國　立　清　華　大　學　命　題　紙

98 學年度＿＿＿＿生命科學院＿＿＿＿系（所）＿＿＿＿丙＿＿＿＿組碩士班入學考試

科目＿＿＿＿近代物理＿＿＿＿科目代碼＿0402＿共＿1＿頁第＿1＿頁 *請在【答案卷】內作答

1. (10%) What are the two basic postulates in the special theory of relativity suggested by Einstein?

2. (10%) Write down (without derivation) the energy eigenvalues of (a) a harmonic oscillator with angular frequency w, and (b) a molecular with moment of inertial I rotating about an axis passing through the center of mass.

3. (10%) Use the uncertainty principle to estimate the ground-state energy for a particle of mass m moving in the one-dimensional potential well $U(x) = k|x|$ where $k > 0$.

4. (10%) For a particle in a three-dimensional cube with volume L^3, the energy eigenvalues are

$$E(n_1, n_2, n_3) = \frac{\pi^2\hbar^2}{2mL^2}(n_1^2 + n_2^2 + n_3^2)$$

where n_1, n_2, and n_3 are the quantum numbers for the motions in three directions. What are the energy eigenvalues and the quantum numbers for the four lowest eigenstates?

5. (10%) A particle of mass M decays at rest into two particles with masses m_1 and m_2 where $M > m_1 + m_2$. Calculate the relativistic momentum of the particle with mass m_1.

6. (50%) Explain (a) Bose-Einstein condensation. (b) High-temperature superconductor. (c)Laser. (d) Josephson effect. (e) Black hole. (f) Stern-Gerlach experiment. (g) Photo-electric effect. (h) Compton scattering. (i) Antiparticle. (j) Hadron.