover Rotation Platform can be used with the ME-6856 Rotating Chair.

## Introduction

The PASCO Rotating Chair is designed to help students learn the basics of rotational motion and inertia by experiencing motion themselves. The Rotating Chair features a stool that can be placed on the platform for rotational studies with the student sitting. In addition, the stool can be removed, and students can sit or lay directly on the platform.

An Accessory Photogate (ME-9420B) or Photogate Head (ME-9498A) can be used to instrument the Rotating Chair for measurements of position, velocity, and acceleration. These measurements can be made in both linear and rotational units. The photogate can be connected to a Smart Timer (ME-9830) or a PASCO interface. A Digital Adapter (PS-2159) allows a Photogate to be connected to a PASPORT interface.



**Warning:** Always remove any objects that might interfere with the rotation of the stool. Placing objects underneath the platform could damage the platform or cause injury.

## Basic Operating Procedure

### Rotating on the Stool

By placing the included stool over the platform, students can investigate the basics of rotational motion.

1. Use the leveling feel to level the base and platform
2. Slide the stool over the platform.
3. Fit each leg into a notch on the edge of the platform.

**Note:** The bottom of each stool leg has a minimum of about 5 cm (about 2 in) clearance from the ground, so remove objects that might interfere with the operation of the stool. *For best performance, keep the rotating chair on a hard floor.*

