

# -TIMELINE-

## 1. Dalton (Doesn't have experiment)

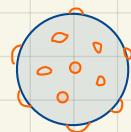
### Theory

1. All matter consists of atoms. ✗
2. Atom of one element cannot be converted into atoms of another element. ✗
3. Atom of an element are identical in mass and other properties and are different from atoms of any other element. ✗
4. Compounds result from the chemical combination of a specific ratio of atoms of different elements. ✓ (สารเคมี = ธาตุที่มีส่วนร่วมกัน)

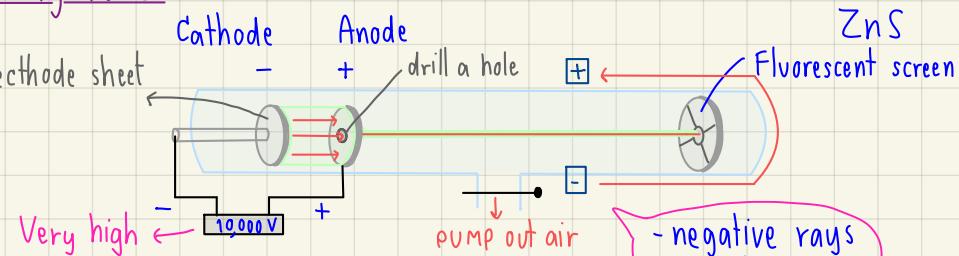
## 2. Thomson

### Cathode ray tube → from William Crookes

$$\frac{e}{m} = 1.76 \times 10^8 \text{ c/g}$$

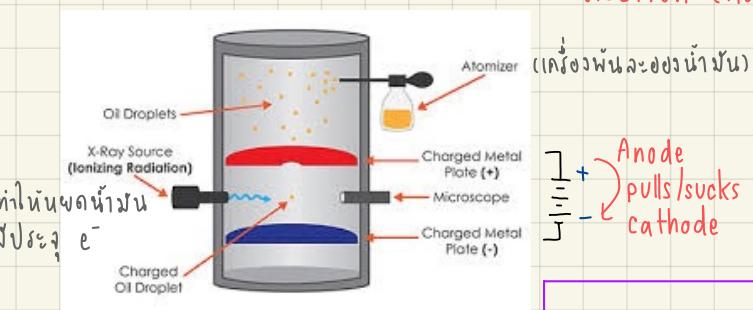


from  
-Electrode sheet  
-e⁻ from air



Note:  
Thomson → Found e⁻  
 $\frac{e}{m}$   
Millikan → Mass of e⁻

## 3. Millikan (Oil-drop experiment) → can calculate electron charge



Electrons will be attached to the oil droplets. Oil droplets fall under the gravity of the Earth and then pass electricity into it, until the oil drop stopped which shows that the gravity of the Earth = electric force and calculates the charge out.

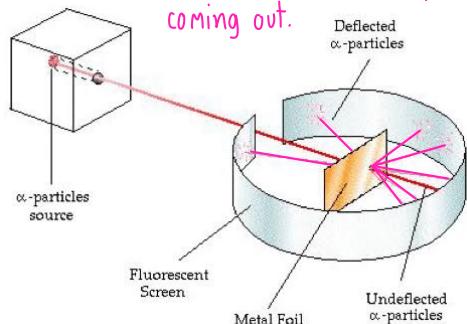
$$e = 1.6 \times 10^{-19} \text{ C}$$

$$\text{Mass of } e^- = 9.41 \times 10^{-28} \text{ g.}$$

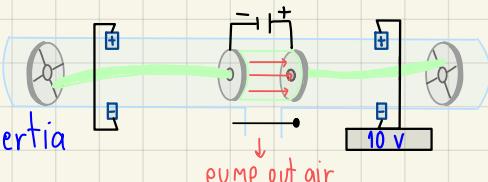
## 4. Rutherford

There are ricochet particles coming out.

∴ Thomson wrong!!



deviate α inertia



Chadwick

Firing alpha particles at the elements, it turned out to be a particle with mass close to the mass of a proton and without electrical charge, the neutron.

