Suggested problems
Chapter 10

The quiz questions will be same or very similar to the following text-book problems.
Refer to the course website for the latest version of this document.
You are encouraged to seek the help of your instructor during his office hours.

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4. The angular position of a point on a rotating wheel is given by $\theta = 2.0 + 4.0\,t^2 + 2.0\,t^3$, where θ is in radians and t is in seconds. At t = 0, what are (a) the point's angular position and (b) its angular velocity? (c) What is its angular velocity at t = 4.0 s? (d) Calculate its angular acceleration at t = 2.0 s. (e) Is its angular acceleration constant?

Answer: (a) θ_0 =2.0 rad ; (b) ω_0 =0; (c)ω_4 = 78 rad/s (d) α_2 =32 rad/s^2 (e)The angular acceleration, depends on time, it is not constant

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26. The flywheel of a steam engine runs with a constant angular velocity of 150 rev/min. When steam is shut off, the friction of the bearings and of the air stops the wheel in 2.2 h. (a) What is the constant angular acceleration, in revolutions per minute-squared, of the wheel during the slowdown? (b) How many revolutions does the wheel make before stopping? (c) At the instant the flywheel is turning at 75 rev/min, what is the tangential component of the linear acceleration of a flywheel particle that is 50 cm from the axis of rotation? (d)What is the magnitude of the net linear acceleration of the particle in (c)?

Answer: (a) -1.14 rev/min^2; (b) 9.9×10^3 rev (c) – 0.99 mm/s^2; (d) 31 m/ s^2

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41. In Fig. 10-34, two particles, each with mass m = 0.85 kg, are fastened to each other, and to a rotation axis at O, by two thin rods, each with length d = 5.6 cm and mass M = 1.2 kg. The combination rotates around the rotation axis with the angular speed ω = 0.30 rad/s. Measured about O, what are the combination's (a) rotational inertia and (b) kinetic energy?

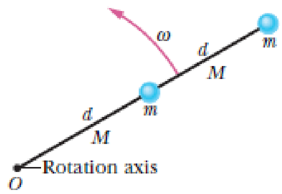

Fig. 10-34 Problem 41.

Answer: (a) 0.023 kg · m^2 (b)1.1 m J

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43. The uniform solid block in Fig. 10-35 has mass 0.172 kg and edge lengths a =3.5 cm, b = 8.4 cm, and c = 1.4 cm. Calculate its rotational inertia about an axis through one corner and perpendicular to the large faces?

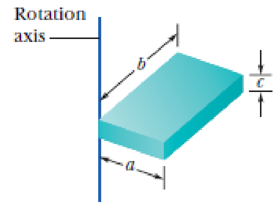

Fig. 10-35 Problem 43.

Answer: (a) 4.7×10^{-4} kg · m^2

66. A uniform spherical shell of mass M= 4.5 kg and radius R = 8.5 cm can rotate about a vertical axis on frictionless bearings (Fig. 10-44). A massless cord passes around the equator of the shell, over a pulley of rotational inertia $I = 3.0 \times 10^{-3}\, kg \cdot m^2$ and radius r = 5.0 cm, and is attached to a small object of mass m = 0.60 kg. There is no friction on the pulley's axle; the cord does not slip on the pulley.What is the speed of the object when it has fallen 82 cm after being released from rest? Use energy considerations.

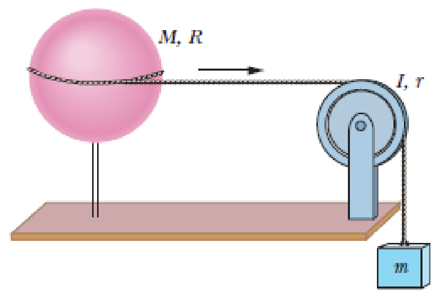

Fig. 10-44 Problem 66.

Answer: (a) 1.4 m/s

81. The thin uniform rod in Fig. 10-50 has length 2.0 m and can pivot about a horizontal, frictionless pin through one end. It is released from rest at angle $\theta = 40°$ above the horizontal. Use the principle of conservation of energy to determine the angular speed of the rod as it passes through the horizontal position.

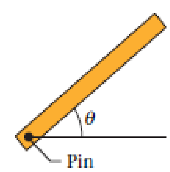

Fig. 10-50 Problem 81.

Answer: 3.1 rad/s