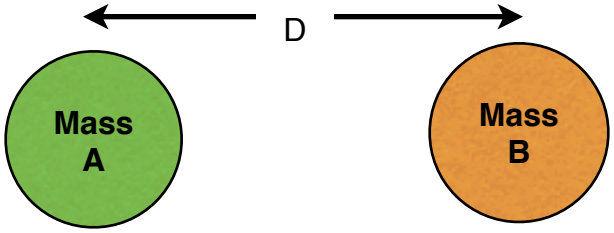
Academic Physics 2011 Centripetal Forces Name_____

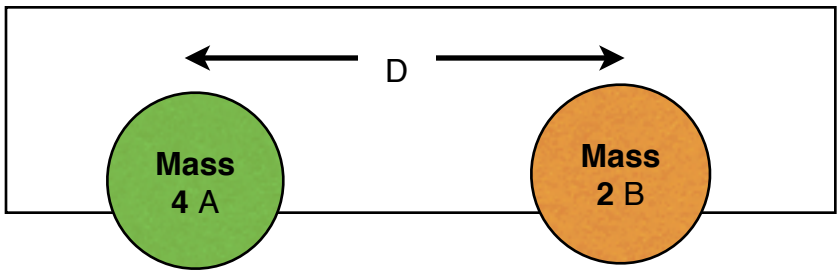


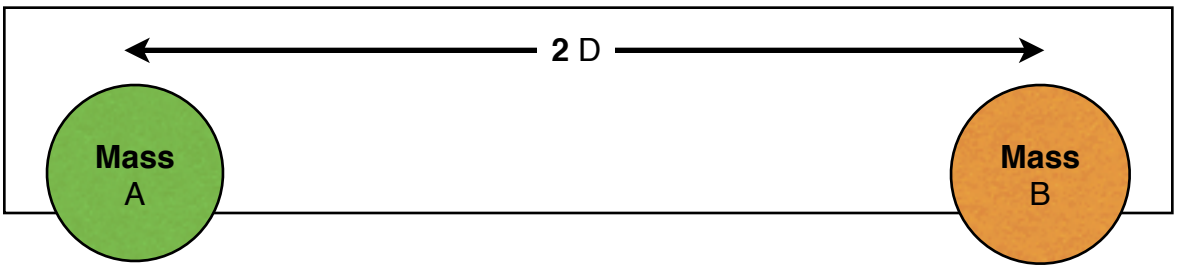
$$G = 6.67x10^{-11}\left(\frac{Nm^2}{kg^2}\right)$$

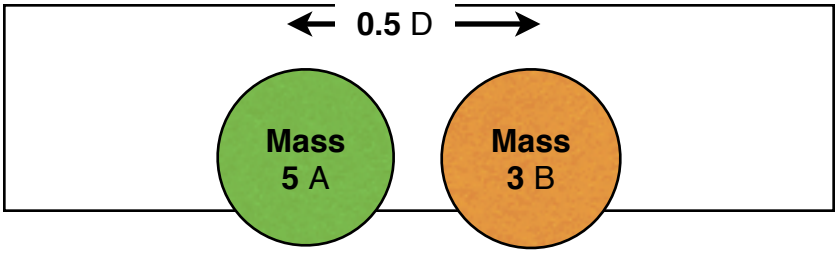
$$F = \frac{GMm}{r^2}$$

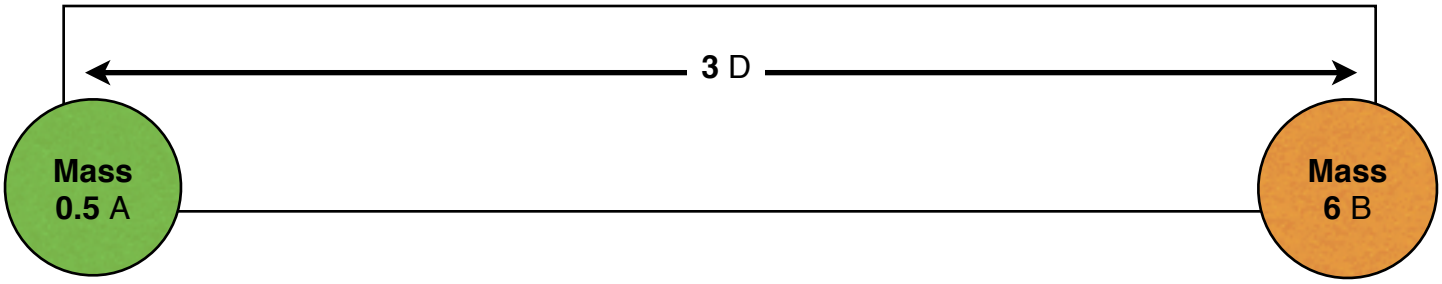
Two masses are separated by a distance, and are attracted by a force of 60N.

