

國立中央大學八十八學年度碩士班研究生入學試題卷

所別: 光電科學研究所 不分組 科目: 普通物理 共三頁 第一頁

1. The magnification of a simple magnifier is given by $15/f$.
- What is the unit of the numerator(分子)?
 - Why is it 15? Can it be 16 or 14?
 - Is this magnification the ratio of the image height to the object height? If not, what is it?

11%

2a) Fig. A is the schematic diagram of the experimental setup of the Young's double slit interference experiment. The incident light is derived from a beam of sun light after a color filter. What is the purpose of the first slit on screen A. If this slit is removed in the experimental setup. What would you observe in screen C.

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- b) Suppose now we cover the slit S_2 on screen B in Fig. A with a glass plate of thickness 12.000mm, does the interference pattern change? If the thickness of the glass plate is 12.0005 mm, does the interference pattern change? In particular, what is the intensity at O now? Assume the index of refraction of the glass plate be 1.6 and $\lambda = 0.6\mu m$.

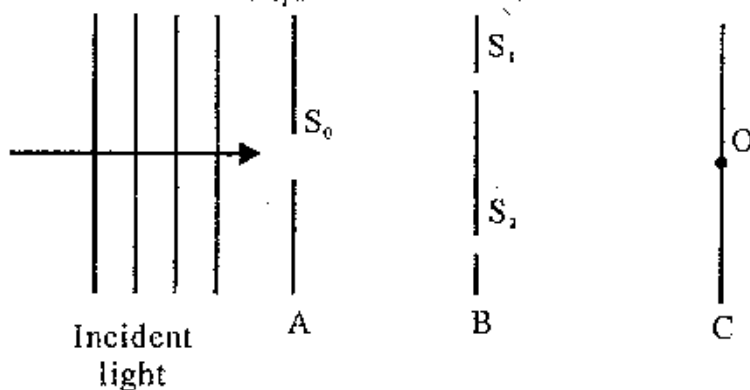


Fig. A

參考用

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3. As we normally experience, radio waves are almost always polarized and visible light is almost always unpolarized, why should this be so?

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4. A typical "light dimmer" used to dim the stage lights in a theater consists of a variable inductor L connected in series with the light bulb B as shown in Fig.B the power supply is 110V(rms) at 50Hz, the light bulb is marked "110V, 1000W"
- What maximum inductance L is required if the power in the light bulb is to be varied by a factor of 4? Assume that the resistance of the light bulb is independent of its temperature.
 - Could one use a variable resistor instead of an inductor? If so, what maximum resistance is required? Why isn't this done?
 - Could you use a variable capacitor to do this job?

