12- A wheel starts from rest and rotates with a constant angular acceleration of 4 rad/s^2 to reach an angular speed of 12 rad/s in 3 s. Find the angle in radians through which it rotates in this time.

10

a) 12 rad b) 4 rad c) 10 rad d) 18 rad e) 14 rad

13- A rotating wheel requires 3 s to rotate through 37 revolutions with an initial angular speed of 57 rad/s. What is the constant angular acceleration of the wheel?

10

a) 44.2 rad/s^2 b) 22.5 rad/s^2 c) 33.7 rad/s^2 d) 10.2 rad/s^2 e) 13.6 rad/s^2

17) The combination of an applied force and a friction force produces a constant total torque of 36 N·m on a wheel rotating about a fixed axis. The applied force acts for 6 s. During this time the angular speed of the wheel increases from 0 to 10 rad/s. The applied force is then removed, and the wheel comes to rest (under the effect of the friction force) in 60 s. Find

10

a) The moment of inertia of the wheel,
b) The magnitude of the frictional torque (in the last 60 s),
c) The number of revolutions of the wheel in the first 6 seconds.
d) The number of revolutions of the wheel in the next 60 seconds

$\omega_f = \omega_i + \alpha t$ $\quad 10 = 0 + \alpha(6) \Rightarrow \alpha = 1.67 \text{ rad/s}^2$

a) $\sum \tau = 36.0 \text{ N} \cdot \text{m} = I\alpha$: $I = \dfrac{\sum \tau}{\alpha} = \dfrac{36.0 \text{ N} \cdot \text{m}}{1.67 \text{ rad/s}^2} = \boxed{21.6 \text{ kg} \cdot \text{m}^2}$

b) $\omega_f = \omega_i + \alpha t$:

$0 = 10.0 + \alpha(60.0)$

$\alpha = -0.167 \text{ rad/s}^2$

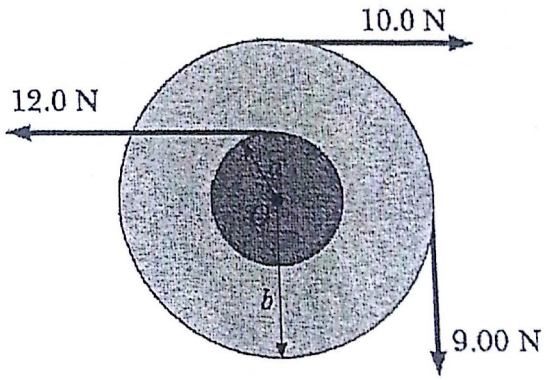
$|\tau| = |I\alpha| = (21.6 \text{ kg} \cdot \text{m}^2)(0.167 \text{ rad/s}^2) = \boxed{3.60 \text{ N} \cdot \text{m}}$

c) Number of revolutions $\theta_f = \theta_i + \omega_i t + \dfrac{1}{2}\alpha t^2$

During first 6.00 s $\theta_f = \dfrac{1}{2}(1.67)(6.00)^2 = 30.1 \text{ rad}$

d) During next 60.0 s $\theta_f = 10.0(60.0) - \dfrac{1}{2}(0.167)(60.0)^2 = 299 \text{ rad}$

12- Find the net torque on the wheel in Figure about the axle through O if $a = 10.0$ cm and $b = 25.0$ cm.



a) + 5.33 N.m b) -7.43 N.m c) -3.55 N.m d) +10.75 N.m e) -4.33 N.m

13- A disk 8.00 cm in radius rotates at a constant rate of 1 200 rev/min about its central axis. Determine

a) Its angular speed,

b) The tangential speed at a point 3.00 cm from its center,

c) The radial acceleration of a point on the rim, and

d) The total distance a point on the rim moves in 2.00 s.

الحل

13) a) $\omega = 2\pi f = \frac{2\pi \text{ rad}}{1 \text{ rev}}\left(\frac{1\,200 \text{ rev}}{60.0 \text{ s}}\right) = \boxed{126 \text{ rad/s}}$

b) $v = \omega r = (126 \text{ rad/s})(3.00 \times 10^{-2} \text{ m}) = \boxed{3.77 \text{ m/s}}$

c) $a_c = \omega^2 r = (126)^2(8.00 \times 10^{-2}) = 1260 \text{ m/s}^2$ so

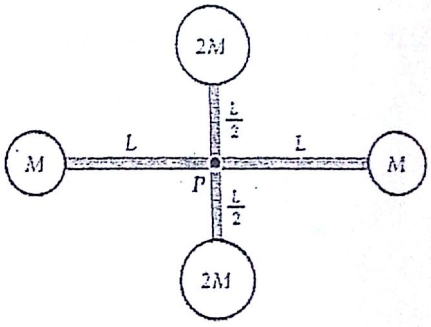
$a_r = \boxed{1.26 \text{ km/s}^2 \text{ tow ard the center}}$

d) $s = r\theta = \omega rt = (126 \text{ rad/s})(8.00 \times 10^{-2} \text{ m})(2.00 \text{ s}) = \boxed{20.1 \text{ m}}$

