

ENGR102: Dynamics Problem Set 5



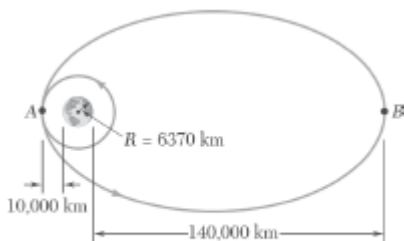
PROBLEM 12.52

A car is traveling on a banked road at a constant speed v . Determine the range of values of v for which the car does not skid. Express your answer in terms of the radius r of the curve, the banking angle θ , and the angle of static friction ϕ_s between the tires and the pavement.



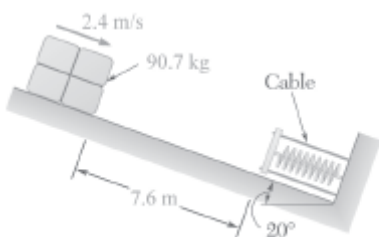
PROBLEM 12.60

Four seconds after a polisher is started from rest, small tufts of fleece from along the circumference of the 25.4-cm-diameter polishing pad are observed to fly free of the pad. If the polisher is started so that the fleece along the circumference undergoes a constant tangential acceleration of 3.7 m/s^2 , determine (a) the speed v of a tuft as it leaves the pad, (b) the magnitude of the force required to free the tuft if the average weight of a tuft is $1.5 \times 10^{-6} \text{ kg}$.



PROBLEM 12.106

The Chandra X-ray observatory, launched in 1999, achieved an elliptical orbit of minimum altitude 10 000 km and maximum altitude 140 000 km above the surface of the earth. Assuming that the observatory was transferred to this orbit from a circular orbit of altitude 10 000 km at point A, determine (a) the increase in speed required at A, (b) the speed of the observatory at B.



PROBLEM 13.65

A spring is used to stop a 90.7 kg package which is moving down a 20° incline. The spring has a constant $k = 22 \text{ kN/m}$ and is held by cables so that it is initially compressed 15 cm. Knowing that the velocity of the package is 2.4 m/s when it is 7.6 m from the spring and neglecting friction, determine the maximum additional deformation of the spring in bringing the package to rest.