How much gravitational force will there be between the pairs of masses below?

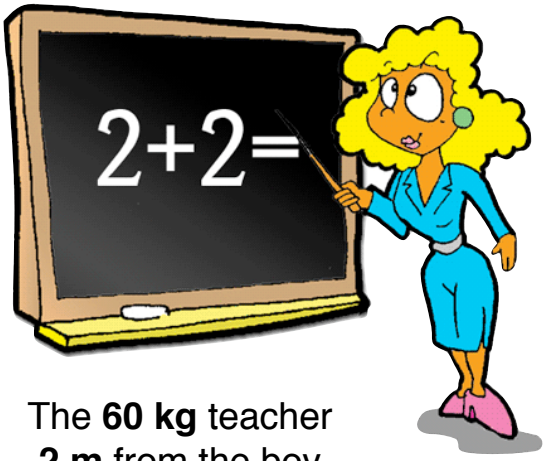








Academic Physics 2011 Centripetal Forces Name_____



The **60 kg** teacher
2 m from the boy

A Freshman boy sits in the middle of a classroom, his mass is 45kg. What is the force of gravitational attraction he feels towards the other 4 things in the room?

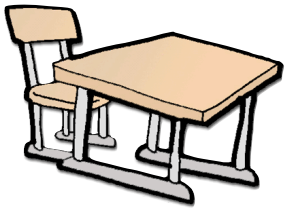
Teacher _____

Calculator _____

Desk _____

Girl _____

The **200 g** calculator
0.2 m from the boy



The **18 kg** desk
0.5 m from the boy

The **40 kg** girl
1 m from the boy

Academic Physics 2011 Centripetal Forces Name_____

1. A professionally pitched baseball has an angular speed of 188.5 rad/s. The radius of a baseball is 3.73 cm. What is the tangential speed of a point on the baseball's surface?

2. A wind turbine is a type of windmill that generates electricity. In order for the turbine to be reasonably efficient,the blades must be very long. Suppose one of the many turbines located near Palm Springs,California, has blades that are 15.2m long and rotate at an angular speed of 6.28 rad/s. What is the tangential speed at the tip of one of these blades?

3. A particular unicycle has a wheel with a radius of 0.30 m. If the unicycle is ridden with a linear speed of 4.5 m/s,what is the wheel's angular speed?

4. The main rotor of a certain helicopter consists of blades that extend 2.00 m from the center of the drive shaft. If the tangential speed at the tips of these blades is 94.2 m/s,what is the rotor's angular speed?

5. The "Barrel of Fun" is found in "fun houses" at certain amusement parks. It consists of a cylindrical tunnel that rotates, so that anyone trying to walk the length of the tunnel is pulled off to one side. Suppose the inner wall of a "Barrel of Fun" has a tangential speed of 0.63 m/s. If the barrel has a radius of 1.5m, what is the barrel's angular speed?

6. A customer sits in a revolving restaurant 11 m from the center. If the customer's tangential speed is 1.92×10^{-2} m/s,how large a centripetal acceleration does the customer experience?

7. NASA uses large centrifuges to study the effects of large forces on astronauts prior to their going into space. A subject in the 20-G centrifuge, which has a radius of 8.9 m,can have a centripetal acceleration as large as 20.0g,where g equals 9.81 m/s. What is the tangential speed of the subject?

8. The Indianapolis Motor Speedway has four banked curves,each of which forms a quarter of a circle. Suppose a race car speeds along one of these curves with a constant tangential speed of 75.0 m/s. Neglecting the effects due to the banking of the curve,the centripetal acceleration on the car is 22.0 m/s^2. What is the radius of the curve?

9. A turntable spins with an angular speed of 3.5 rad/s. A quarter placed on the turntable has a centripetal acceleration of 2.0 m/s^2. How far is the quarter from the center of the turntable?

10. A model electric train moves along a circular track. The train has a tangential speed of 0.35 m/s and has a centripetal acceleration of 0.29 m/s^2. What is the radius of the track?

11. A roller-coaster has a loop-the-loop in which the centripetal acceleration on the cars and passengers just equals 9.81 m/s^2.If the tangential speed of the roller-coaster cars is 15.7 m/s,what is the radius of the loop-the-loop?

12. With an average mass of only 30.0 g,the mouse lemur of Madagascar is the smallest primate on Earth. Suppose this lemur swings on a light vine with a length of 2.4 m,so that the tension in the vine at the bottom point of the swing is 0.393 N. What is the lemur's tangential speed at that point?

13. In 1994, Mata Jagdamba of India had very long hair. It was 4.23 m long. Suppose Mata conducted experiments with her hair. First,she determined that one hair strand could support a weight of 245 N. She then attached a small mass to the same hair strand and swung it in the horizontal plane. If the strand broke when the tangential speed of the mass reached 8.1 m/s,how large was the mass?

