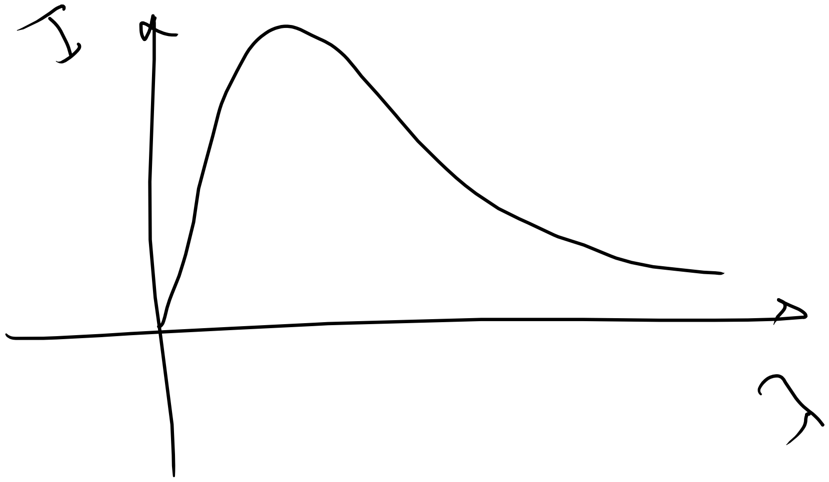
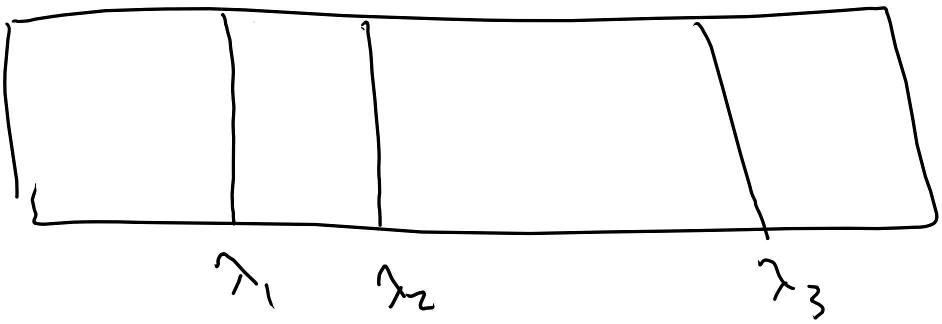
Gas

dielectric strength



line spectrum



Balmer Series: $\frac{1}{\lambda} = R_H\left[\frac{1}{2^2} - \frac{1}{n^2}\right]$

Hydrogen

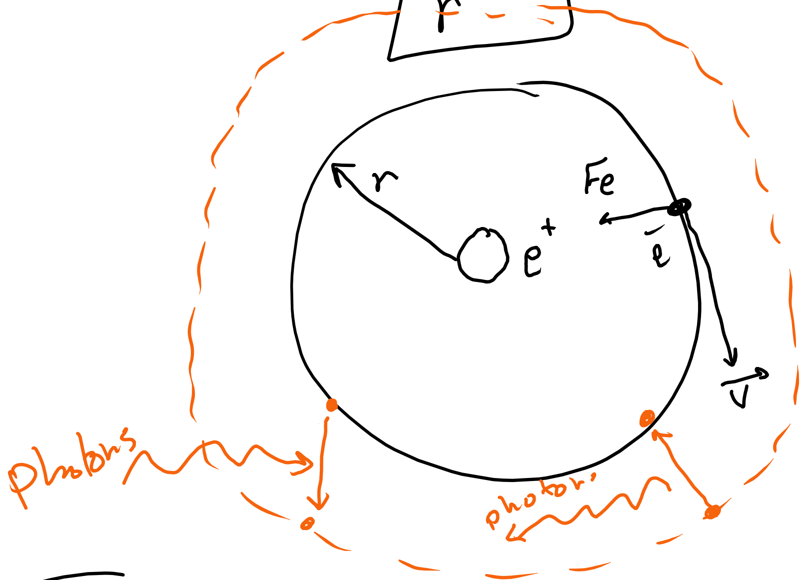
n: 3, 4, 5, 6, ...

R_H : $1.09 \times 10^7\ m^{-1}$

Bohr's Model of the H atom:

$$F_e = \boxed{\frac{k_e e^2}{r^2}} = m_e a = \boxed{m_e \frac{v^2}{r}}$$

$$\boxed{v = \sqrt{\frac{k_e e^2}{m_e r}}}$$



The electron stays in a stationary orbit ⇒ there is no Energy loss!

