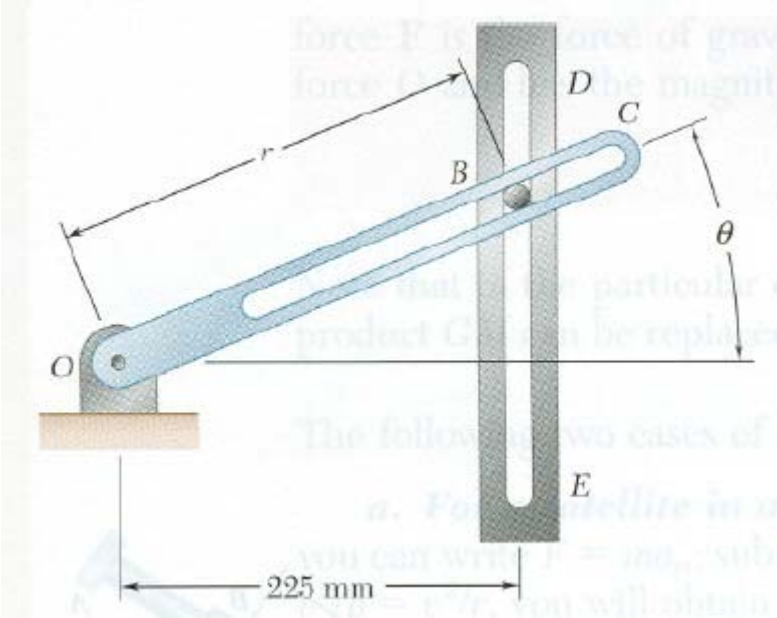
# 동역학 446.204A 003

## 과제 # 3

배부일: 10월 6일
제출 기한: 10월 17일 (금)

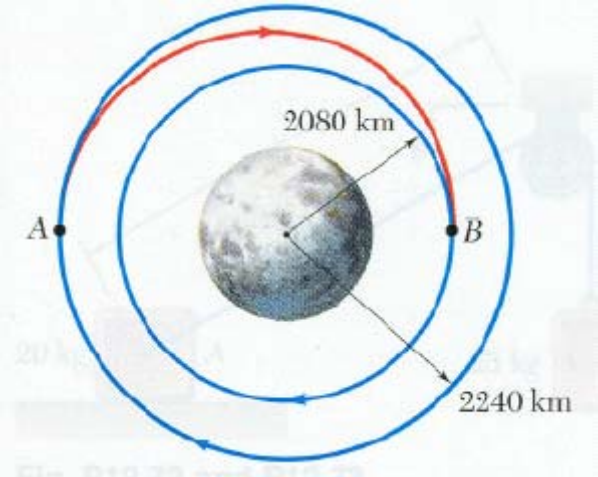
1.

**12.69** The 110 g pin $B$ slides along the slot in the rotating arm $OC$ and along the slot $DE$ which is cut in a fixed horizontal plate. Neglecting friction and knowing that arm $OC$ rotates at a constant rate $\dot{\theta}_0 = 10$ rad/s, determine for any given value of $\theta$ $(a)$ the radial and transverse components of the resultant force $\mathbf{F}$ exerted on pin $B$, $(b)$ the forces $\mathbf{P}$ and $\mathbf{Q}$ exerted on pin $B$ by arm $OC$ and the wall of the slot $DE$, respectively.



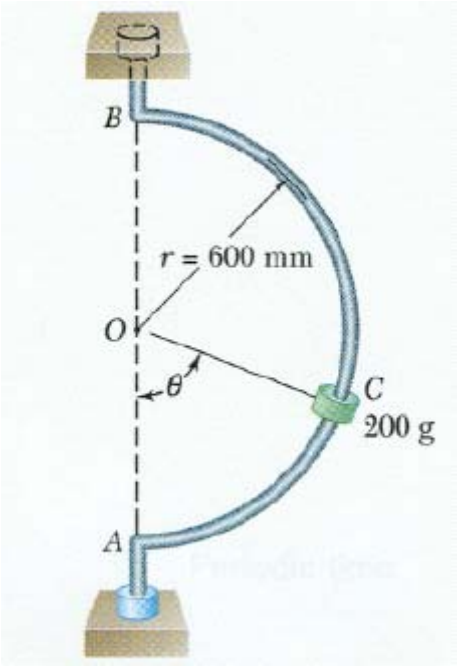
2.

**12.88** A space vehicle is in a circular orbit of 2240 km radius around the moon. To transfer to a smaller orbit of 2080 km radius, the vehicle is first placed in an elliptic path $AB$ by reducing its speed by 26.3 m/s as it passes through $A$. Knowing that the mass of the moon is $73.5 \times 10^{21}$ kg, determine (*a*) the speed of the vehicle as it approaches $B$ on the elliptic path, (*b*) the amount by which its speed should be reduced as it approaches $B$ to insert it into the smaller circular orbit.