## IMPORTANT

### SUMMARY

p⁺ was found by Goldstein

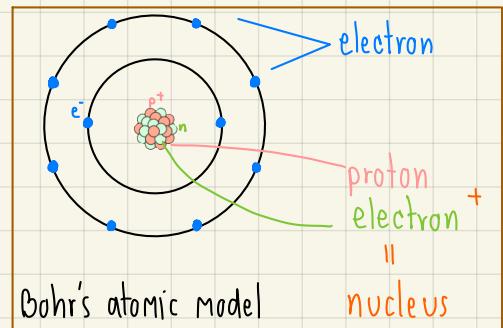
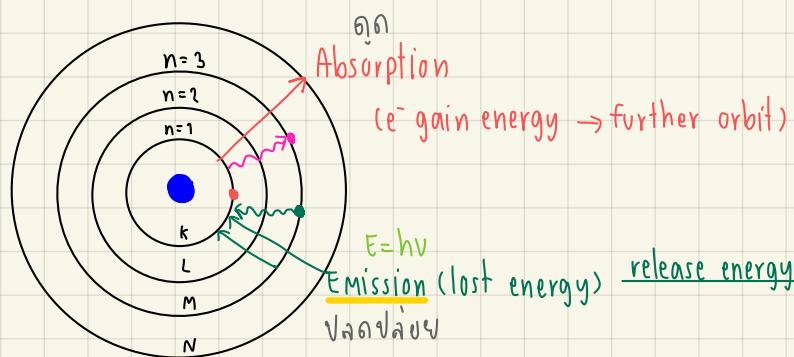
n was found by Chadwick → Co. with Rutherford

e⁻ was found by Thomson

# ATOMIC SPECTRUM

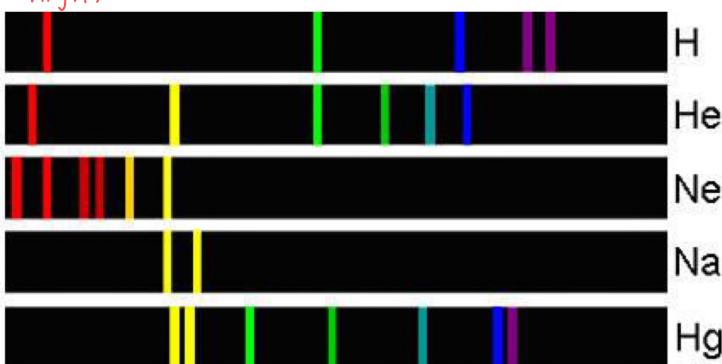
→ from Bohr's atomic model

↳ Release energy → spectrum

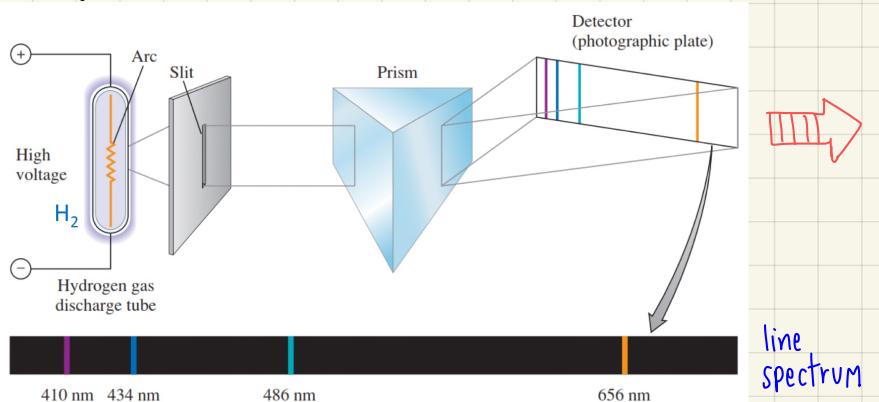


Different element Different spectrum → visible light

(λ high)  $E \propto V$  (E high, V high)



