

Circular Motion Commotion – Answer Key

1) A lighthouse sweeps out a beam four times every minute.

What is its period?

Givens:

Time = one minute = 60 sec

Revolutions = 4 cycles

Equation:

Period (T) = Time / cycle

Answer:

$T = 60 \text{ sec} / 4 \text{ cycles} = 15 \text{ seconds}$

What is the tangential velocity of the lighthouse beam on an object 500 m from the lighthouse?

Givens:

Radius = 500 m

Period = 15 sec

Equation:

Tangent Velocity = $(2 \pi R) / T$

Answer:

$V = 3140 \text{ m} / 15 \text{ sec} = 209.3 \text{ m/s}$

2) A yoyo is whipped around in a clockwise circle that has a radius of .80 m. The yoyo revolves once every second and has a mass of .60 kg

What is the period of the yoyo?

Givens:

Radius = .80 m

Revolution = 1

Time = 1 second

Mass = .60 kg

Equation:

Period (T) = Time / cycle

Answer:

$T = 1 \text{ sec} / 1 \text{ cycles} = 1 \text{ second}$

What is the frequency of the yoyo?

Givens:

Radius = .80 m

Revolution = 1

Time = 1 second

Mass = .60 kg

Equation:

Frequency (f) = Cycle / Time

Answer:

$F = 1 \text{ cycle} / 1 \text{ sec} = 1 \text{ cycle} / \text{sec}$ or hertz

What is the tangential velocity?

Givens:

Radius = .80 m

Revolution = 1

Period = 1 second

Mass = .60 kg

Equation:

Tangent Velocity = $(2 \pi R) / T$

Answer:

$V = 5.024 \text{ m} / 1 \text{ sec}$

$V = 5.024 \text{ m/s}$

What is the centripetal acceleration?

Givens:

Radius = .80 m
Revolution = 1
Period = 1 second
Mass = .60 kg

Equation:

$$\text{Centripetal Acceleration } (A_c) = V^2 / r$$

Answer:

$$A = 25.24 \text{ m}^2/\text{s}^2 / .8 \text{ m} = 31.6 \text{ m/s}^2$$

What is the centripetal force?

Givens:

Radius = .80 m
Revolution = 1
Period = 1 second
Mass = .60 kg

Equation:

$$\text{Centripetal force } (F_c) = M \times A_c$$

Answer:

$$F_c = .60 \text{ kg} \times 31.6 \text{ m/s}^2 = 18.9 \text{ kg m/s}^2 \text{ or N}$$

3) A bug sits on an old phonograph record which spins at a rate of 33 1/3 rpm. The bug sits .15m from the center of the record.

What is the tangential velocity of the bug?

Givens:

Radius = .15 m
Revolution = 33.3
Time = 1 min = 60 seconds

Equation:

$$\text{Tangent Velocity} = (2 \pi R) / T$$

$$\text{Period } (T) = \text{Time} / \text{Cycle}$$

$$T = 60 \text{ sec} / 33.3$$

$$T = 1.8 \text{ sec}$$

Answer:

$$V = .942 \text{ m} / 1.8 \text{ sec}$$

$$V = .52 \text{ m/s}$$

What is the frequency of the bug?

Givens:

Radius = .15 m
Revolution = 33.3
Time = 1 min = 60 seconds

Equation:

$$\text{Frequency } (f) = \text{Cycle} / \text{Time}$$

Answer:

$$f = 33.3 \text{ rev} / 60 \text{ sec}$$

$$f = .56 \text{ rev/sec or hz}$$