

Answer on Question #52298, Physics, Other

7. An 80-kg man and his car are suddenly accelerated from rest to a speed of 5 m/s as a result of a rear-end collision. Assuming the time taken to be 0.3s, find:

- the impulse on the man and
- the average force exerted on him by the back seat of his car.

Solution:

The impulse on the man is

$$p = mv = 80 * 5 = 400 \text{ kg} \cdot \text{m/s}$$

If a force F is applied to a particle for a time interval t , the momentum of the particle changes by an amount

$$p = Ft$$

Thus,

$$F = \frac{p}{t} = \frac{400}{0.3} = 1333.3 \text{ N}$$

Answer: a) 400 kg · m/s; b) 1333.3 N

8. An airplane propeller is rotating at 1900 rev/min.

- Compute the propeller's angular velocity in rad/s.
- How long in seconds does it take for the propeller to turn through 30.0 degrees?

Solution:

a. The conversion between a frequency f measured in hertz and an angular velocity ω measured in radians per second are:

$$\omega = 2\pi f$$

We have $f = 1900 \text{ rev/min} = 1900/60 = \frac{95}{3} \text{ Hz}$

$$\omega = 2\pi f = 2 \cdot 3.14159 \cdot 95/3 = 199 \text{ rad/s}$$

b. The angle is

$$\varphi = \omega t$$

Thus,

$$t = \frac{\varphi}{\omega} = \frac{30^\circ * \pi}{180^\circ} * \frac{1}{199} = 0.0026 \text{ s}$$

Answer: a. 199 rad/s; b. 0.0026 s.

9. A disk with a 1.0-m radius reaches a maximum angular speed of 18 rad/s before it stops 30 revolutions after attaining the maximum speed. How long did it take the disk to stop?

Solution:

*distance traveled = circumference * number of revolutions*

Thus,

$$d = 2\pi R * 30 = 60\pi \text{ m}$$

The linear speed is

$$v = R\omega = 1 * 18 = 18 \text{ m/s}$$

The time is

$$t = \frac{d}{v} = \frac{60\pi}{18} = 10.5 \text{ s}$$

Answer: 10.5 s.

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