國立中央大學 106 學年度碩士班考試入學試題

所別： 物理學系生物物理碩士班 不分組(一般生)　　共 1 頁 第 1 頁

科目： 普通物理

本科考試禁用計算器　　＊請在答案卷內作答

參考用

本次試題皆爲問答題，共有五大題，每題二十分.

1. (20pts) Please explain the phenomenon "resonance" in the physics of forced (driven) oscillations.

2. (20pts) The sound speed of air (treated as an ideal gas) is $v = \sqrt{\gamma P/\rho}$, where P is the atomospheric pressure, ρ is the mass density and $\gamma = 1.4$ is a dimensionless constant for a diatomic gas. (a) (10pts) Please show that the expression $\sqrt{\gamma P/\rho}$ gives the dimension (unit) of speed. (b) (10pts) Please estimate the sound speed of air at room condition (temperature T=300 K, $P = 1$ atm $= 1.01 \times 10^5$ Pa; your numerical answer needs at least one significant digit (one significant digit is OK)).

3. (20pts) In a heat-insulated container, n moles of ideal gas of and temperature T suddenly undergoes free expansion such that its volume changes from V to $2V$. What is its entropy change?

4. (20pts) Please explain about Young's experiment of double-slit interference.

5. (20pts) Consider a RC circuit, where a resistor (of resistance R) and capacitor (of capacitance C) is connected in series with a constant dc voltage source (of voltage V_0). (a) (7pts) Please write down the equation of state for this circuit. (b) (6pts) Please show that $q(t) = CV_0[1 - e^{-t/(RC)}]$ is an answer of your equation of state, where q represents the charge on one end of the capacitor. (c) (7pts) Please plot $q(t)$ versus time t (your sketch has to show its qualitative behavior).