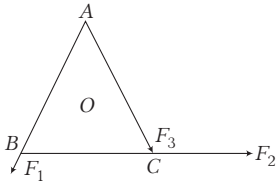
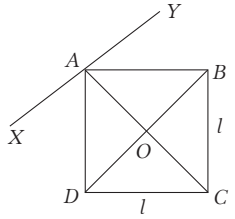
What should be the magnitude of F_3, so that the total torque about O is zero?



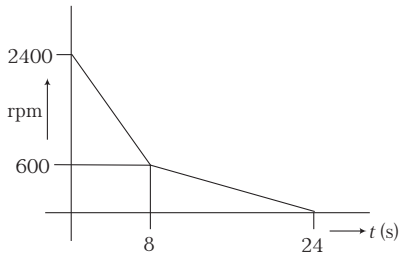
(a) $\frac{F_1 + F_2}{2}$ (b) $F_1 - F_2$ (c) $F_1 + F_2$ (d) $2(F_1 + F_2)$

14. Four point masses each of mass m are placed at the corners of a square $ABCD$ of side l. The moment of inertia of the system about an axis passing through A and parallel to BD is



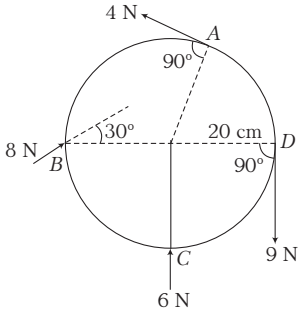
(a) $\sqrt{3}\, ml^2$ (b) $3\, ml^2$ (c) ml^2 (d) $2\, ml^2$

15. A table fan rotating at a speed of 2400 rpm, is switched OFF and the resulting variation of the rpm with time as shown in the figure. The total number of revolutions of the fan before it comes to rest is



(a) 420 (b) 190 (c) 280 (d) 380

16. Forces are applied on a wheel of radius 20 cm as shown in the figure. The torque produced by the forces 4 N at A, 8 N at B, 6 N at C and 9 N at D at angles indicated is

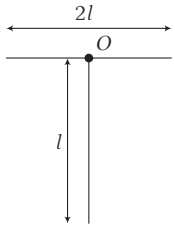


(a) 5.4 N-m anti-clockwise (b) 1.80 N-m clockwise
(c) 2.0 N-m clockwise (d) 3.6 N-m clockwise

17. A uniform rod of mass 2 kg and length 1 m lies on a smooth horizontal plane. A particle of mass 1 kg moving at a speed of 2 ms^{-1} perpendicular to the length of the rod strikes it at a distance $\frac{1}{4}$ m from the centre and stops. What is the angular velocity of the rod about its centre just after the collision?

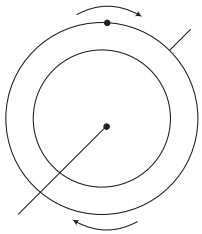
(a) 3 rad s^{-1} (b) 4 rad s^{-1} (c) 1 rad s^{-1} (d) 2 rad s^{-1}

18. For the uniform T shaped structure with mass $3M$, moment of inertia about an axis normal to the plane and passing through O would be



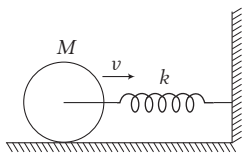
(a) $\frac{2}{3} Ml^2$ (b) Ml^2
(c) $\frac{Ml^2}{3}$ (d) None of these

19. A disc is free to rotate about a smooth horizontal axis passing through its centre of mass. A particle is fixed at the top of the disc. A slight push is given to the disc and it starts rotating. During the process,



(a) only mechanical energy is conserved
(b) only angular momentum (about the axis of rotation) is conserved
(c) Both mechanical energy and angular momentum are conserved
(d) Neither the mechanical energy nor the angular momentum are conserved

20. A solid sphere rolls without slipping and presses a spring of spring constant k as shown in figure. Then, the compression in the spring will be



(a) $v\sqrt{\frac{2M}{3k}}$ (b) $v\sqrt{\frac{2M}{5k}}$ (c) $v\sqrt{\frac{5k}{7M}}$ (d) $v\sqrt{\frac{7M}{5k}}$