國立成功大學

114學年度碩士班招生考試試題

編　號：51

系　所：太空與電漿科學研究所

科　目：普通物理

日　期：0210

節　次：第 1 節

注　意：1.不可使用計算機
2.請於答案卷(卡)作答，於試題上作答，不予計分。

1. (5%) Explain the meaning of the unit electronvolt (eV) and describe how it differs from volt (V).
2. (5%) Calculate the temperature T (in K) corresponding to the energy of 1 eV.
3. (5%) Consider a photon with an energy of 1 keV. Calculate the corresponding wavelength of the electromagnetic wave.
4. (5%) Consider an electron with 2 MeV kinetic energy. Calculate its rest energy, total energy, momentum, and speed.
5. (10%) Consider an electron with 1 keV of kinetic energy moving perpendicularly to the lines of a uniform magnetic field (B=1 G). Calculate its cyclotron frequency and orbital radius.
6. (15%) In an RLC series circuit, $R = 9\ \Omega$, $C = 100\ \mu F$, $L = 0.04\ H$, The frequency of the alternating electromotive force is 50Hz, and its peak voltage is 100 V. Determine the circuit's impedance, phase angle, and voltage across each component.
7. (15%) A non-conducting plane of thickness d has a uniform volume charge density ρ. Derive the electric field distribution both inside and outside the plate.
8. (20%) Write down the four Maxwell equations and explain the physical meaning of each equation.
9. (20%) An ideal gas undergoes adiabatic expansion from an initial temperature T_1 to a final temperature T_2. Prove that the work done by the gas is $C_v(T_1 - T_2)$, where C_v is the specific heat at constant volume.

Useful constants

Planck's constant: $h = 6.626 \times 10^{-34}$ Js

Speed of light: $c = 3 \times 10^8$ m/s

Electron mass: $m_e = 9.1 \times 10^{-31}$ kg

Fundamental charge: $q_e = 1.6 \times 10^{-19}$ C

Boltzmann constant: $k_B = 1.38 \times 10^{-23}$ J/K