Ch7 Q12. Is it possible for an object to recieve a larger impulse form a small force than from a large force? Explain.

Yes, impulse is force acted over a time. A small force used over a long time could impart more impulse than a large force only acting for a moment.

Ch7 P51. The CM of an empty 1250 Kg car is 2.40 m behind the front of the car. How far from the front of the car will the CM be when two people sit in the front seat 2.80 m from the front of the car, and three people sit in the back seat 3.90 m from the front? Assume that each person has a mass of 65.0 Kg.

CM coordinates are defined by

$$x_{\rm cm} = \frac{\sum_i x_i m_i}{\sum_i m_i}.$$

Thus, we have that

$$\begin{aligned} x_{\rm cm} &= \frac{1250\,\text{Kg}\times 2.40\text{m}+2\times 2.80\text{m}\times 65.0\text{Kg}+3\times 3.90\text{m}\times 65.0\text{Kg}}{1250\text{Kg}+5\times 65.0\text{Kg}} \\ &= 2.62\,\text{m} \end{aligned}$$

so just a slight offset (22 cm).

Ch7 Q16. At a hydroelectric power plant, water is directed at high speed against turbine blades on an axle that turns an electric generator. For maximum power generation, show the turbine blades be designed so that the water is brought to a dead stop, or so that the water rebounds?

Rebounding results it the blades having to impart a larger impulse, as so the blades would be pushed harder by the water.

Ch7 P63. A 52 Kg woman and a 72-Kg man stand 10.0 m apart on nearly frictionless ice (a) How far from the woman is their CM?

We have, choosing the woman as the origin,

$$\begin{aligned} x_{\rm cm} &= \frac{52\text{Kg}\times 0\text{m}+72\text{Kg}\times 10\text{m}}{(72+52)\text{Kg}} \\ &= \frac{720}{124}\text{m} \\ &= 5.8\,\text{m}. \end{aligned}$$

(b) If each holds one end of a rope, and the man pulls on the rope so that he moves 2.5m, how far from the woman will he be now?

The woman has moved a little, too, however, the center of mass has not moved with respect to a coordinate system external to both. Letting where the woman was originally stay the origin, we have that

$$\begin{aligned} 5.8\,\text{m} &= \frac{52\text{Kg}x + 72\text{Kg}\times 7.5\text{m}}{124\text{Kg}} \\ &= 0.4194\,\text{x}+4.355\text{m} \\ \Rightarrow 1.445\text{m} &= 0.4194\,\text{x} \\ \Rightarrow x &= 3.446\text{m}. \end{aligned}$$

Thus, they are now

$$\begin{aligned} d &= 7.5\text{m}-3.446\text{m} \\ &= 4.1\text{m} \end{aligned}$$

apart.

(c) How far will the man have moved when he collides with the woman?

They will collide at the center of mass, so he moves 10.0m-5.8m=4.2m.

Ch8 Q2. Suppose a disk rotates at constant angular velocity. (a) Does a point on the rim have radial and or/ tangential acceleration?

It has no tangential acceleration, otherwise, it wouln't be constant angular velocity.

(b) If the disk's angular velocity increases uniformly, does the point have radial and/or tangential accleration?

It has both.

(c) For which cases would the magnitude of either component of linear acceleration change?

For (b), the tangential component will be constant but since it is speeding up, the radial component must increase. For (a), both stay constant.

Ch8 P8. A bicycle with tires 68 cm in diameter travels 9.2 km. How many revolutions do the wheels make?

One full rotation is the diameter times π. Thus,

$$\begin{aligned} c &= .68\pi\text{m} \\ &= 2.13\,\text{m}. \end{aligned}$$

Thus, the total number of rotations is

$$\begin{aligned} N &= \frac{9200}{2.13} \\ &= 4300\,\text{rotations}. \end{aligned}$$

Ch8 Q3. Can a small force ever exert a greater torque than a larger force? Explain.

Yes, because it depends on the lever and an the angle. A very large force exerted directly at the axis of rotation would give absolutely no torque.

Ch8 P20. A cooling fan is turned off when it is running at 850 rev/min. It turns 1250 revolutions before it comes to a stop. (a) What was the fan's angular acceleration, assumed constant?

We have that using or 1-D kinematic equations, we have f_i, f_f, and $\Delta\theta$. Thus, we can use

$$\begin{aligned} 0^2 &= (850\text{rev/min})^2 + 2\alpha 1250\text{rev} \\ \Rightarrow\alpha &= -\frac{(850\text{rev/min})^2}{2500\text{rev}} \\ &= -289\,\text{rev/min}^2. \end{aligned}$$

To find the time, we can use

$$\begin{aligned} 0 &= 850\text{rev/min} - 289\,\text{rev/min}^2 t \\ \Rightarrow t &= \frac{850\text{rev/min}}{289\,\text{rev/min}^2} \\ &= 2.94\,\text{min}. \end{aligned}$$