

國立中央大學 106 學年度碩士班考試入學試題

共 1 頁 第 1 頁

所別： 地球科學學系地球物理 碩士班 不分組(一般生)

地球科學學系地球物理 碩士班 不分組(在職生)

科目： 普通物理學

本科考試禁用計算器

*請在答案卷 內作答

(一) Conservation of momentum (共 25 分)

A bullet of mass m_1 is fired into a pendulum of mass m_2 and length L . The speed of the bullet as it enters the mass m_2 is V_1 . First, assume that the collision is elastic, and that $m_1 \ll m_2$.

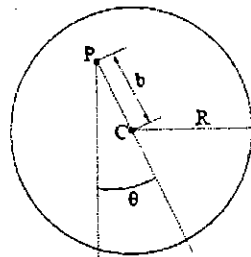
- (1) If the pendulum is initially at rest, what is the speed of the bullet after the collision? (5 分)
- (2) Now suppose that when the collision occurs, the pendulum, at the bottom of its swing, is moving to the left with velocity V_2 . What now is the speed of the bullet after the elastic collision? (5 分)

Now assume that the collision is completely inelastic. The pendulum is at rest before the collision, $m_1 < m_2$, but the speed V_1 of the bullet is unknown.

- (3) After the collision, the pendulum moves to the right and it comes to a halt when the string makes an angle θ_{max} with the vertical. What was the speed of the bullet? (5 分)
- (4) Substitute in your answer $\theta_{max} = 0$. Does your result make sense? (5 分)
- (5) Could θ_{max} be 90° ? Explain your answer. (5 分)

(二) Rotation (共 25 分)

A solid, uniform disk of mass M and radius R is oscillating about an axis through P . The axis is perpendicular to the plane of the disk. Friction at P is negligibly small and can be ignored. The distance from P to the center, C , of the disk is b (see figure). The gravitational acceleration is g . The rotational inertia I of this disk is $1/2MR^2$.



- (1) When the displacement angle is θ , what then is the torque relative to point P ? (10 分)
- (2) What is the rotation inertia about the axis through P ? (5 分)
- (3) The torque causes an angular acceleration about the axis through P . Write down the equation of motion in terms of the angle θ and the angular acceleration. (10 分)

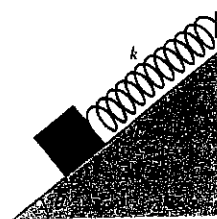
(三) Sound (共 25 分)

- (1) Please give the definition of (a) decibel ; (b) intensity (10 分).
- (2) A certain sound source is increased in sound level by 30.0 dB. By what multiple is (a) its intensity increased (10 分) and (b) its pressure amplitude increased? (5 分)

(四) SHM (共 25 分)

In the right figure, a block weighting W , which can slide without friction on an incline at angle θ , is connected to the top of the incline by a massless spring of unstretched length l and spring constant k .

- (1) How far from the top of the incline is the block's equilibrium point? (10 分)
- (2) if the block is pulled slightly down the incline and released, what is the period of the resulting oscillations? (answer with W, θ, l, k and g) (15 分)



參考用