

國立臺灣師範大學 104 學年度碩士班招生考試試題

科目：普通物理

適用系所：科學教育研究所

注意：1.本試題共 1 頁，請依序在答案卷上作答，並標明題號，不必抄題。2.答案必須寫在指定作答區內，否則不予計分。

1. What is “Doppler Effect”? Derive the details and give some examples for its application. (10 points)
2. Explain what is “Carnot's Cycle” or “Carnot's Engine”. Plot the cycle in a **P-V** diagram. (15 points)
3. There is a thick metallic spherical shell with the inner radius = R_i and outer radius = R_o . The shell is charged with $+Q$.
 - (a) Where is the charge $+Q$ distributed? Calculate the surface or volume charge density. (5 points)
 - (b) Calculate and plot the electric field $\mathbf{E}(\mathbf{r})$ for $r=0 \sim \infty$. (Note: r is the distance to the center of this spherical shell.) (10 points)
 - (c) Calculate and plot the electrical potential $\Phi(\mathbf{r})$ for $r=0 \sim \infty$. (5 points)
4. What are (a) Simple Harmonic Oscillation and (b) Damped Oscillation? Derive the equations for the each case and explain the details. (20 points)
5. Write down the four Maxwell's Equations and explain their physical meaning respectively. (20 points)
6. Derive that the energy level E_n in a hydrogen atom is proportional to $1/n^2$, where $n=1, 2, 3, \dots$ is the index of energy level. (15 points)