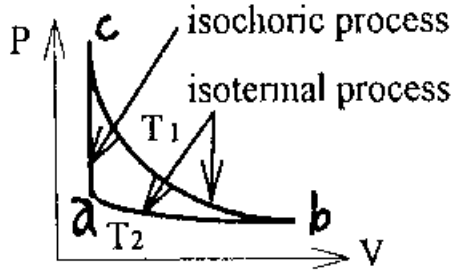
國立中央大學八十五學年度碩士班研究生入學試題卷

(1)請用熱力學第二定律證明,如下圖的熱力循環過程(a-b-c-a)中兩條等溫線(T_1,T_2)不可能有交點。(10%)

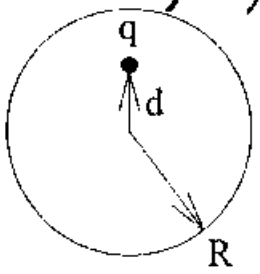


(2)寫出熱力學第一定律。問熱力系統中所謂的內能以何種方式儲存於系統中,請說明。(10%)

(3)請寫出電磁學的 Maxwell equations,並從 Maxwell equations 導出電磁場的波動方程。(10%)

(4)地磁的強度爲0.5G,我們假設在赤道上空地磁爲南北向均勻分佈,從宇宙射線的觀測中我們得知,因地磁的關係,在赤道附近,我們所能觀測到渺子(μ),其最小能量爲1.6×10^{-10}Joule,假設渺子以光速運動,〔渺子質量爲1.8×10^{-28}Kg且帶一正(或負)電荷〕。在此我們不考慮相對論,問從地表算起,赤道附近地磁所含蓋的垂直距離爲多少?(10%)

(5)金屬球殼的半徑爲R,一點電荷置於距離球心d(d<R)處,問球內的平均電場爲何(平均電場$\overline{E}=\int\vec{E}dV/\int dV$)?(10%)



(6) In the case of a one dimensional linear oscillation, the object is a point of mass m with damping coefficient b and a resonant frequency ω_o. Assume that the gravitational force is too small to be neglected.

a). Write down the equation of motion of this object. Explain clearly how and why each term in this equation should be like what you have written down. (5%)

b). If this object is pulled a distance L from its equilibrium position at time $t = 0$ and then released and free of any external forces, describe the motion of this object at time $t > 0$. Explain with physical meanings.(15%)

c). If this object is under an external force $F_o \cos \omega t$, describe how will the energies transforming among kinetic energy, potential energy, and whatever forms of energies after the force been applied for a very long time. (10%)

(7) In the case of a one dimensional simple harmonic oscillation without damping, assume the object is a point of mass m and have a resonant frequency ω_o. Disregard the gravitational force field.

a). How will you choose your generalized coordinates to describe this motion? Draw a graph to illustrate your choice. (5%)

b). Write down the Lagrangian and the Hamiltonian for this motion. Explain the physical meaning of your results. (10%)

c). Solve the Euler-Lagrange equation of motion for this system. (5%)