1.(a) Describe the photoelectric process. (10%)
   (b) Prove that the photoelectric process for a free electron
       is not possible. (10%)

2. Suppose that the wave function at t=0 for a particle in a one-
   dimensional box is given by

$$\Psi(x,0) = \frac{1}{\sqrt{a}}(\cos\frac{\pi x}{a} + \sin\frac{2\pi x}{a})$$

   where a is denoted the length of the box.

   (a) What is the subsequent form of the wave function $\Psi(x,t)$? (10%)
   (b) Calculate the probability density and interpret the result.(10%)
   (c) Evaluate the expectation values of position x and momentum p.
       (10%)

3. Calculate the orientations of the spin vector $\vec{S}$ with respect to
   a magnetic field direction. (20%)

4. Explain (a) Stern-Gerlach experiment, (b) normal Zeeman effect,
   (c) exclusion principle and periodic table. (30%)