Set #1

1. In the Bohr's model of the H atom, give an expression for:
   a. the electron speed as a function of the orbit radius.
   b. the total energy as a function of the orbit radius.

2. How many different photons could be emitted upon a transition from the n=5 down to the fundamental n=1 of an H atom. Compute the exact frequency for one of the transitions.

3. A commercial (green) laser pointer has a max/output power $P \leq 1\ mW$ and a beam spot $w_o = 1.1\ mm$. If $\lambda = 532\ nm$ is the light source wavelength, compute the (1.) pointer photon's flux and (2.) the number of photons emitted in 10 sec when you purposely cover half of the exit hole with your finger. (Neglect divergence).

4. a. Give the potential energy of a charge q_2 located at $\mathbf{r}_2$ due to the presence of a charge q_1 located at $\mathbf{r}_1$.
   b.Derive the force exerted on the charge q_2 as due to the charge q_1.
   c.Discuss the two charge possibilities.
   d. Apply the above results to the case of an electron placed at a distance r from a nucleus of a H atom (Bohr's model).
   e.Redo part d. for a nucleus of charge Ze.

Extra.

In a photoelectric experiment *Ca* is used as photocathode and the following values of stopping potential V_s vs. wavelength λ are measured:

λ, Å	2536	3132	3650	4047
ν, Hz $\times 10^{15}$	1.18	0.958	0.822	0.741
V_s, V	1.95	0.98	0.50	0.14

Calculate the Planck constant $\hbar$ and the work function Φ.