PHYS101 Tutorial 4 – PHYS101-21S2

These questions are to be started in your tutorial session and the answers to be submitted post-tutorial via LEARN.

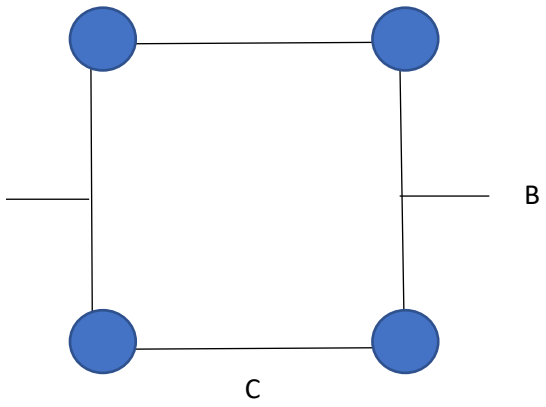
1. A disk is spinning with an initial angular velocity of 2 rad/s. It is measured 5 seconds later and found to be spinning at 6 rad/s. Assuming that the angular acceleration is constant, calculate the angular acceleration of the disk and the angular displacement that the disk went through over these 5 seconds? Is it possible to solve this problem if we do not assume that the angular acceleration is constant?

$\frac{4}{5} = \alpha$ $\frac{4}{5}$ rad s^{-2}

no

2. An object is constructed using four balls that weigh 2 kg each and four rigid but massless rods that are 1 m in length (as shown below). It is fixed at points A and B (halfway along the rods) so that it cannot move linearly but remains free to rotate about these points. A force of 15 N (into the page) is applied on a rod at point C.
    a. Calculate the inertia of the system
    b. Calculate the magnitude of the torque that results from the force
    c. Calculate the angular acceleration that results from this force
    d. If this force remains acting on the bar but does not change direction, describe what will happen to the system.

It will reach equilibrium at 90° from start position



$I = \sum mr^2$

$= 4(2 \times 0.5^2)$

$= 2$ kg m^2

$T = 0.5 \times 15$

$= 7.5$ N m

$\alpha = T/I = 3.75$

3. A wheel is mounted on a wall and given a push to start it spinning. This wheel has very light spokes and a heavy rim so can be considered a ring with a radius of 70 cm that weighs 8 kg. It is timed to be rotating at a constant rate of 5 revolutions per minute.
    a. Calculate the rotational kinetic energy of the system
    b. A torque is applied to the rim of the wheel which slows the rotation down to 3 revolutions per minute. Calculate the work done by this torque
    c. If the deceleration in question b happens over 2.5 seconds calculate the power associated with this change in rotation rate.

$E_k = \frac{1}{2} I \omega^2$ $I = mr^2 = 8 \times 0.7^2 = 3.92$ $\omega = 0.523$

$= 0.538$ $W = E_f - E_i$ $E_f = 0.193$ $W = 0.344$ J

$P = \frac{0.344}{2.5} = 0.137$ W