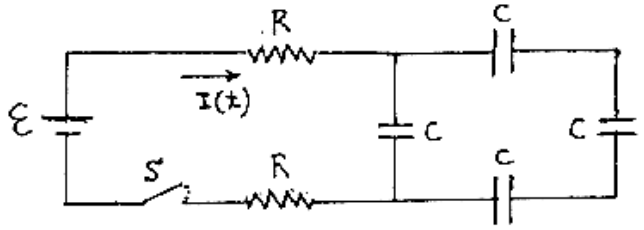
國立中央大學八十四學年度碩士班研究生入學試題卷

所別：太空科學研究所　　組　科目：普通物理　　共 1 頁 第 1 頁

參考用

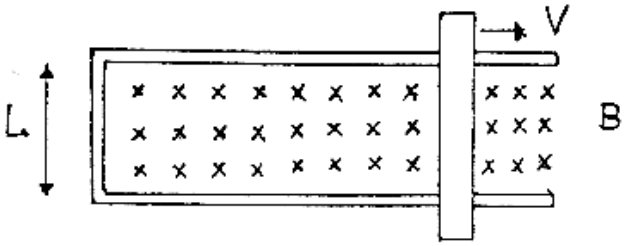
(1) 20 分

The switch S in the figure has been in open state for time $t < 0$. (a) What is the equivalent circuit for the combination as shown in the figure? (b) Let the switch S be closed at $t = 0$, and make the capacitors start to charge. Derive the current $I(t)$ through the resistors as a function of time.



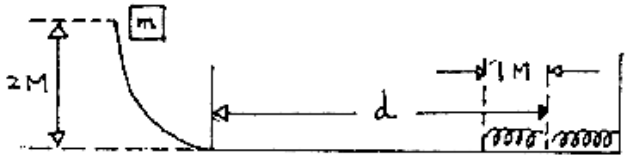
(2) 20 分

A rod with resistance R lies across frictionless conducting rails in a uniform magnetic field B, as shown. Assume the rails have negligible resistance. Calculate the force that must be applied by a person to pull the rod to the right at constant speed v.



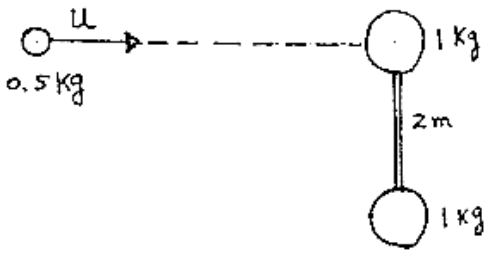
(3) 20 分

A block of mass $m = 5.0kg$ starts from rest and slides down a track which consists of a frictionless curved portion and a level portion along which the coefficient of kinetic friction between the block and the track $\mu_k = 0.2$. The block comes to rest momentarily after traveling a total distance d along the level portion, compressing a spring placed at the end by an amount $x = 1.0M$. If the spring is massless with a force constant $k = 4.9NM^{-1}$, find the distance d. Answer in M.



(4) 20 分

A particle of mass $M = 0.5kg$ moving at speed $u = 4m/s$ strikes a dumbbell consisting of two blocks of equal mass $M = 1kg$ separated by a massless rod of length $2\ m$ (see the figure). The dumbbell and the particle are free to slide on a horizontal surface. Find: (a) the speed of the center of mass of the system after the particle sticks to one of the blocks; (b) the angular velocity of the system about the center of mass.



(5) 20 分

What is the statement of the second law of thermodynamics in terms of (a) heat engine; (Kelvin-Planck statement); (b) refrigerator (Clausius statement); (c) entropy? Are these statements equivalent to one another?