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科目：近代物理
節次： 2

國立臺灣大學 109 學年度碩士班招生考試試題

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※ 注意：請於試卷內之「非選擇題作答區」依序作答，並應註明作答之大題及小題題號。

Prob. 1 (15%) Describe the research done by below persons in modern physics.

(a) Marie Curie (3%) (b) Wilhelm Röntgen (3%) (c) Ernest Rutherford (3%) (d) Hendrik Casimir (3%) (e) James Peebles, Michel Mayor, and Didier Queloz (3%).

Prob. 2 (18%) (a) Find the change in wavelength of 80 pm X-rays that are scattered 120^0 by a target. (6%) (b) Find the angle between the directions of the recoil electron and the incident photon. (6%) (c) Find the energy of the recoil electron. (6%) Hint: This is about the Compton effect.

Prob. 3 (18%) A beam of neutrons that emerges from a nuclear reactor contains neutrons with a variety of energies. To obtain neutrons with an energy of 0.05 eV, the beam is passed through a crystal whose atomic planes are 0.2 nm apart. At what angles relative to the original beam will the desired neutrons be diffracted?

Prob. 4 (18%) (a) Find the frequencies of revolution of electrons in $n = 1$ and $n = 2$ Bohr orbits. (6%) (b) What is the frequency of the photon emitted when an electron in an $n = 2$ orbit drops to an $n = 1$ orbit? (6%) (c) An electron typically spends about 10^{-8} second in an excited state before it drops to a lower state by emitting a photon. How many revolution does an electron in an $n = 2$ Bohr orbit make in 10^{-8} second? (6%)

Prob. 5 (15%) Starting from Schrodinger's equation find the number of bound states for a particle of mass 2200 electron mass in a square well potential of depth 70MeV and radius 1.42 $\times 10^{-13}$ cm.

Prob. 6 (16%) An atom has a single electron outside closed inner shells. (a) What total angular J can the atom have if it is in a P state? (8%) (b) What total angular J can the atom have if it is in a D state? (8%)

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