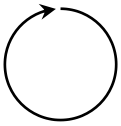
## CONCEPT: CIRCUMFERENCE, PERIOD AND FREQUENCY IN UNIFORM CIRCULAR MOTION

● When objects complete a full **ROTATION** a.k.a. **REVOLUTION** a.k.a. **CYCLE:**



**-** the distance traveled is called the CIRCUMFERENCE ___ = _____

**- Period** (__) → # of _____ per _____; Unit**: [ __ ]** or **[ ——— ]**

**T = —** ⇔ $f$ = —

**- Frequency** (__) → # of _____ per _____; Unit**: [ ___ = — ]** or **[ ——— ]**

EXAMPLE**:** Calculate the period and frequency of your motion if you complete**:**

**a)** 4 rotations in 2 seconds

**b)** 0.5 rotations in 3 seconds

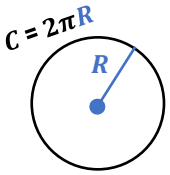
PROBLEM**:** Modern windmills usually spin at a rate of 20 Revolutions Per Minute (**R.P.M**)**.** At this rate, how long does it take for a windmill blade to complete a full rotation?

| Circ. Motion |
| --- |
| $a_C = \frac{v_T^2}{R}$ |
| $T = \frac{1}{f} \Leftrightarrow f = \frac{1}{T} = \frac{\text{RPM}}{60}$ |

● Whenever you're given Revs per Minute (RPMs), to get frequency → $f = \frac{\text{RPM}}{60}$

## CONCEPT: MORE EQUATIONS FOR VELOCITY AND ACCELERATION IN UNIFORM CIRCULAR MOTION

● We can combine the circumference, period, and frequency into equations for $v_T$ and $a_C$:




$v_T = \frac{\text{distance}}{\text{time}}$ ⇒ $v_T$ = ___ = ___ OR _____

$a_C = \frac{v_T^2}{R}$ ⇒ $a_C$ = ___ OR _____

EXAMPLE: A ball moves in a circle of radius 10m. Calculate:

**a)** its speed if it takes 60 seconds to complete 100 rotations

**b)** its centripetal acceleration if it completes 1 rotation every 3 minutes

PROBLEM: A 3kg rock spins horizontally at the end of a 2m string at 90 RPM. Calculate its centripetal acceleration.

| Circ. Motion |
| --- |
| $a_C = \frac{v_T^2}{R} = \frac{4\pi^2 R}{T^2} = 4\pi^2 R f^2$ |
| $T = \frac{1}{f} \Leftrightarrow f = \frac{1}{T} = \frac{\text{RPM}}{60}$ |
| $v_T = \frac{C}{T} = \frac{2\pi R}{T} = 2\pi R f$ |

PROBLEM: A big problem for astronauts in space is the lack of gravity! One way to simulate gravity is to build a space ship with spinning rings attached to it. If a cylindrical space station of diameter = 500m is spun about its axis, how fast in revolutions per minute (RPM) must it turn so the astronauts inside feel an acceleration equal to that of Earth ***(g)***?

| Circ. Motion |
| --- |
| $a_C = \frac{v_T^2}{R} = \frac{4\pi^2 R}{T^2} = 4\pi^2 R f^2$ |
| $T = \frac{1}{f} \Leftrightarrow f = \frac{1}{T} = \frac{\text{RPM}}{60}$ |
| $v_T = \frac{C}{T} = \frac{2\pi R}{T} = 2\pi R f$ |