MYP Physics Circular Motion Mathematical Formulas Notes   Name: ___________________

1. Concepts of circles

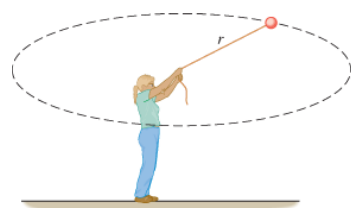
Things you should already know or about to know.

The ________________ of a circle is a measurement of the full arc length of a circle or simply the perimeter of a circle. To calculate the circumference of a circle, you would use the formula _________________ or ________________ where r is the radius of the circle and $d$is the diameter of the circle. (use 3.14 for pie)

2. Time, Period

The time ____

A student is spinning a ball attached to a string and it takes 0.75 seconds for the ball to complete one revolution, we say that



____

or

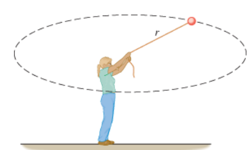
____

3. Frequency

Frequency is ____

____.

A student is spinning a ball attached to a string and it takes 0.75 seconds for the ball to complete one revolution. How frequent did the ball travel around the circle?



To answer this, we want to set it up so that the number of revolutions per unit time. It is one revolution per 0.75 seconds.

Therefore, the frequency is

____

____

____

4. Relationship between period and frequency

Period is ____
And
Frequency is ____

____.

Units:
The unit for period is _________________.

The unit for frequency is _______________________. (___________)

We can see that period is ____.

_______________ and _______________

5. Circular motion linear speed

To calculate how fast you are moving as you go around a circle, we still use our linear speed equation

of _________________ where d is the distance and t is the time.

For a circle, the distance is the circumference of the circle__________________ and

the time is the _______________ of the object.

Therefore, linear speed: ____.

6. Centripetal acceleration and centripetal force

The derivation for centripetal acceleration is beyond this course, therefore we are going to just used it rather than understand how to derive it.

Centripetal acceleration formula is _______________________________

From Newton's 2^{nd} Laws of Motion, ______________________

We have the centripetal force ______________________________

7. The equations to compute circular motion

Linear speed: ___________________________

Centripetal acceleration: ___________________________

subbing in ___________for $\boldsymbol{v}$ we could rewrite the equation into

$\boldsymbol{a_c} =$ ____

Centripetal force: ______________________________________

____

____

8. Practice Problems

1. Timmy twirls a tennis ball (mass = 0.06 kg) attached to a rope (length = 1m) in a horizontal circle above his head. It completes one revolution is 0.5 seconds. Determine the linear speed of the ball.

2. A cyclist turns a corner with a radius of 50m at a speed of 10m/s.
a. What is the cyclist's acceleration?

b. If the cyclist and cycle have a combined mass of 120kg, what is the force causing them to turn?

3. A 14000N car traveling at 25m/s rounds a curve of radius 200m. Find the following:
a. The centripetal acceleration of the car.

b. The force that maintains centripetal acceleration.

c. The minimum coefficient of static friction between the tires and road that will allow the car to round the curve safely.

MYP Physics Circular Practice Problems

1. During their physics field trip to the amusement park, Tyler and Maria took a rider on the Whirligig. The Whirligig ride consists of long swings which spin in a circle at relatively high speeds. As part of their lab, Tyler and Maria estimate that the riders travel through a circle with a radius of 6.5 m and make one turn every 5.8 seconds. Determine the speed of the riders on the Whirligig.

2. During the spin cycle of a washing machine, the clothes stick to the outer wall of the barrel as it spins at a rate as high as 1800 revolutions per minute. The radius of the barrel is 26 cm.

a. Determine the speed of the clothes (in m/s) which are located on the wall of the spin.

b. Determine the acceleration of the clothes.

3. Elmira, New York boasts of having the fastest carousel ride in the world. The merry-go-round at Eldridge Park takes riders on a spin at 8.0 m/s. The radius of the circle about which the outside riders move is approximately 7.4 m.

a. Determine the time for outside riders to make one complete circle.

b. Determine the acceleration of the riders.

4. A manufacturer of CD-ROM drives claims that the player can spin the disc as frequently as 1200 revolutions per minute.

a. If spinning at this rate, what is the speed of the outer row of data on the disc; this row is located 5.6 cm from the center of the disc?

b. What is the acceleration of the outer row of data?

5. In the display window of the toy store at the local mall, a battery-powered plane is suspended from a string and flying in a horizontal circle. The 631-gram plane makes a complete circle every 2.15 seconds. The radius of the circle is 0.950 m. Determine the velocity of, acceleration of, and net force acting upon the plane.

6. Dominic is the star discus thrower on South's varsity track and field team. In last year's regional competition, Dominic whirled the 1.6 kg discus in a circle with a radius of 1.1 m, ultimately reaching a speed of 52 m/s before launch. Determine the net force acting upon the discus in the moments before launch.

7. Justin is driving his 1500-kg Camaro through a horizontal curve on a level roadway at a speed of 23 m/s. The turning radius of the curve is 65 m. Determine the minimum value of the coefficient of friction which would be required to keep Justin's car on the curve.