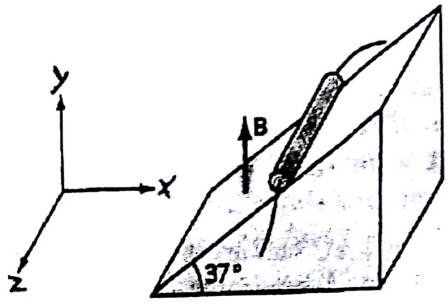
國立成功大學 107 學年度第一學期 普通物理期末考 A 卷

1. [Modern Physics]

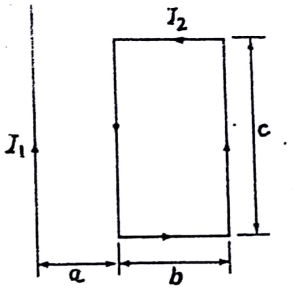
   (a) What assumptions did Plank make in dealing with the problem of blackbody radiation? Discuss the consequences of these assumptions. **(10 points)**

   (b) In the photoelectric effect, explain why the stopping potential depends on the frequency of light but not on the intensity. **(10 points)**

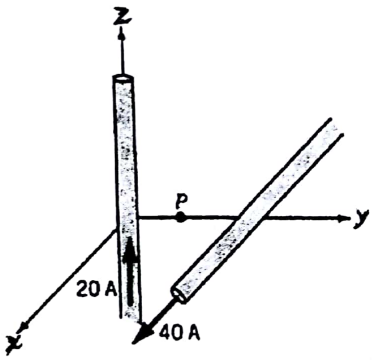
2. A rod of length $l = 20$ cm and mass $m = 60$ g lies on a plane inclined at 37° to the horizontal, as shown in right figure. A current enters and levels the rod via light flexible wires which we ignore. For what current (magnitude and direction) will the rod be in equilibrium in a magnetic field $\mathbf{B} = 0.25\,\mathbf{j}$ T. **(10 points)**



3. A long, straight wire and a rectangular loop lie in the same plane, as shown in right figure. The dimensions and current are indicated. Find the net force on the loop. **(10 points)**



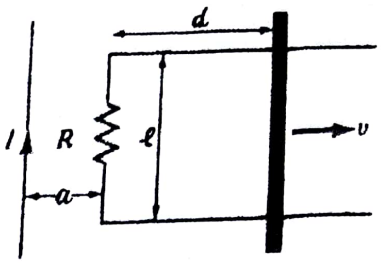
4. Two infinite straight wire lie parallel to the x and z axes respectively, as in the following figure. One wire lies along the z axis while the other is located at $y = 25$ cm. Find the resultant magnetic field at the point P, $y = 15$ cm. The directions and values of the currents are indicated. **(10 points)**



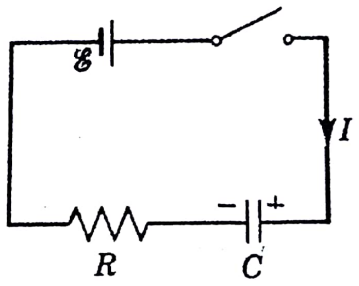
5. The plane of loop with dimension 12 cm × 20 cm is initially perpendicular to a uniform 0.2-T magnetic field. Find the ~~change~~ change in flux through the loop if it is turned through 120 about an axis perpendicular to the field lines. **(10 points)**

6. Find the induced emf in an inductor L when the current varies according to the following functions of time: (a) $I = I_0 \exp(-t/\tau)$; (b) $I = at - bt^2$, (c) $I = I_0 \sin(\omega t)$ **(10 points)**

7. A long, straight wire carries a constant current I = 15 A. A metal rod of length l = 50 cm moves at constant velocity on rails of negligible resistance that terminate in a resistor R = 0.05 Ω, as shown in right figure. Find the induced current in the resistor given a = 2 cm, d = 5 cm, and v = 25 cm/s. **(10 points)**

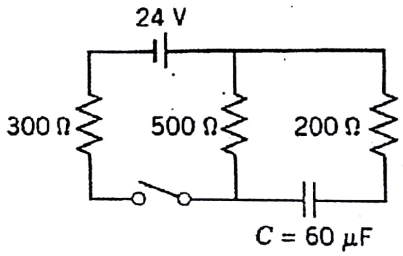


8. In an RC charging circuit (shown in right figure), ε = 400 V, $R = 2 \times 10^5$ Ω, C = 60 μF and Q = 0 at t = 0. Find: (a) the potential difference across C after one time constant; (b) the potential difference across R after one time constant; (c) the energy stored in C after 5 s; (d) the power loss in R after 5 s. **(10 points)**



9. A capacitor C = 20 μF has an initial charge of 60 μC. It is connected across an inductor L = 8 mH at t = 0. (a) What is the frequency of oscillation? (b) What is the maximum current through L? (c) What is the first time at which the energy is equally shared by C and L? **(10 points)**

10. (a) The switch in right figure is initially closed. What is the charge on the capacitor? (b) The switch is opened at t = 0. How long does it take for the charge on C to reach 35% of its maximum value? **(10 points)**



11. 感謝各位同學的配合，使得這一整學期的普通物理課程能順利進行，並讓我有機會在有限的時數內跟各位介紹物理的全貌。希望同學能利用最後的一些時間，將你對於這堂普通物理課程的感想，或是對我與課程內容的任何建議寫下，以作為我日後改進教學的參考，謝謝各位。 **(10 points)**

Note: Total 120 points; 各題計算過程需詳述，否則不與計分。