

Please frequently write your name up here Key

AP Physics 1: 7.5 Frequency & Centripetal Force (Individual Practice)

1. What are the units for frequency, and describe frequency in your own words.

Hz ($\frac{\text{rot}}{\text{sec}}$) amount of rotations per second

2. What are the units for period, and describe it in your own words.

seconds amount of time to complete one rotation

3. Write down all the formulas for circular motion. Centripetal Force, Centripetal acceleration, velocity, and period.

$$F_c = \frac{mv^2}{r} \quad a_c = \frac{v^2}{r} \quad f = \frac{1}{T} \quad T = \frac{1}{f} \quad v = \frac{2\pi r}{T}$$

4. A little kid is spinning a ball around in a circle really fast. The ball at the end of the string has a frequency of 5Hz. Calculate how much time it takes for the ball to complete one rotation and what is this called?

$$f = 5 \text{ Hz} \quad T = \frac{1}{f} = .2 \text{ seconds}$$

5. What is another way to write Hz.

$$\frac{\text{rotations}}{\text{second}}$$

6. A car is driving around a circular track that has a radius of 500 meters. If the car has a period of 125 seconds, what is the centripetal acceleration of the car?

$$r = 500 \text{ m} \quad T = 125 \text{ sec} \quad a_c = \frac{v^2}{r} = \frac{(25.1)^2}{500} = 1.26 \text{ m/s}^2$$
$$v = \frac{2\pi(500)}{125} = 25.1 \text{ m/s}$$

7. An object is being spun in a circle with a centripetal force of F_c . If the object has a mass of m_1 and a velocity of v , create an equation for the radius of curvature using these variables.

$$F_c = \frac{m_1 v^2}{r}$$

$$r = \frac{m_1 v^2}{F_c}$$

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8. If the centripetal acceleration of a ball spinning is a_c with a velocity of v and a radius of R then how would the radius of the ball's string change if the velocity was doubled and the acceleration was 3 times larger?

$$a_c = \frac{v^2}{R} \rightarrow \text{original} \\ R = \frac{v^2}{a_c}$$

$$\text{New} \\ \frac{(2v)^2}{3a_c} = \frac{4}{3} \frac{v^2}{a_c}$$

$$\boxed{\frac{4}{3}R}$$

9. A cross country runner runs, with a constant velocity, around a traditional high school track, 400m, as shown below. The runner has a mass of 60-kg and a period of 0.008 laps/second. Answer the questions below regarding the situation.

$$\begin{aligned} \cancel{x} &= 400\text{m} \\ m &= 60\text{kg} \\ f &= .008\text{Hz} \end{aligned}$$

- a. During what intervals does the runner have acceleration, if any.

S-P and Q-R



- b. How much time does it take for the runner to go around the track once? What is this called?

$$T = \frac{1}{.008} = \boxed{125 \text{ seconds}}$$

- c. What is the runner's velocity throughout one lap?

$$v = \frac{x}{t} = \frac{400\text{m}}{125\text{s}} = 3.2 \text{ m/s}$$

- d. If the curvature of the track has a radius of 31.83 meters, what is the centripetal force acting on the runner as she runs around the turn?

$$r = 31.83\text{m} \\ F_c = \frac{mv^2}{r} = \frac{60(3.2)^2}{31.83} = 19.3 \text{ N}$$

- e. Does this centripetal force change throughout the turn? Explain.

No because none of the variables change. m , v , and r .