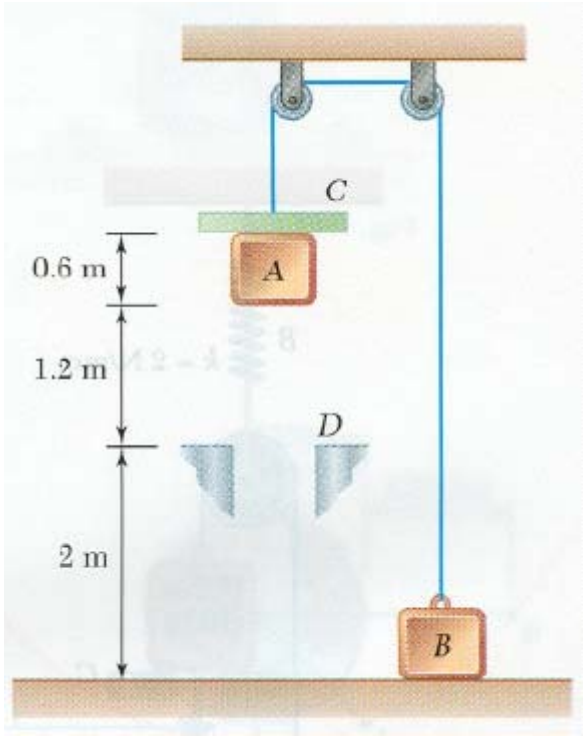

3.

**12.127** A small 200 g collar $C$ can slide on a semicircular rod which is made to rotate about the vertical $AB$ at the constant rate of 6 rad/s. Determine the minimum required value of the coefficient of static friction between the collar and the rod if the collar is not to slide when (*a*) $\theta = 90°$, (*b*) $\theta = 75°$, (*c*) $\theta = 45°$. Indicate in each case the direction of the impending motion.



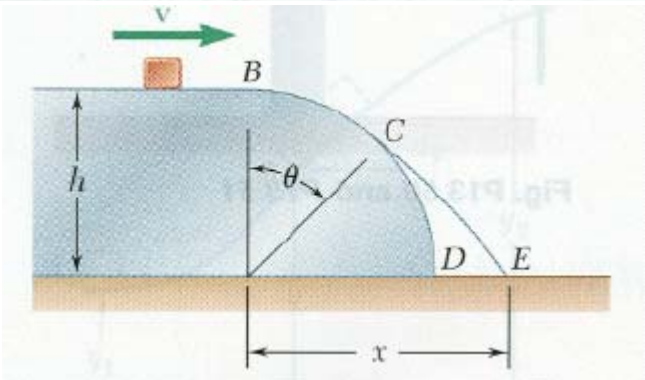

4.

**13.24** Two blocks $A$ and $B$, of mass 8 kg and 10 kg, respectively, are connected by a cord which passes over pulleys as shown. A 6-kg collar $C$ is placed on block $A$ and the system is released from rest. After the blocks move 1.8 m, collar $C$ is removed and blocks $A$ and $B$ continue to move. Determine the speed of block $A$ just before it strikes the ground.



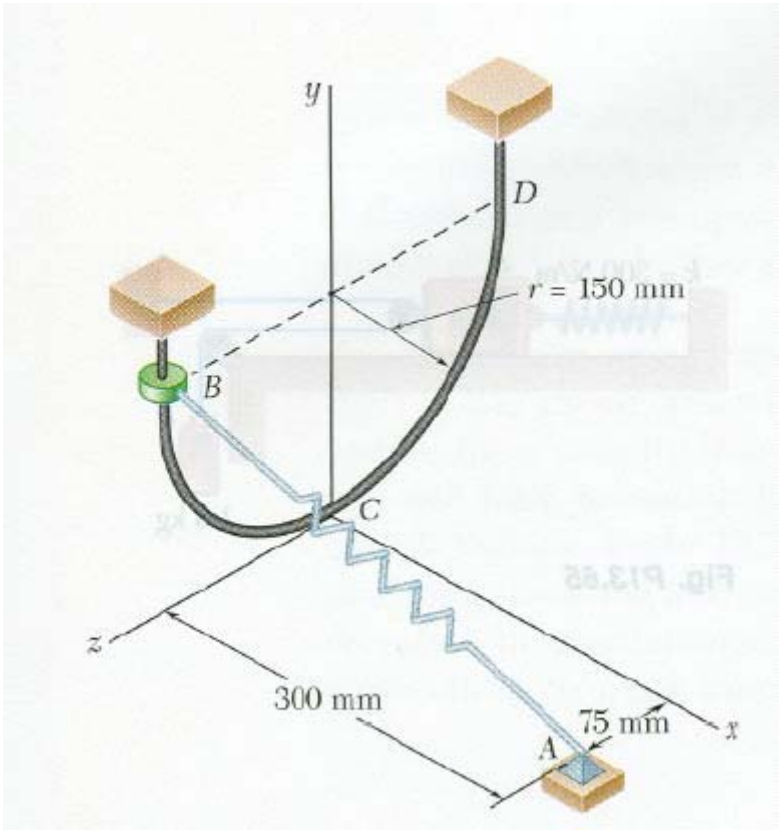

5.

