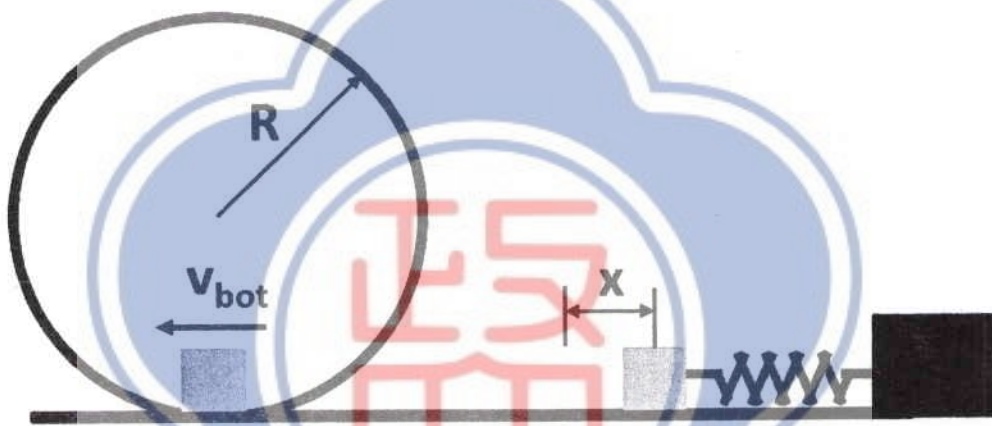
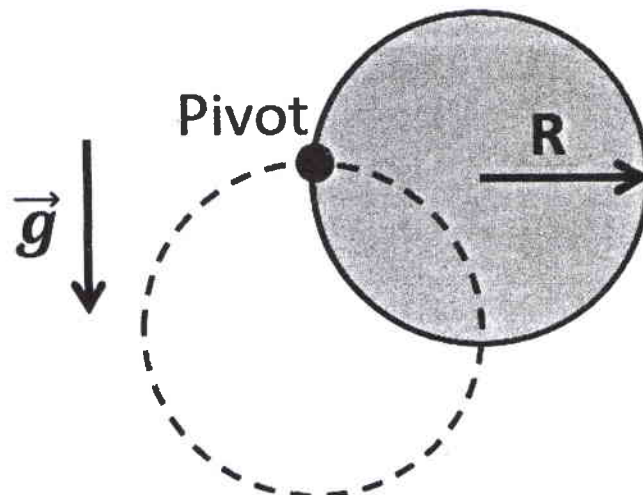


考試科目	普通物理	系所別	應用物理研究所	考試時間	2月18日(一)第一節
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1. (16%) A block of mass 0.50 kg is pushed against a horizontal spring of negligible mass until the spring is compressed a distance  $x$ . The force constant of the spring is 800 N/m. When it is released, the block travels along a frictionless, horizontal surface to the bottom of a vertical circular track of radius  $R = 0.50$  m, and continues to move up the track. The block's speed at the bottom of the track is  $v_{\text{bot}} = 10.0$  m/s, and the block experiences an average friction force of 5.00 N while sliding up the track. (a) What is  $x$ ? (b) If the block were to reach the top of the track, what would be its speed at that point? (c) Does the block actually reach the top of the track, or does it fall off before reaching the top? (d) What is the normal force exerted by the track on the block when the block reach top?

