

國立中央大學 107 學年度碩士班考試入學試題

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)

共 2 頁 第 1 頁

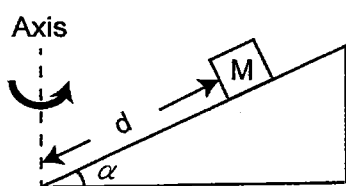
科目：普通物理學

本科考試禁用計算器

*請在答案卷(卡)內作答

1. (1) What are the physical definition for friction force ? What exactly differences between static friction, kinematic friction and rolling friction ? The answer must be included mathematic expression. (10 %)

- (2) A block of mass M is placed on a plane, where μ_s is the coefficient of static friction between the block and the plane. The plane is inclined at an angle α . When the plane is stationary, the block slips down the plane.



We can keep the block in place on the incline by resolving the plane around the vertical axis shown below. In this case, what is the maximum period of revolution (that is, the slowest rotation) that will keep the block on the incline a distance d from the lower end ? (15 %)

2. (1) Please explains what is Work-Energy Theorem and derive it by using physical and mathematical expressions. (10 %)

- (2) A circus performer of inertia M is launched into the air by a "cannon" that contains a spring platform for which the spring constant is κ . The performer climbs into the cannon, compressing the spring. Then the spring is additionally compressed so that initial position of the platform is a distance d below the position of the platform when the spring is relaxed. What maximum speed does the performer attain after launch ? How high above the relaxed position of the spring platform does the performer fly ? Please analysis the problem in work-energy theorem and also shows the energy transfer by using energy bar chart. (15 %)

3. (1) Please derive the wave equation and explains the physical meanings. (10 %)

- (2) A transverse wave pulse traveling along a rope is described by the time-dependent wave function $f(x, t) = Ae^{-(kx-\omega t)^3}$, with wave number $k = 2\pi \text{ m}^{-1}$ and angular frequency $\omega = 2\pi \text{ s}^{-1}$. (a) Sketch the time-dependent wave function at $t=0$ and $t=5.0 \text{ s}$ (4 %) (b) Sketch the pulse as a function of time (the displacement curve) at $x=0$ and $x=5.0 \text{ m}$ (4 %) (c) Show that the function given above satisfies the wave equation (5 %) (d) What is the wave speed of the pulse ? (2 %)

注意:背面有試題

參考用

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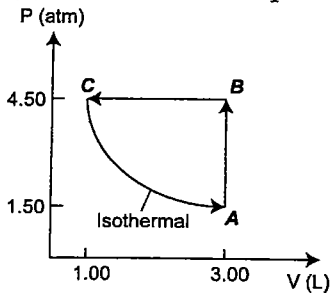
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4. (1) Please describe the physical meaning in three laws of thermodynamics. (10 %)

(2) A 2.00 mol sample of an ideal diatomic gas goes through a cycle ABCA that



shown in figure. The CA process is a reversible isothermal expansion. What is (a) the net work done by the gas during one cycle? (3 %) (b) How much energy is added to the gas by heat during one cycle? (3 %) (c) How much energy is exhausted from the gas by heat during one cycle? (3 %) (d) What is efficiency of the cycle? (3 %)

(e) What would be the efficiency of a Carnot engine operated between the temperatures at points A and B during each cycle? (3 %)

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