

淡江大學 105 學年度日間部寒假轉學生招生考試試題

系別：物理系光電物理組二年級

科目：普通物理

6-1

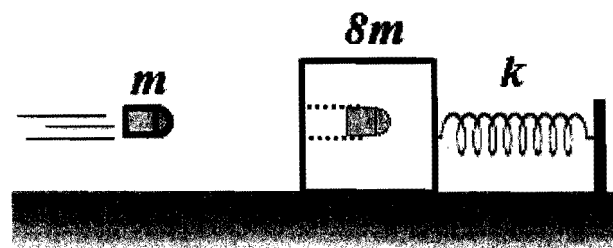
考試日期：12月3日(星期六) 第2節

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1. What is the Poynting vector \vec{S} ? Furthermore, please find the \vec{S} for a given EM wave with the linearly polarized electric field $\vec{E} = E_0 \sin(kx - \omega t) \hat{k}$ [hint: $\frac{\partial B_y}{\partial t} = \frac{\partial E_z}{\partial x}$] [20 points]
2. Please explain the origin of the phase difference in optical interference [10 points]
3. What is the Snell's law? Please derive it by the Fermat's principle (the path of the light propagated is the one with a minimum traveling time) [10 points]
4. What is the de Broglie wavelength of a particle (with a mass m and charge q) which is accelerated by a potential V to a nonrelativistic speed. [10 points]
5. The force of a stretched rubber band is given approximately by Hooke's Law ($F_x = -kx$) Suppose a rubber band with $k = 50.0$ N/m and at temperature $T = 27^\circ\text{C}$ is stretched by $x = 1.2$ cm. For a small additional stretching, at what rate dS/dx does the entropy of the rubber band decrease? [10 points]

6. What is the Hall effect? [10 points]

7. A bullet (with a mass m) was fired horizontally at a rest block (with a mass of $8m$) which is connected to a fixed end with a spring (spring constant k). (a) Please determine the initial velocity of the bullet if the stretching distance of the spring is d after the bullet combined with the block. [10 points] (b) What is the thermal energy at the beginning of the collision? [10 points]



8. When you washed your Teddy bear (with a mass M_B) with a washing machine, you will dry it by spinning it. Suppose the coefficient of static friction between Teddy bear and wall of the laundry tube is μ_s and the radius of the tube is R , please determine the minimum speed of the spin which will keep Teddy on the wall of the laundry tube. (the gravitational constant is g) [10 points]