4. To rotate, place feet on the foot rung or extend them out from the stool (See Figure 2).

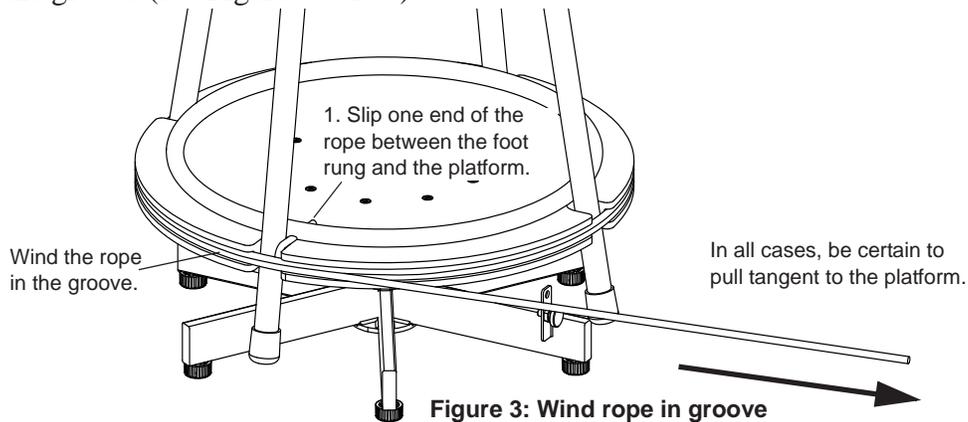


Figure 2: Rotating the Stool

### Accelerating the Rotating Chair with a Rope or Cord

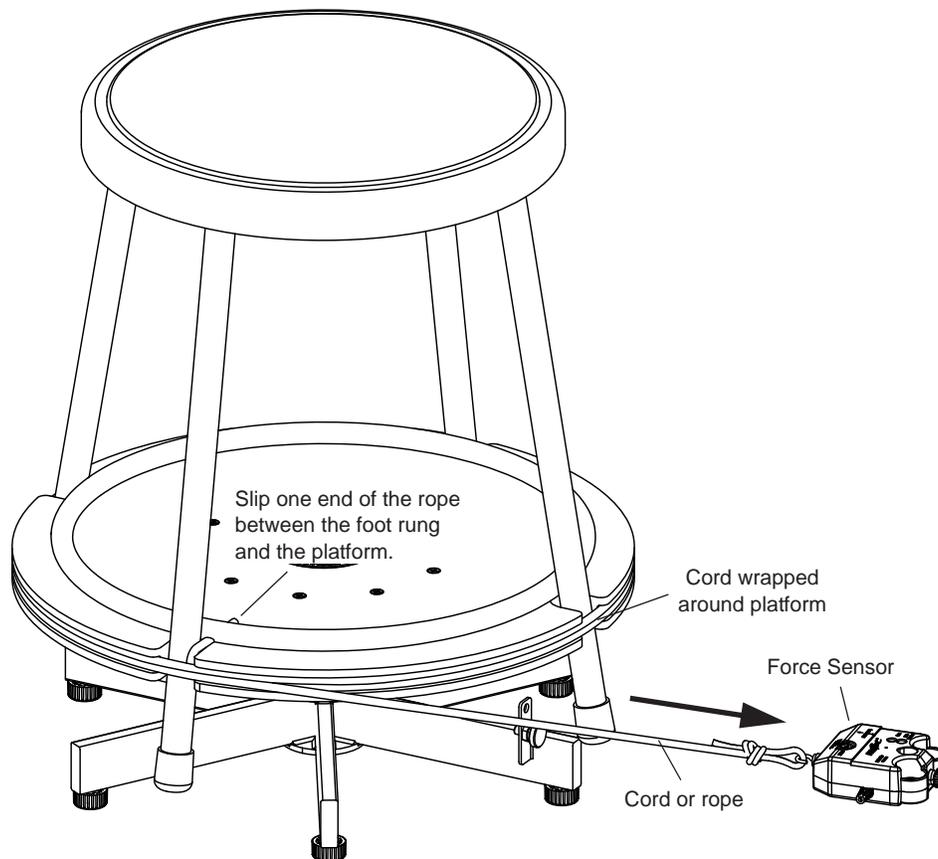
The rotating chair can be accelerated with the push of a hand or the use of a rope or cord. A rope or cord has the advantage of providing a force at a known distance from the axis of rotation (lever arm). This is very useful when using the  $\tau = I\alpha$  expression to investigate torque and rotational motion.

1. Slip one end of the rope between the foot rung and the platform, then wind the desired length of rope in the groove (see Figure 3 below).



2. Be sure to pull the rope or cord free when finished applying the torque to the rotating chair.

**Note:** It is best to use rope or cord that has minimal stretch. A great way to measure the force exerted on the platform is to tie the free end of the rope or cord to a force sensor and pull it to apply the torque (see Figure 4). In all cases, be certain to pull tangent to the platform.



## Attaching the Photogate for Motion Measurements

PASCO's Accessory Photogate (ME-9204B) or Photogate Head (ME-9498A) can be attached to the bottom platform and used with the built-in "flags" (spokes) to create a smart pulley.

1. Use the included thumbscrew to attach the Photogate Head to the photogate support on one leg of the base. (See Figures 5).

