

$$\text{Wt of flywheel} = 50000 \text{ N}$$

$$\text{mass of } \text{''} = \frac{50000}{9.81} = 5096.84 \text{ kg}$$

$$\text{Radius of gyration } k = 1 \text{ m}$$

$$I = mk^2$$

$$= 5096.84 \times 1 = 5096.84$$

(a) Retarding torque

$$L\alpha = 5096.84 \times 0.1047$$

$$= \boxed{533.64 \text{ Nm}}$$

(b) change in KE

$$= \text{initial KE} - \text{final KE}$$

$$= \frac{1}{2} I \omega_0^2 - \frac{1}{2} I \omega^2$$

$$= \frac{1}{2} \times 5096.84 (41.89^2 - 29.32^2)$$

$$= \boxed{\cancel{2286442.9} \text{ Nm}} \quad \boxed{2281115.462 \text{ Nm}}$$

(c) change in angular momentum

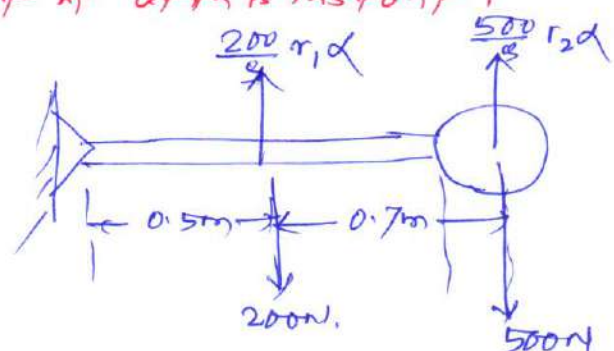
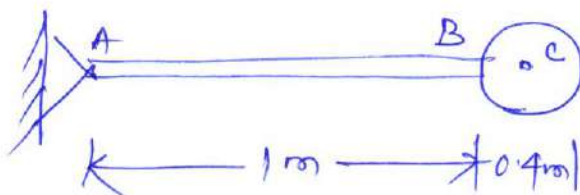
$$I\omega_0 - I\omega$$

$$= 5096.84 (41.89 - 29.32)$$

$$= \boxed{64067.298 \text{ Nm}}$$

Q.3

A cylinder weighing 500N is welded to a 1m long uniform bar of 200N. Determine the acceleration with which the assembly will rotate about point A, if released from rest in horizontal position. Determine the reactions at A at this instant.



Let α = angular acceleration of the assembly (3)

I = mass moment of inertia of the assembly

$$I = I_G + Md^2 \quad (\text{transfer formula})$$

$$\text{mass } ML \text{ of bar about } A = \frac{1}{2} \times \frac{200}{9.81} \times 1^2 + \frac{200}{9.81} \times (0.5)^2$$
$$= 6.7968$$

mass ML of cylinder about A

$$= \frac{1}{2} \times \frac{500}{9.81} \times 0.2^2 + \frac{500}{9.81} \times 1.2^2$$
$$= 74.4$$

$$ML \text{ of the system} = 6.7968 + 74.4 = 81.2097$$

Rotational moment about A

$$M_A = 200 \times 0.5 + 500 \times 1.2 = 700 \text{ Nm}$$

$$M_A = I\alpha$$

$$\Rightarrow \alpha = \frac{700}{81.2097} = \boxed{8.6197} \text{ rad/sec}$$

Instantaneous acceleration of rod AB is vertical and $= r_1 \alpha = 0.5 \times 8.6197$
 $= 4.31 \text{ m/s}^2$

Similarly instantaneous acceleration of cylinder $= r_2 \alpha = 1.2 \times 8.6197$
 $= 10.34 \text{ m/s}^2$

Applying D'Alembert's dynamic equilibrium

$$R_A = 200 + 500 - \frac{200}{9.81} \times 4.31 - \frac{500}{9.81} \times 10.34$$

$$\Rightarrow \boxed{R_A = 84.93 \text{ N}} \quad (\text{Ans})$$