Exercise of Chapter One

1) By using the classical methods, show that for an electron in hydrogen atom;
   a) The potential energy is $V(r) = -\frac{1}{4\pi\epsilon_0}.\frac{e^2}{r}$
   b) The total energy is $E = -\frac{1}{8\pi\epsilon_0}.\frac{e^2}{r}$
   c) What is the physical meaning of the minus sign in (a) and (b)

2) An electron in hydrogen atom in its first orbit,
   a) Show that the radius is $r_1 = 0.53\ A^o = 0.53\times10^{-10}$ m.
   b) Calculate its angular and linear velocity.
   c) Prove that the electron velocity (v) to the light velocity (c) ratio is about 7×10^{-3} /n.

3) Compute the De Broglie wave length for,
   a) A projectile having a mass 1.0×10^{-3} kg and its velocity is 3×10^7 m/s.
   b) Electron accelerated by a potential difference 100V.

4) Show that the length of De Broglie wave associated with an electron accelerated from the rest is ; $\lambda = 12.27/\sqrt{V}$ $(A°)$.

5) Discuss the statement "Photons is the basic constituents of radiation".

6) Calculate the number of photons that will make up 6.625 J of energy for a radiation having frequency 10^{17} Hz.

7) With what velocity must an electron travel so that its momentum is equal to that of a photon with wavelength of $\lambda = 5200\ A^o$.

8) Discuss the equation $2\pi r_n = n\lambda_n$.

9) What is the physical meaning of the following equations?
   a) $\Delta\varphi\,.\,\Delta L_x \geq \hbar$
   b) $\Delta E\,.\,\Delta t \geq \hbar$

10) Use the equation $\Delta x\,.\,\Delta p_x \geq \hbar$ to obtain the equation $\Delta E\,.\,\Delta t \geq \hbar$