8.1 Uniform Circular Motion

LEARNING TARGETS

8.1	I can define, analyze, and solve problems involving uniform circular motion.

Uniform Circular Motion

An object that moves in a circle at a constant speed is said to experience **uniform circular motion.**

Circular Motion

Circular motion is often described in terms of the **frequency**, f, the number of revolutions per second.

f

The **period**, T, of an object revolving in a circle is the time required for one complete revolution.

86,400 s

Circular Motion

Period and frequency are reciprocals of each other.

$$T = \frac{1}{f} \quad \text{and} \quad f = \frac{1}{T}$$

units

s

units

$\frac{1}{s} = s^{-1} = Hz$

Hertz

Circular Motion

When an object moves in a circle, the distance it travels in one revolution is the circumference of the circle, $2\pi r$. The time it takes for one revolution is the period, T. Therefore,

$$\text{speed} = \frac{2\pi(\text{radius})}{\text{period}} \quad \text{or} \quad v = \frac{2\pi r}{T}$$

Uniform Circular Motion

A favorite ride at the fair is the Starship, which has a radius of 6.6 m. At top speed the ride rotates at 24 rpm (revolutions per minute).

a) What is the frequency of the ride?

$\frac{24\ rev}{min} \times \frac{1\ min}{60\ s} = 0.4\ Hz$

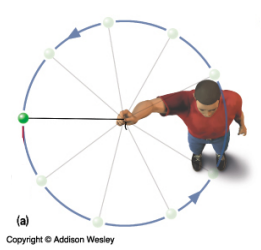
b) What is the period of rotation for the ride?

$T = \frac{1}{f} = 2.5\ s$

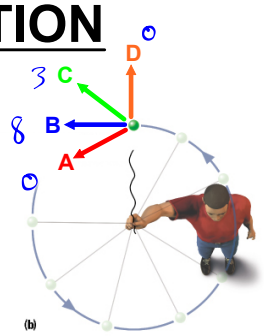
c) What linear speed does a person travel on the ride?

$V = \frac{2\pi r}{T} = 17\ m/s$

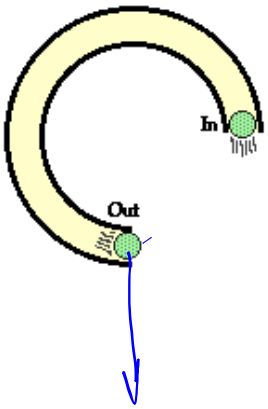
QUESTION



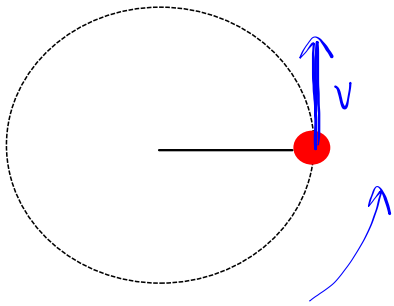
QUESTION



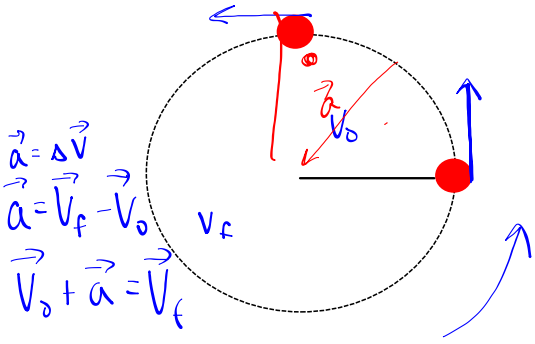
What About Now?



VELOCITY VECTORS



ACCELERATION?



Centripetal Acceleration

The center-seeking acceleration of an object moving in a circle at a constant speed.

Centripetal Acceleration = $a_c = \frac{v^2}{r}$

(v = linear velocity, r = radius of circle)

* Always points to the center of the circle.

Uniform Circular Motion

A favorite ride at the fair is the Starship, which has a radius of 6.6 m. At top speed the ride rotates at 24 rpm (revolutions per minute).

d) What is the acceleration of a person on the Starship when it is rotating at top speed?

$a_c = \frac{v^2}{r} = \frac{17^2}{6.6} = 44\ m/s^2$

Attachments

Olympics 2004- Hammer Throw.mp4