12- When a spinning boy brings his arms closer to his body, his moment of inertia will

a) depend on his initial angular velocity b) be conserved c) increase d) remain constant e) decrease

13-The rigid object shown is rotated about an axis perpendicular to the paper and through point P. The total kinetic energy of the object as it rotates is equal to 3 J. If $M = 2$ kg and $L = 0.50$ m, what is the angular velocity of the object? Neglect the mass of the connecting rods and treat the masses as particles.



a) 1.5 rad/s b) 3 rad/s. c) 3.5 rad/s d) 4.5 rad/s e) 2 rad/s

15- A disk 5.00 cm in radius rotates at a constant rate of 1300 rev/min about its central axis. Determine

a) Its angular speed,

b) The tangential speed at a point 4.00 cm from its center,

c) The radial acceleration of a point on the rim,

d) The total distance a point on the rim moves in 2.00 s.

الحل

15) a) $\omega = 2\pi f = \frac{2\pi \text{ rad}}{1 \text{ rev.}} \cdot \frac{1300 \text{ rev}}{60} = 136 \text{ rad/s}$

b) $v = \omega r = (136)(4 \times 10^{-2} \text{ m}) = 5.44 \text{ m/s}$

c) $a_c = \omega^2 r = (136)^2 (5 \times 10^{-2}) = 924.8 \text{ m/s}^2$

d) $s = r\theta = \omega r t = (136)(5 \times 10^{-2})(2) = 13.6 \text{ m}$

10- A wheel rotating about a fixed axis has an angular position given by $\theta = 10 + 4t^3$, where θ is measured in radians and t in seconds. What is the angular acceleration of the wheel at t = 3 s

a) 24 rad/s² b) 72 rad/s² c) 60 rad/s² d) 92 rad/s² e) 128 rad/s²

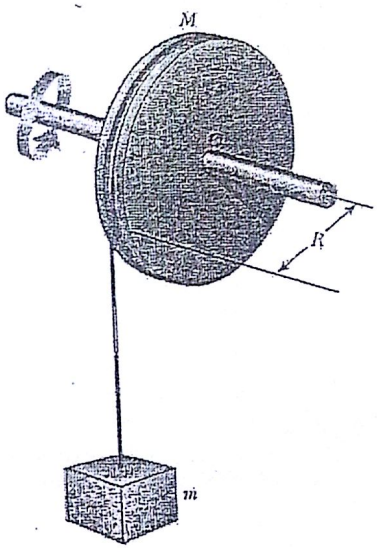
11- A wheel starts from rest and rotates with a constant angular acceleration about a fixed axis. It completes the first revolution 6 s after it started. How long after it started will the wheel complete the second revolution?

a) 8.5 s b) 9.4 s c) 6.6 s d) 10.2 s e) 7.6 s

Give a detailed answer for the following problem

18- A wheel 1m in diameter rotates on a fixed frictionless horizontal axle. Its moment of inertia about this axis is 5 kg.m^2. A constant tension of 20 N is maintained on a rope wrapped around the rim of the wheel so as to cause the wheel to accelerate. If the wheel starts from rest at t=0, calculate:

(a) The angular acceleration of the wheel,
(b) The wheel angular speed at t= 3 s,
(c) The kinetic energy of the wheel at t= 3 s,
(d) The length of rope unwound in the first 3 s.



الثالث ١٨ ، ١٩ كل واحدة بـ ٨ درجات (٨×٢) = ١٦ درجة
موزعة على كل مطلوب من المطاليب الأربع يعني كل مطلوب ٢

(18) a) $\tau = I\alpha = FR \Rightarrow \alpha = \frac{FR}{I} = \frac{20(0.5)}{5} = 2\ rad/s$ ٢ درجة

b) $\omega = \alpha t = 2 \times 3 = 6\ rad/s$ ٢ درجة

c) $K = \frac{1}{2} I\omega^2 = \frac{1}{2}(5 \times 6^2) = 90\ J$ ٢ درجة

d) $\theta = \frac{1}{2}\alpha t^2 = \frac{1}{2}(2)(3^2) = 9\ rad \Rightarrow S = R\theta = 0.5 \times 9 = 4.5\ m$ ٢ درجة