

參  
考  
用

(1) Calculate

- (a) the power received from the sun at the earth, (5%)
- (b) the total power radiated by the sun, (5%)
- (c) the temperature of the sun ? (5%)

[ the solar energy received at the earth at normal incidence is  $S = 1350 W / m^2$ ,  
the radius of the earth's orbit is  $R = 1.5 \times 10^{11} m$ ,  
the radius of the sun is  $r_s = 6.96 \times 10^8 m$ ,  
the radius of the earth is  $r_e = 6.378 \times 10^6 m$ ,  
the Stefan-Boltzmann constant is  $\sigma = 5.67 \times 10^{-8} W / m^2 / K^4$ .]

(2) A photon of frequency  $\nu$  is scattered, after colliding with an electron initially at rest, through an angle of  $90^\circ$ . Find the frequency  $\nu'$  after being scattered in terms of the original frequency  $\nu$ . (15%)

(3) A particle of mass  $m$  moves in a one-dimensional harmonic

$$\text{potential } V(x) = \frac{1}{2} \kappa x^2,$$

- (a) What is its time-dependent Schrödinger equation ? (5%)
- (b) Show that  $\Psi(x) = A \exp(-\alpha x^2)$  is a solution of Schrödinger equation provided that  $\alpha$  has a particular value. (10%)
- (b) Deduce the corresponding value of the energy  $E$  of the particle, expressing it in terms of oscillating frequency  $\nu$  of a classical particle of mass  $m$  moving under the influence of a spring with spring-constant  $\kappa$ . (10%)

(4) What is a photon ? (15%)

(5) Explain the uncertainty principle. (15%)

(6) Describe the periodic table of the elements. (15%)