1. (20%) Describe below in brief.
(a) Casimir effect
(b) Franck-Hertz experiment
(c) Correspondence principle
(d) Selection rules
(e) Fluorescence
(f) Vacuum fluctuations
(g) Bose-Einstein condensate
(h) Brillouin zones
(i) Pair production
(j) SQUID

2. (20%) Derive the equation for Compton effect.

3. (20%) A particle of mass m moves in a two-dimensional potential well, $V(x, y) = 0$ for $0 < x < a$ and $0 < y < a$, with walls at $x = 0$, $x = a$, $y = 0$, and $y = a$. Obtain the energy eigen functions and eigen values.

4. (15%) (a) What are the possible values of **L** for a system of two electrons whose orbital quantum numbers are $l_1 = 1$ and $l_2 = 3$?
(b) What are the possible values of **S**?
(c) What are the possible values of **J**?

5. (15%) The Fermi energy in silver is 5.51 eV.
(a) What is the average energy of the free electrons in silver at 0 K?
(b) What temperature is necessary for the average molecular energy in an ideal gas to have this value?
(c) What is the speed of an electron with this energy?

6. (10%) A measurement establishes the position of a proton with an accuracy of ± 10 pm. Find the uncertainty in the proton's position 0.1 second later. Assume $v << c$.

試題隨卷繳回