**13.45** A small block slides at a speed $v = 3$ m/s on a horizontal surface at a height $h = 1$ m above the ground. Determine (*a*) the angle $\theta$ at which it will leave the cylindrical surface *BCD*, (*b*) the distance $x$ at which it will hit the ground. Neglect friction and air resistance.



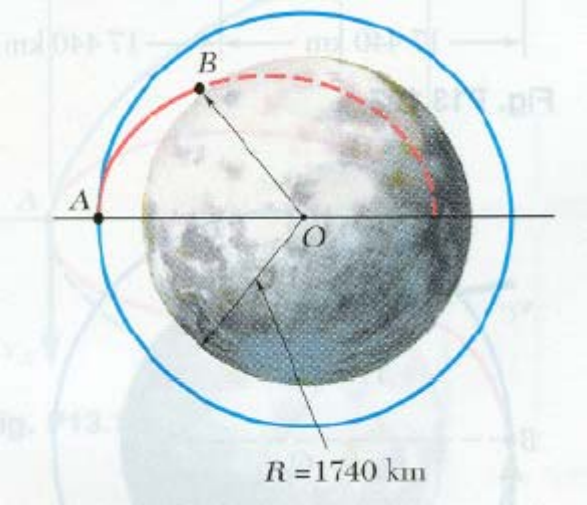
6.

**13.69** A 500-g collar can slide without friction along the semicircular rod *BCD*. The spring is of constant 320 N/m and its undeformed length is 200 mm. Knowing that the collar is released from rest at *B*, determine (*a*) the speed of the collar as it passes through *C*, (*b*) the force exerted by the rod on the collar at *C*.



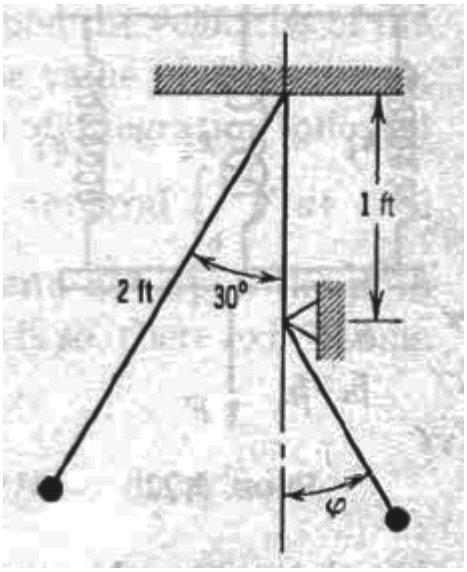
7.

**13.112** When the lunar excursion module (LEM) was set adrift after returning two of the Apollo astronauts to the command module, which was orbiting the moon at an altitude of 140 km, its speed was reduced to let it crash on the moon's surface. Determine (*a*) the smallest amount by which the speed of the LEM should have been reduced to make sure that it would crash on the moon's surface, (*b*) the amount by which its speed should have been reduced to cause it to hit the moon's surface at a 45° angle. (*Hint*: Point *A* is at the apogee of the elliptic crash trajectory. Recall also that the mass of the moon is 0.0123 times the mass of the earth.)



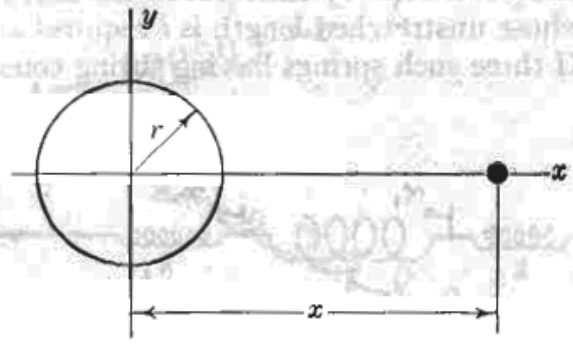

8.

**3.19.** A particle weighing 1 lb is supported as a simple pendulum by a massless inextensible string 2 ft in length. The pendulum is released from rest at an angle of 30° as shown in the diagram. When the string is just vertical, it strikes a rigid support and the particle continues to swing as a pendulum of shorter length. (a) Find the maximum value of the angle $\phi$. (b) Find the force exerted on the weight by the string when $\phi = 30°$.




9.

**3.25.** The force of gravity varies inversely as the square of the distance from the center of the earth. A projectile in space is thus acted upon by a gravitational force $F_x = -W\frac{r^2}{x^2}$, where $W$ is the weight of the projectile at the earth's surface and $r$ is the radius of the earth. How much work




PROB. 3.25

must be done against the gravitational force if the projectile is to reach a distance of $(x - r)$ from the earth's surface? Neglecting air resistance, what initial velocity must the projectile have in order to reach that distance? What initial velocity must the projectile have to escape from the earth's gravitational field? Take the radius of the earth as 4000 mi.

10.

**3.27.** A beam is found to deflect $\delta$ in. under the point of application of a static load $W$. It is also found that the magnitude of the deflection is proportional to the load. If the weight $W$ is raised a distance of $h$ ft and is dropped on the beam, what is the maximum deflection of the beam under the load? Neglect the mass of the beam.