

CHAPTER

8

Study Guide

Rotational Motion

Vocabulary Review

Write the term that correctly completes the statement. Use each term once.

- |                      |                     |                         |
|----------------------|---------------------|-------------------------|
| angular acceleration | centrifugal "force" | Newton's second law for |
| angular displacement | Coriolis "force"    | rotational motion       |
| angular velocity     | lever arm           | radian                  |
| center of mass       | moment of inertia   | torque                  |

1. \_\_\_\_\_ Angular acceleration is directly proportional to the net torque and inversely proportional to the moment of inertia is a statement of \_\_\_\_\_.
2. \_\_\_\_\_ As an object rotates, the change in angle is called \_\_\_\_\_.
3. \_\_\_\_\_ The \_\_\_\_\_ of a rotating object can be calculated by dividing its angular displacement by the time it takes for the displacement to occur.
4. \_\_\_\_\_ The \_\_\_\_\_ of an object is the point on the object that moves in the same way that a point particle would move.
5. \_\_\_\_\_ The \_\_\_\_\_ is the resistance to rotation.
6. \_\_\_\_\_ The \_\_\_\_\_ is  $\frac{1}{2}\pi$  of a revolution of a spinning object.
7. \_\_\_\_\_ The apparent force that seems to pull an object on a spinning platform toward the outside of the platform is called the \_\_\_\_\_.
8. \_\_\_\_\_ The result of dividing the change in angular velocity by the time it takes to make the change is \_\_\_\_\_.
9. \_\_\_\_\_ \_\_\_\_\_ is the measure of how effectively a force causes rotation.
10. \_\_\_\_\_ When a force is exerted on a rotating object, the change in angular velocity depends on the \_\_\_\_\_, which is the perpendicular distance from the axis of rotation to the point where the force is exerted.
11. \_\_\_\_\_ When the horizontal motion of an object in a rotating frame of reference seems to deflect, the apparent force is the \_\_\_\_\_.

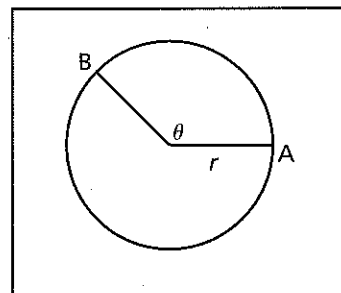
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## Section 8.1

## Describing Rotational Motion

In your textbook, read about rotational motion on pages 197–200.

Refer to the diagram at right to answer questions 1–7. If the statement is true, write true. If the statement is false, rewrite the italicized part to make it true.



- If a point on the car moving along the edge of the circle rotates from point A to point B in a counterclockwise direction, its angular displacement is *positive*.  
\_\_\_\_\_
- The value of  $\theta$  is approximately  $\frac{5\pi}{4}$  rad.  
\_\_\_\_\_
- The variable  $r$  represents the distance *the point moves as the circle rotates*.  
\_\_\_\_\_
- The actual distance the point travels* is its angular displacement.  
\_\_\_\_\_
- Angular displacement is measured in *meters*.  
\_\_\_\_\_
- If it takes 4 s for the point to move so that  $\theta = \pi$ , its angular velocity is  $\frac{\pi}{4}$  rad/s.  
\_\_\_\_\_
- If the point is at rest at A and it has an angular velocity of  $\frac{5\pi}{4}$  rad/s when it reaches point B 2 s later, it has an angular acceleration of  $\frac{10\pi}{4}$  rad/s<sup>2</sup>.  
\_\_\_\_\_

## Section 8.2

## Rotational Dynamics

In your textbook, read about torque and net torque on pages 201–204.

Answer the following questions. Use complete sentences.

- Sometimes sit-ups are done with your arms out in front of you, and sometimes they are done with your hands behind your head. In terms of torque, why is it less difficult to do a sit-up with your arms out in front of you?  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

2. Can a force of 400 N exert a greater torque than a force of 900 N? Explain your answer.

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3. Latoya has two batons. Baton A has identical round objects on each end. The round objects on the ends baton B are unequal in size and mass.

- a. When Latoya holds each of the batons in the middle, which one has net torque equal to zero? Explain your answer.

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- b. How can Latoya hold baton B so that it has net torque equal to zero?

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4. Barbara exerts a force of 48 N on the outer edge of a door that is 76 cm wide. What is the torque if the force is perpendicular to the door?

In your textbook, read about the moment of inertia on pages 205–210.

*For the objects described in questions 5–12, write the formula you would use to calculate the moment of inertia.*

*Calculate the moment of inertia for each. Show your calculations.*

5. A solid rubber ball has a radius of 32 cm and a mass of 0.85 kg with the axis of rotation through the center.

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6. A metal hoop has a diameter of 4.0 m and a mass of 1.2 kg with the axis of rotation through the central diameter.
  
7. A broom handle has a length of 1.67 m and a mass of 580 g with the axis of rotation through the center.
  
8. A piece of aluminum foil has a length of 7.2 cm, a width of 4.5 cm and a mass of 50.0 g with the axis of rotation through the center.
  
9. A 12-cm slice of a tree trunk has a radius of 48 cm and a mass of 12 kg with the axis of rotation through the center.
  
10. A metal rod has a length of 1.3 m and a mass of 2.8 kg with the axis of rotation through the end.
  
11. A flat cookie sheet has a length of 35 cm, a width of 22 cm, and a mass of 467 g with the axis of rotation through the center.
  
12. A pencil lead has a mass of 0.66 g and a length of 12.6 cm with the axis of rotation through the center.