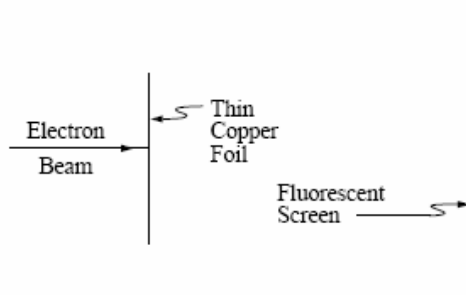


More Quantum Mechanics

Problem 1:



In order to observe a ring diffraction pattern on the screen shown above, which of the following conditions must be met?

- (A) The electron beam must be polarized.
- (B) The electron beam must be approximately monoenergetic.
- (C) The copper foil must be a single crystal specimen.
- (D) The copper foil must be of uniform thickness.
- (E) The electron beam must strike the foil at normal incidence.

Problem 2:

The anomalous Zeeman effect results from

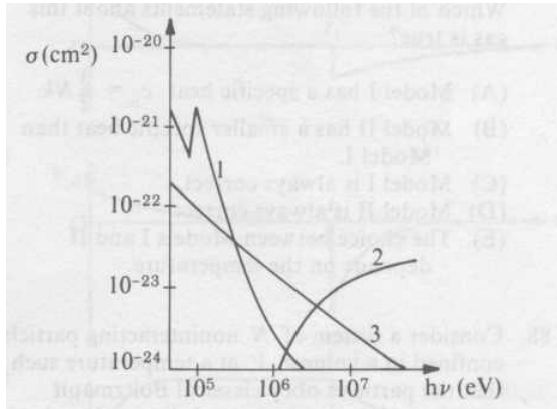
- (A) a nonuniform applied magnetic field
- (B) more than one isotope being present
- (C) a magnetic moment arising from electron spin
- (D) a nuclear quadrupole moment
- (E) forbidden atomic transitions

Problem 3:

Sodium has eleven electrons and the sequence in which energy levels fill in atoms is $1s$, $2s$, $2p$, $3s$, $3p$, $4s$, $3d$, etc. What is the ground state of sodium in the usual notation $^{2S+1}L_J$?

- (A) 1S_0
- (B) $^2S_{\frac{1}{2}}$
- (C) 1P_0
- (D) $^2P_{\frac{1}{2}}$
- (E) $^3P_{\frac{1}{2}}$

Problem 4:



The figure above shows the photon interaction cross sections for lead in the energy range where the Compton, photoelectric, and pair production processes all play a role. What is the correct identification of these cross sections?

- (A) 1 = photoelectric, 2 = Compton, 3 = pair production
- (B) 1 = photoelectric, 2 = pair production, 3 = Compton
- (C) 1 = Compton, 2 = pair production, 3 = photoelectric
- (D) 1 = Compton, 2 = photoelectric, 3 = pair production
- (E) 1 = pair production, 2 = photoelectric, 3 = Compton

Problem 5:

A transition in which one photon is radiated by the electron in a hydrogen atom when the electron's wave function changes from ψ_1 to ψ_2 is forbidden if ψ_1 and ψ_2

- (A) have opposite parity
- (B) are orthogonal to each other
- (C) are zero at the center of the atomic nucleus
- (D) are both spherically symmetrical
- (E) are associated with different angular momenta

Problem 6:

The ground-state energy of positronium is most nearly equal to

- (A) -27.2 eV
- (B) -13.6 eV
- (C) -6.8 eV
- (D) -3.4 eV
- (E) 13.6 eV