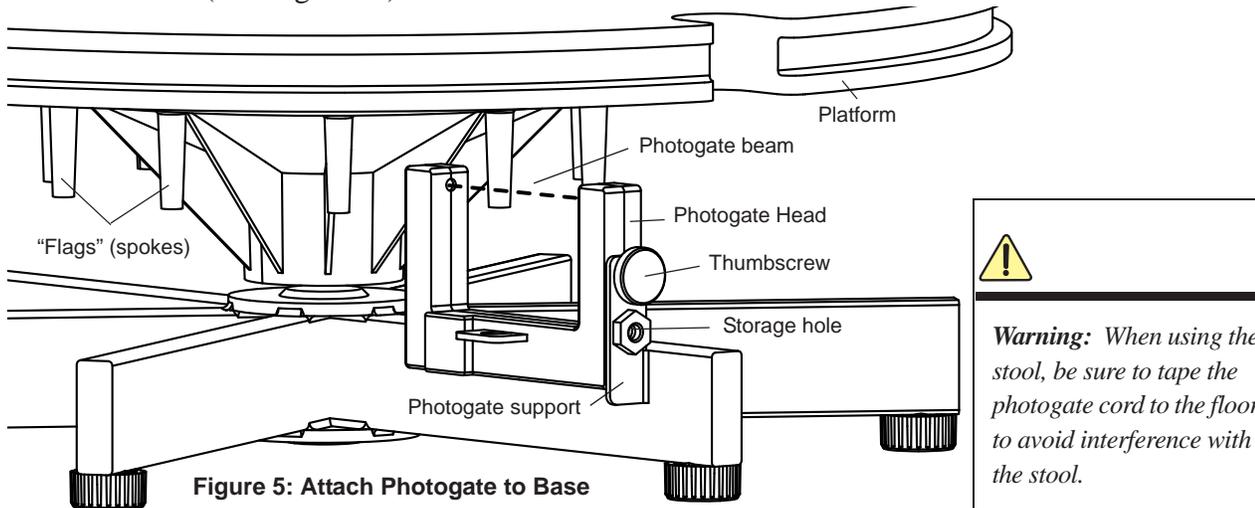


Figure 5: Attach Photogate to Base

2. Connect the photogate to a PASCO interface or a Smart Timer.
3. Students can now measure position, velocity, and acceleration of the rotating chair and its rider from both linear and rotational frames of reference.

## Suggested Experiments

### Moment of Inertia Experiments

Students can both qualitatively and quantitatively investigate the moment of inertia with the Rotating Chair.

1. Ask a student to sit on the stool of the Rotating Chair with masses in each hand.
2. Have the student sitting on the stool (the rider) extend his/her arms outward.
3. Have another student (or lab partner) rotate the rider.
4. After gaining speed, ask the rider to pull the masses into his/her chest.  
Qualitatively, the rider and observers will notice the increase in rotational speed as the masses are pulled toward the center axis of rotation.
5. Use a photogate mounted on the photogate support to provide quantitative measurements of position, velocity, and acceleration.

Using the expression  $\tau = I\alpha$ , students can relate the angular acceleration that results when the masses are moved inward to a decrease in the moment of inertia of the system.



**Warning:** Ask students to tightly grip the masses with their hands and fingers. To avoid injuries, always enforce appropriate safety precautions in the classroom.

### Torque Experiments

By applying different torques to the platform and using the photogate to measure the angular acceleration, students can produce a graph to help them discover the moment of inertia for the system.

1. Attach a photogate head to the photogate support on the base of the rotating chair.

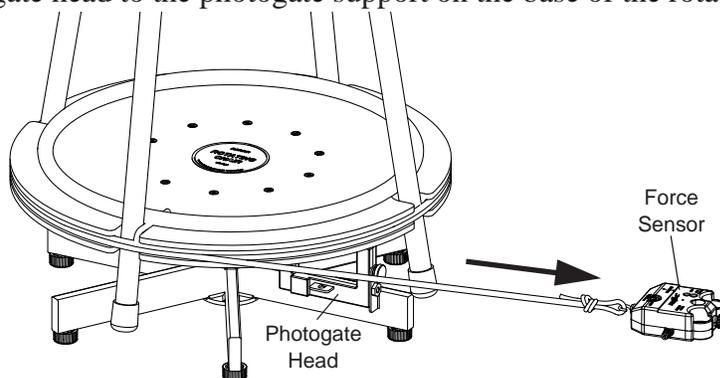


Figure 6: Torque Experiment



**Note:** For optimal rotation, keep the rotating chair on a hard floor.

2. Wrap a rope or cord around the groove of the rotating chair platform (see Figure 8).
3. Attach a Force Sensor to the rope or cord.
4. Ask one student to sit on the stool.
5. Ask another student to pull the cord to accelerate the rider. Be certain to pull the cord tangent to the platform.

6. Repeat step 5 two more times, increasing the amount of force (torque) in each case. A graph with torque on the vertical axis and angular acceleration on the horizontal axis will produce a slope equal to the moment of inertia for the system.
7. The experiment could then be repeated with the mass of the system distributed in a different fashion. For instance, the student could be tucked in while rotating on the chair in the first experiment and have arms extended in the second experiment.

## Technical Support

For assistance with the ME-6856 Rotating Chair or any other PASCO products, contact PASCO as follows:

Address: PASCO scientific

10101 Foothills Blvd.

Roseville, CA 95747-7100

Phone: +1 916 462 8374 (outside USA) or 877-373-0300 (toll-free inside USA)

Web: [www.pasco.com](http://www.pasco.com)

Email: [techsupp@pasco.com](mailto:techsupp@pasco.com)

For more information about the Rotating Chair and the latest revision of this Instruction Sheet, go to the PASCO web site at [www.pasco.com](http://www.pasco.com) and enter the Model Number or Product Name in the Search window.

### Limited Warranty

For a description of the product warranty, see the PASCO catalog.

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