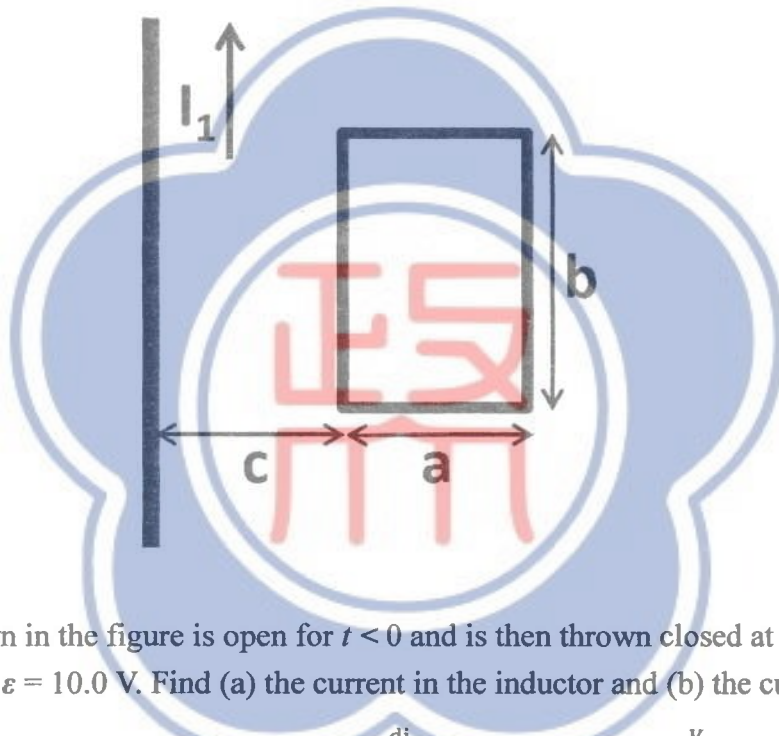


2. (16%) A uniform solid disk of radius  $R$  and mass  $M$  is free to rotate on a frictionless pivot through a point on its rim. If the disk is released from rest in the position shown by the copper-colored circle, (a) what is the moment of inertia of the disk about the pivot point? (if we know the moment of inertia of a disk is  $MR^2/2$ ) (b) What is the angular speed when the disk reaches the position indicated by the dashed circle? (c) What is the speed of the lowest point on the disk in the dashed position? (d) If the disk is replaced by a uniform hoop, what is the angular speed when the hoop reaches the position indicated by the dashed circle? (Answer the question in terms of  $g$ ,  $M$ , and  $R$ )

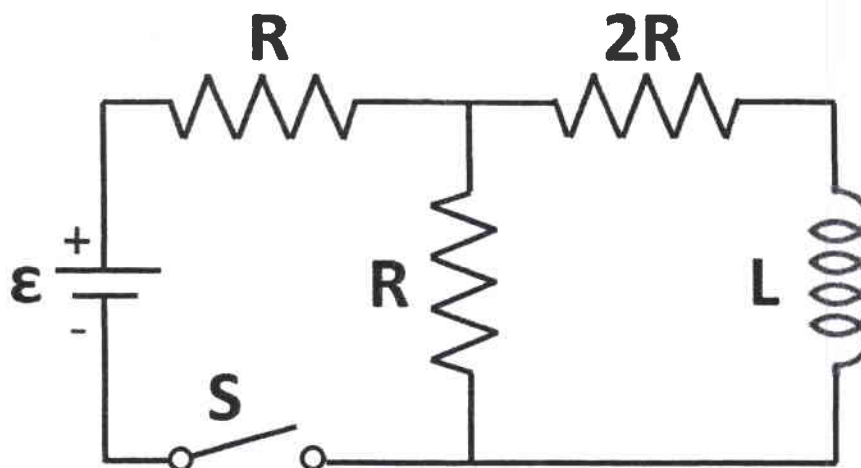


考試科目	普通物理	系所別	應用物理研究所	考試時間	2月18日(一)第一節
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3. (16%) In the figure, the long, straight wire carried a time varying  $t$  current  $I_1(t) = 5t$  (A). The wire lies in the plane of the rectangular loop, which is made of metal with resistance per meter of  $0.0693 \times 10^{-6}$  ( $\Omega/\text{m}$ ). The dimensions in the figure are  $a = 2$  m,  $b = 3$  m, and  $c = 2$  m. (a) Determine the magnetic flux through the loop due to the current  $I_1$ . (b) Find the current in the loop. (c) What is the direction of current in the loop? (d) Find magnitude and direction of the net force exerted on the loop by the magnetic field created by the wire at  $t=2$ s. Note  $\ln(2)=0.693$ .