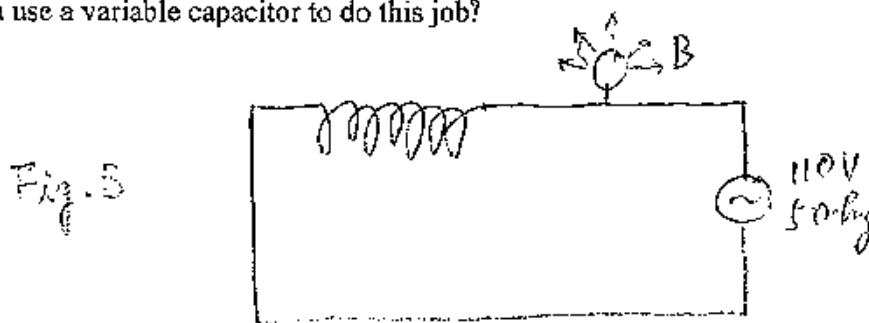


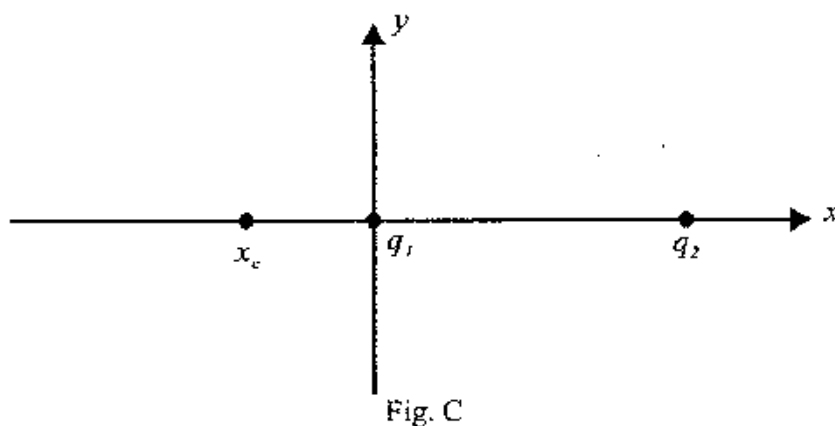
Fig. B

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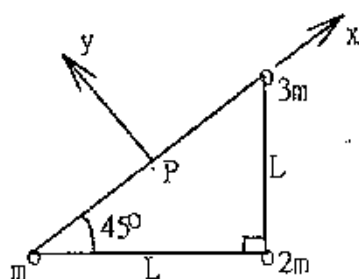
5. A point charge $q_1 = 1.6 \times 10^{-6} \text{ coul.}$ is fixed at the origin of a rectangular coordinate system, and a second point charge $q_2 = -10 \times 10^{-6} \text{ coul.}$ is fixed at $x = 8.6 \text{ mm}, y = 0$. The locus of all points in the xy plane with $V=0$ is a circle centered on the x axis, as shown in Fig. C. Find (a) the location x_c of the center of the circle and (b) the radius of the circle. Fig. C 在第二頁

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Three point masses (m , $2m$, $3m$) are located at the vertices of the triangle shown in the diagram. Find the principal moments of inertia about the point, P , on the hypotenuse halfway between the vertices. (6%)

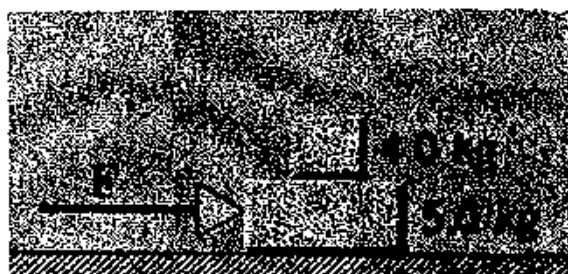


7. A ball of mass m and radius R is placed inside a larger hollow sphere with the same mass and inside radius $2R$. The combination is at rest on a frictionless surface in the position shown in the following figure. The smaller ball is released, rolls around the inside of the hollow sphere, and finally comes to rest at the bottom. How far will the larger sphere have moved during this process? (6%)



參考用

8. A 4.0-kg block is put on top of a 5.0-kg block (See the figure below). In order to cause the top block to slip on the bottom one, a horizontal force of 12 nt must be applied to the top block. Assume a frictionless table with a horizontal surface and (a) the maximum horizontal force F which can be applied to the lower block so that the blocks will move together and (b) the resulting acceleration of the blocks. (8%)



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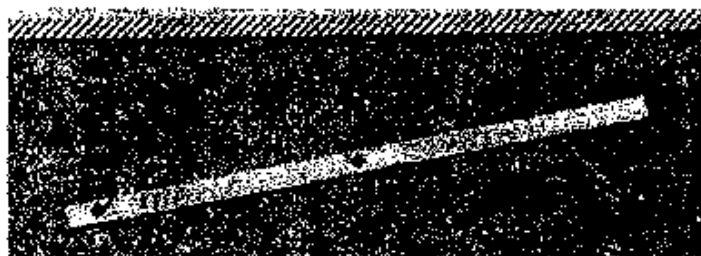
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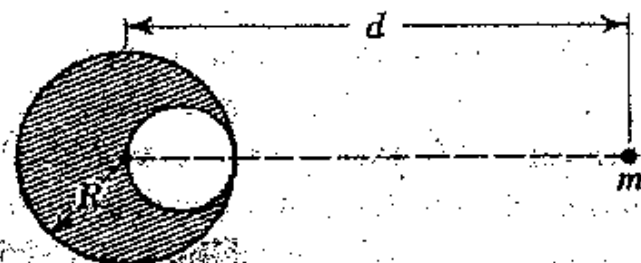
普通物理

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9. A long uniform rod of length L and mass M is free to rotate in a horizontal plane about a vertical axis through its center. A spring with force constant k is connected horizontally between the end of the rod and a fixed wall as shown in the figure below. What is the period of the small oscillation that result when the rod is pushed slightly to one side and released? (10%)



10. A spherical hollow is made in a lead sphere of radius R , such that its surface touches the outside surface of the lead sphere and passes through its center. The mass of the sphere before hollowing was M . With what force, according to the law of universal gravitation, will the lead sphere attract a small sphere of mass m , which lies at a distance d from the center of the lead sphere on the straight line connecting the centers of the spheres and of the hollow? (10%)



參考用

11. A 0.1-kg block slides back and forth along a straight line on a smooth horizontal surface. Its displacement from the origin is given by

$$x = 10 \cos(10t + \frac{\pi}{2})$$

with x is in cm and t in seconds (a) What is the oscillation frequency? (b) What is the maximum speed acquired by the block? At what value of x does this occur? (c) What is the maximum acceleration of the block? At what value of x does this occur? (d) What force must be applied to the block to give it this motion? (10%)