14. Pat Kinch used a racing cycle to travel 21 m/s. Suppose Kinch moved at this speed around a circular track. If the combined mass of Kinch and the cycle was 92.0 kg and the average force that maintained his circular motion was 12.8 N,what was the radius of the track?

15. In 1992,a team of 12 athletes from Great Britain and Canada rappelled 446 m down the CN Tower in Toronto, Canada. Suppose an athlete with a mass of 75.0 kg, having reached the ground,took a joyful swing on the 446 m-long rope. If the speed of the athlete at the bottom point of the swing was 12 m/s,what was the tension in the rope? Neglect the rope's mass.

16. Deimos,a satellite of Mars,has an average radius of 6.3 km. If the gravitational force between Deimos and a 3.0 kg rock at its surface is 0.025 N,what is the mass of Deimos?

17. A 3.08×10^4 kg meteorite is on exhibit in New York City. Suppose this meteorite and another meteorite are separated by 1.27×10^7m (a distance equal to Earth's average diameter).If the gravitational force between them is 2.88×10^{-16}N,what is the mass of the second meteorite?

18. In 1989,a cake with a mass of 5.81×10^4 kg was baked in Alabama. Suppose a cook stood 25.0 m from the cake. The gravitational force exerted between the cook and the cake was 5.0×10^{-7}N. What was the cook's mass?

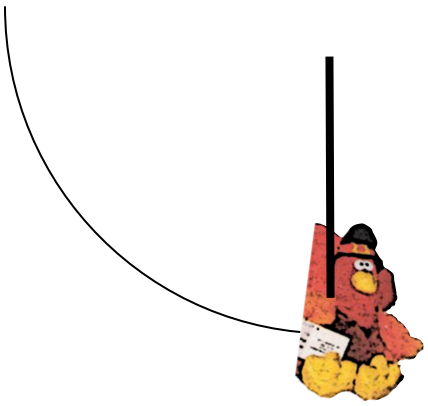
19. The largest diamond ever found has a mass of 621g. If the force of gravitational attraction between this diamond and a person with a mass of 65.0 kg is 1.0×10^{-12} N, what is the distance between them?

20. The passenger liners Carnival Destiny and Grand Princess, built recently, have a mass of about 1.0×10^8 kg each. How far apart must these two ships be to exert a gravitational attraction of 1.0×10^{-3}N on each other?

21. Jupiter,the largest planet in the solar system, has a mass 318 times that of Earth and a radius that is 36.4 times greater than Earth's. Calculate the magnitude of the gravitational force exerted on a 50.0 kg mass on Jupiter's surface.

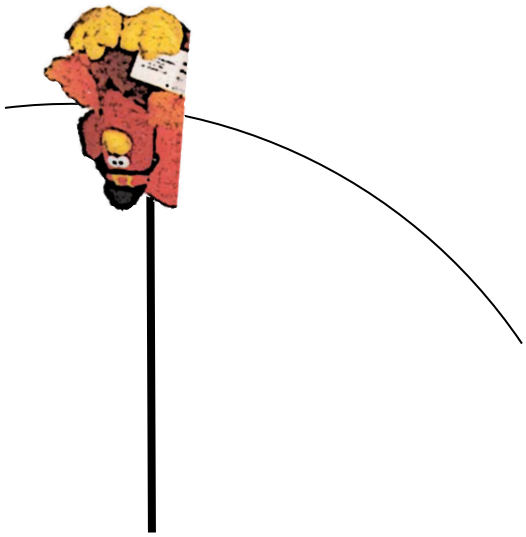
Academic Physics 2011 Centripetal Forces Name_____

1. Mr. Gobbles (Mass = **4kg**) is swinging from a rope (length = **2.3m**). If at the bottom of the vertical circular path the speed of "Gobbles" is **5.9 m/s**, find the tension in the rope.



T=

2. What is the minimum speed to get "Gobbles" over the top?
   Hint: What tension would be in the string if "Gobbles" **just** makes it around the circle?

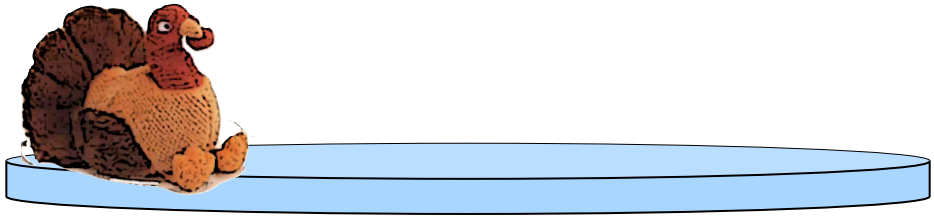


T_{min}=

v_{min}=

Academic Physics 2011 Centripetal Forces Name_____

5. For more fun, a turkey (Mass = **11kg**) goes on a ride at the elementary school playground (radius = **2.3m**). Find the greatest velocity he can have if the coefficient of friction for the ride and the turkey is **0.55**.