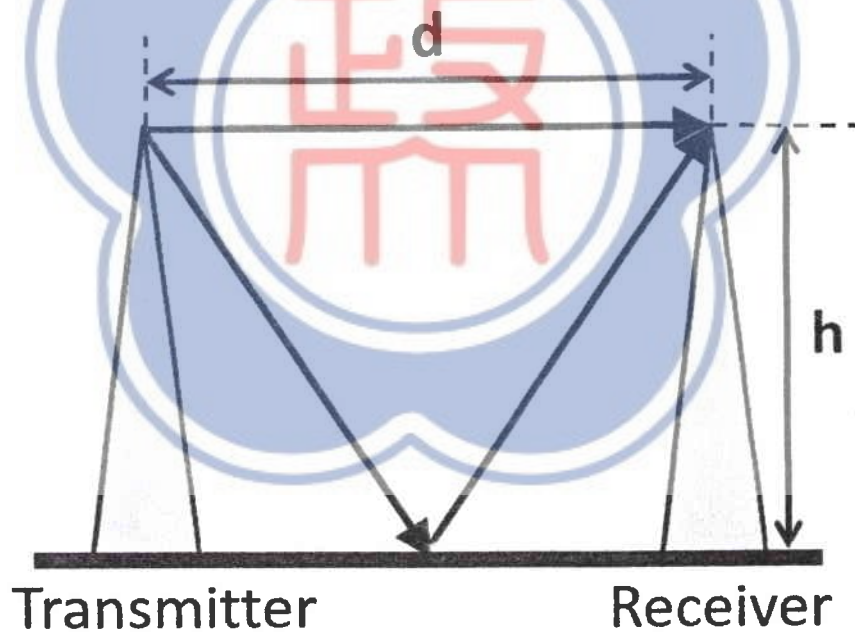


4. (20%) The switch shown in the figure is open for  $t < 0$  and is then thrown closed at time  $t = 0$ . Assume  $R = 4.00 \Omega$ ,  $L = 1.00$  H, and  $\mathcal{E} = 10.0$  V. Find (a) the current in the inductor and (b) the current in the switch as functions of time thereafter. (RL circuit:  $V - iR_{eq} - L \frac{di}{dt} = 0 \rightarrow i(t) = \frac{V}{R_{eq}}(1 - e^{-R_{eq}t/L})$ )



考試科目	普通物理	系所別	應用物理研究所	考試時間	2月18日(一)第一節
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5. (16%) A 1.00-m-radius circular mirror focuses the Sun's rays onto a circular absorbing plate 2.70 cm in radius, which holds a can containing 1.00 kg of water at 20.0°C. (a) If the solar intensity is 1370 W/m<sup>2</sup>, what is the intensity on the absorbing plate? At the plate, what are the maximum magnitudes of the fields (b)  $\vec{E}$  and (c)  $\vec{B}$  (d) If 40.0% of the energy is absorbed, what time interval is required to bring the water to its boiling point? Note the specific heat capacity of water is 4186 J/kg°C, the permeability in free space  $\mu_0 = 4\pi \times 10^{-7} \text{ Tm/A}$ , the speed of light in vacuum is  $3 \times 10^8 \text{ m/s}$
6. (16%) Figure shows a radio-wave transmitter and a receiver separated by a distance  $d = 96.0 \text{ m}$  and both a distance  $h = 36.0 \text{ m}$  above the ground. The receiver can receive signals both directly from the transmitter and indirectly from signals that reflect from the ground. Assume the ground is level between the transmitter and receiver and a 180° phase shift occurs upon reflection. Determine the longest wavelengths that interfere (a) constructively and (b) destructively



備

註

- 一、作答於試題上者，不予計分。
- 二、試題請隨卷繳交。