Practice Exercises

Exercise 1: Marianne puts her favorite Backstreet Boys disc in her CD player. If it spins with a frequency of 1800 revolutions per minute, what is the period of spin of the compact disc?

Answer: _____

Exercise 2: Hamlet, a hamster, runs on his exercise wheel, which turns around once every 0.5 s. What is the frequency of the wheel?

Answer: _____

Exercise 3: A sock stuck to the inside of the clothes dryer spins around the drum once every 2.0 s at a distance of 0.50 m from the center of the drum. a) What is the sock's linear speed? b) If the drum were twice as wide but continued to turn with the same frequency, would the linear speed of a sock stuck to the inside be faster than, slower than, or the same speed as your answer to part a?

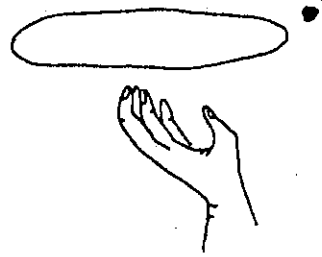
Answer: **a.** _____

Answer: **b.** _____

Exercise 4: What is the radius of an automobile tire that turns with a frequency of 11 Hz and has a linear speed of 20.0 m/s?

Answer: _____

Exercise 5: Luigi twirls a round piece of pizza dough overhead with a frequency of 60 revolutions per minute. a) Find the linear speed of a stray piece of pepperoni stuck on the dough 10. cm from the pizza's center. b) In what direction will the pepperoni move if it flies off while the pizza is spinning? Explain the reason for your answer.



Answer: **a.** _____

Answer: **b.** _____

Exercise 6: Earth turns on its axis approximately once every 24 hours. The radius of Earth is 6.38×10^6 m. a) If some astronomical catastrophe suddenly brought Earth to a screeching halt (a physical impossibility as far as we know), with what speed would Earth's inhabitants who live at the equator go flying off Earth's surface? b) Because Earth is solid, it must turn with the same frequency everywhere on its surface. Compare your linear speed at the equator to your linear speed while standing near one of the poles.

Answer: **a.** _____

Answer: **b.** _____

Exercise 7: Jessica is riding on a merry-go-round on an outer horse that sits at a distance of 8.0 m from the center of the ride. Jessica's sister, Julie, is on an inner horse located 6.0 m from the ride's center. The merry-go-round turns around once every 40.0 s. a) Explain which girl is moving with the greater linear speed. b) What is the centripetal acceleration of Julie and her horse?

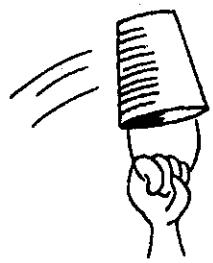
Answer: **a.** _____

Answer: **b.** _____

Exercise 8: A cement mixer of radius 2.5 m turns with a frequency of 0.020 Hz. What is the centripetal acceleration of a small piece of dried cement stuck to the inside wall of the mixer?

Answer: _____

Exercise 9: A popular trick of many physics teachers is to swing a pail of water around in a vertical circle fast enough so that the water doesn't spill out when the pail is upside down. If Mr. Lowell's arm is 0.60 m long, what is the minimum speed with which he can swing the pail so that the water doesn't spill out at the top of the path?



Answer: _____

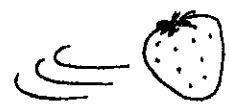
Exercise 10: To test their stamina, astronauts are subjected to many rigorous physical tests before they fly in space. One such test involves spinning the astronauts in a device called a *centrifuge* that subjects them to accelerations far greater than gravity. With what linear speed would an astronaut have to spin in order to experience an acceleration of 3 g's at a radius of 10.0 m? (1 g = 10.0 m/s^2)

Answer: _____

Exercise 11: At the Fermilab particle accelerator in Batavia, Illinois, protons are accelerated by electromagnets around a circular chamber of 1.00-km radius to speeds near the speed of light before colliding with a target to produce enormous amounts of energy. If a proton is traveling at 10% the speed of light, how much centripetal force is exerted by the electromagnets? (Hint: The speed of light is 3.00×10^8 m/s, $m_p = 1.67 \times 10^{-27}$ kg)

Answer: _____

Exercise 12: Roxanne is making a strawberry milkshake in her blender. A tiny, 0.0050-kg strawberry is rapidly spun around the inside of the container with a speed of 14.0 m/s, held by a centripetal force of 10.0 N. What is the radius of the blender at this location?



Answer: _____