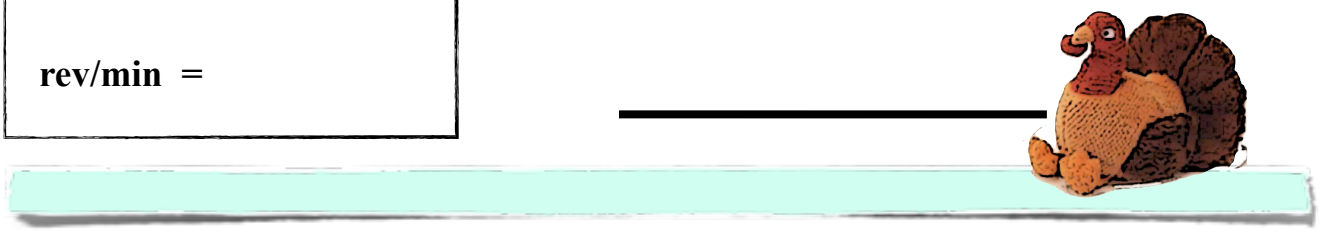


V =

6. A turkey (mass = **6kg**) is spinning around on an ice pond **μ = 0**, tied to a rope (length = **8m**). How many times does the bird circle each minute, if the bird feels a centripetal acceleration of **5 g**?

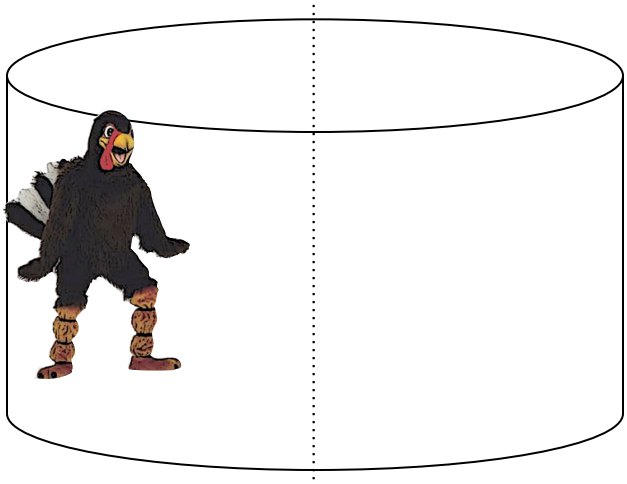
v =

rev/min =



Academic Physics 2011 Centripetal Forces Name_____

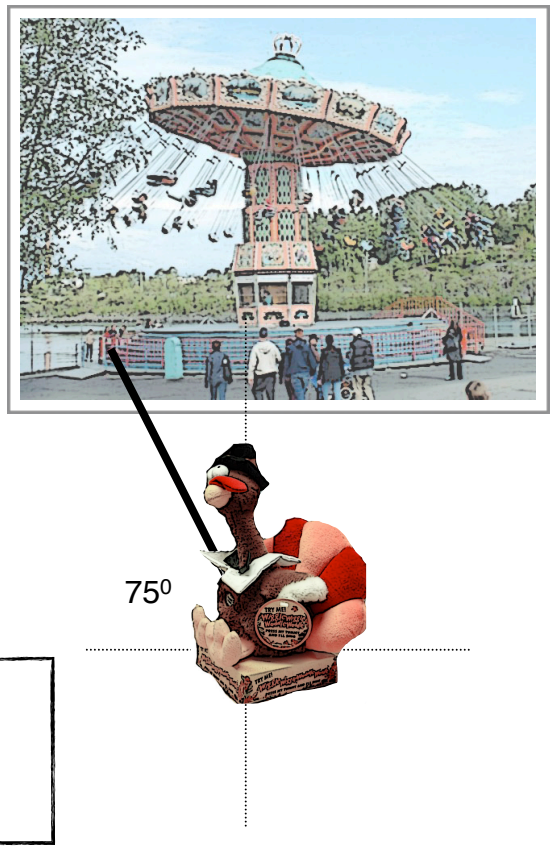
3. A strange man (m = **80 kg**) in a turkey costume goes on the Rotor ride (r = **3.2m**). As they lower the floor of the ride, the ride completes a turn every **4.1 s**. What is the necessary value of **μ** so that the turkey-man will not fall?



v =

μ_{min} =

4. This turkey (m = **10kg**) is on a safer ride at the amusement park. As the ride operates, the chain creates a **75°** angle with the ground, and a path with a **3.9m** radius. Find the tension in the chain, and the velocity of the turkey.



T =

V =