High-energy state → lower-energy state ⇒ radiation

lower-energy → high-energy ⇒ absorb

$$E_i - E_f = hf$$

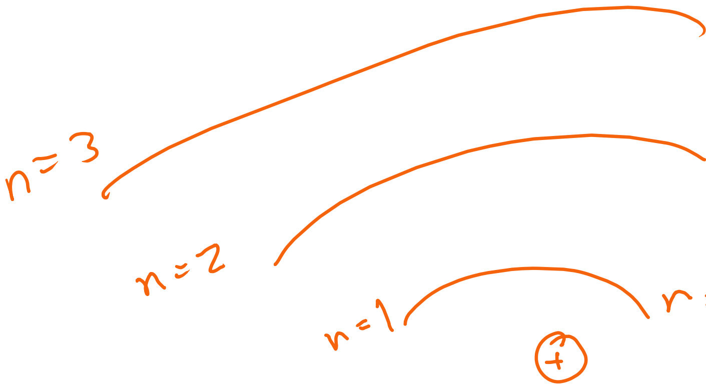
$$r = n^2 a_0 \quad ; \quad n = 1, 2, 3, \ldots$$

$\boxed{\text{quantized}}$

$a_0 \to 0.0529$ nm

$a_0, 4a_0, 9a_0, \ldots$

$$E_n = \frac{-13.606}{n^2}\ eV \ ; \ n = 1, 2, 3, \ldots$$



$r = 4a_0$, $E_2 = \frac{-13.606}{4} = -3.405$

$r = a_0$, $E_1 = -13.606$

$$E_i - E_f = hf \Rightarrow f = \frac{E_i - E_f}{h}$$

$$\Rightarrow \lambda = \frac{c}{f}$$

$$\frac{1}{\lambda} = R_H \left[\frac{1}{n_f^2} - \frac{1}{n_i^2} \right]$$

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other atoms:

$C \rightarrow$ 6 electrons
6 protons

carbon

$$r_n = n^2 \frac{a_0}{Z} \ ; \ E_n = \frac{-13.606}{n^2} Z^2$$

$Z \rightarrow$ atomic number

Quantum Numbers:

C → 6 electrons
↓
carbon

4 quantum numbers: (QN)

1) n (shell) : principal QN ; 1, 2, 3, 4, ...

2) ℓ (subshell) : orbital QN ; $\ell = 0, 1, 2, \ldots, n-1$

3) m_ℓ : magnetic orbital QN
$m_\ell = -\ell, \ldots, 0, \ldots, \ell$

4) m_s : spin number $m_s = +\frac{1}{2}, \frac{-1}{2}$

$n = 3$ (18 electrons)

ℓ:	0	1	2
m_ℓ:	0	-1, 0, 1	-2, -1, 0, 1, 2
m_s:	$+\frac{1}{2}$, $\frac{-1}{2}$	$+\frac{1}{2}$ $\frac{-1}{2}$, $+\frac{1}{2}$ $\frac{-1}{2}$, $+\frac{1}{2}$ $\frac{-1}{2}$	

$$\# \text{ of electrons} = 2n^2$$

$\ell \Rightarrow L = \sqrt{\ell(\ell+1)}\;\hbar \; ; \; \hbar = \frac{h}{2\pi}$

$\downarrow \quad = m_e v r$

angular momentum

$\Rightarrow \cos\theta = \frac{L_z}{L} = \frac{m_\ell}{\sqrt{\ell(\ell+1)}}$

$m_\ell \Rightarrow L_z = m_\ell \hbar$; z component of L

$m_s \Rightarrow S = \sqrt{m_s(m_s+1)}\;\hbar = \frac{\sqrt{3}}{2}\hbar$

spin angular momentum $\rightarrow S_z = m_s \hbar = \pm\frac{1}{2}\hbar$

N $\Rightarrow$ 7 electrons $\quad 2n^2$

Hund's $\rightarrow$ $n \;\ell\; m_\ell$

carbon 6

n = 1

ℓ: 0

m_ℓ: 0

m_s: $+\frac{1}{2}$ $\quad -\frac{1}{2}$

$\boxed{2}$

n = 2

ℓ: 0 $\quad$ 1

m_ℓ: 0 $\quad$ -1 $\quad$ 0 $\quad$ 1

wrong

$\boxed{2}$

2,0,0 $\quad$ 2,1,-1 $\quad$ 2,1,0 $\quad$ 2,1,1 $\rightarrow n \;\ell\; m_\ell$

n = 3