

# 國立清華大學 105 學年度碩士班考試入學試題

系所班組別：生命科學院丙組

考試科目（代碼）：近代物理(0602)

共\_\_1\_\_頁，第\_\_1\_\_頁 \*請在【答案卷】作答

1. (10%) Two spaceships, A and B, travel from earth to outer-space. An astronomer on earth observes that A and B travel in opposite directions with the same speed  $0.8c$  ( $c$  is the speed of light). What is the speed of A relative to B?
2. (10%) A particle with mass  $M$  is confined in a one-dimensional box between  $x=0$  and  $x=L$ . Apply Heisenberg's uncertainty relation to estimate the energy of this particle at the ground state. The answer is a function of  $M$ ,  $L$ , and the Planck's constant  $h$ .
3. (5%) What is the spin angular momentum of a photon (in unit of  $h/2\pi$ )?
4. (5%) A particle decays at rest with a lifetime of one hour. What is lifetime of this particle moving at a speed  $v=0.6c$ ?
5. (15%) A photon hits an electron at rest, producing an electron-positron pair:  
$$\gamma + e^- \rightarrow e^- + e^+ + e^-$$
  
Calculate the minimum energy of the incident photon. The electron mass is  $0.5\text{MeV}/c$ .
6. (15%) Consider a particle with mass  $m$  within a box with volume  $L^3$ . Write down the Schrodinger's equation and derive the quantized energy of the ground state.
7. (10%) Describe the experiment by Wu in 1956 which shows that parity is not conserved in beta decay. This experiment is so important that Lee and Yang got a Nobel Prize in 1957.
8. (30%) Explain (a) Einstein's principle of equivalence. (b) Red shift in astronomy. (c) Mossbauer effect. (d) Higgs particle. (e) Fermion.