

國立清華大學命題紙

99 學年度生命科學院丙組碩士班入學考試

科目 近代物理 科目代碼 0402 共 2 頁第 1 頁 *請在【答案卷】內作答

1. (5%) What is the spin angular momentum of a proton (in unit of $h/2\pi$)?
2. (10%) Consider the one-dimensional harmonic motion of a particle with energy

$$E = \frac{p^2}{2m} + \frac{kx^2}{2}.$$

Derive the ground-state energy from the Heisenberg's uncertainty relation $px \geq h/2\pi$ where h is the Planck's constant. Do not solve the Schrodinger equation.

3. (10%) Consider a particle with mass m within a cube with volume L^3 . Write down the Schrodinger equation and derive the quantized energy of the ground-state.
4. (5%) What is the relativistic momentum of a particle with rest mass m and speed $v = 0.8c$ (c is the speed of light)?
5. (5%) A particle decays at rest with a lifetime t_0 . What is the lifetime $t(v)$ of this particle moving at a speed of $v = 0.6c$ (c is the speed of light)?
6. (5%) The classical model of hydrogen atom where an electron moves in a circular orbit around a heavy proton is not correct. In the Bohr's model of hydrogen atom, he introduced a very important condition for the circular motion of electron. Explain Bohr's quantization condition.
7. (5%) Describe one experiment which indicates that parity conservation is violated.
8. (5%) Consider a particle with mass m and speed v . What is the de Broglie wavelength of this particle?

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9. (50%) Explain

- (a) Stefan's law of blackbody radiation.
- (b) Magic numbers of nuclei.
- (c) Chandrasekhar limit in astronomy.
- (d) Bragg equation.
- (e) Work function.
- (f) BCS theory.
- (g) Standard model of particle physics.
- (h) Bohr's correspondence principle.
- (i) Space quantization.
- (j) Curie's law.