## HYDROGEN



formula

$$\lambda \nu = c$$

$$E_J = h\nu$$

$$E_J = \frac{hc}{\lambda}$$

$$c = 3 \times 10^8 \text{ m/s}$$

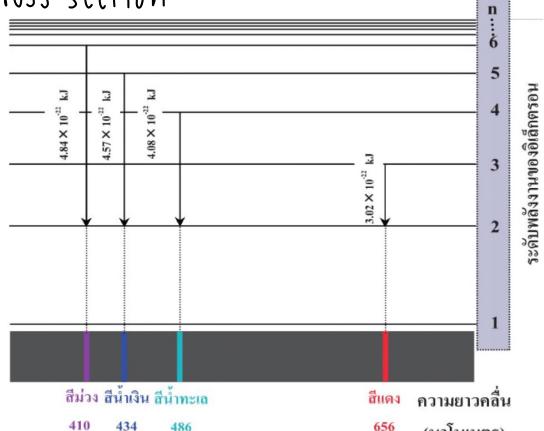
$$h = 6.626 \times 10^{-34} \text{ J.s}$$

$\nu$  = frequency (Hz)

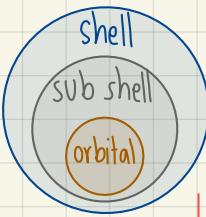
$E$  = Energy (kJ)

$\lambda$  = Wavelength (nm)

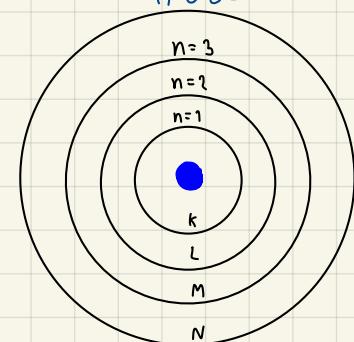
Cross section



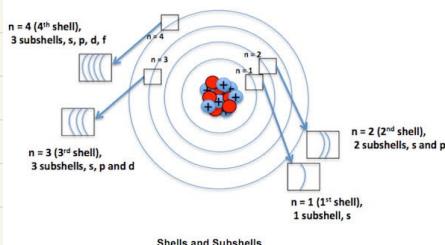
# Electron cloud atomic model



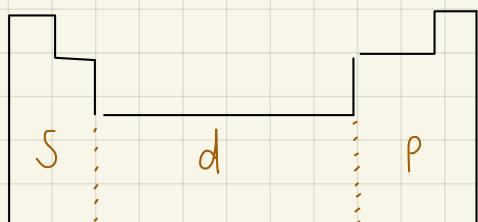
## SHELL



## SUB SHELL



## ORBITAL



► Number of  $e^-$  in each level

$$= 2n^2$$

► Max.  $e^-$  in each level

$$K = 2 \quad (2 \times 1^2)$$

$$L = 8 \quad (2 \times 2^2)$$

$$M = 18 \quad (2 \times 3^2)$$

$$N = 32 \quad (2 \times 4^2)$$

$$O = 50 \quad (2 \times 5^2)$$

$$P = 72 \quad (2 \times 6^2)$$

$$Q = 98 \quad (2 \times 7^2)$$

► Sub shell (Max.  $e^-$ ) orbital

$$S = 2 \quad ( ) + 4$$



$$P = 6 \quad ( ) + 4$$



$$D = 10 \quad ( ) + 4$$



$$F = 14 \quad ( ) + 4$$



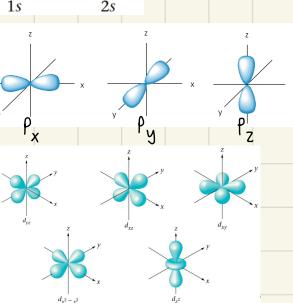
$$G = 18 \quad ( ) + 4$$



s-orbital



p-orbital



d-orbital

► Ex.  $_{11} \text{Na} \rightarrow 1s^2 2s^2 2p^6 3s^1$



► Ex.  $_{11} \text{Na} \rightarrow 2 \underline{8} 1$

K ( $n=1$ ) 2

L ( $n=2$ ) 8

M ( $n=3$ ) 18

N ( $n=4$ ) 32

O ( $n=5$ ) 50

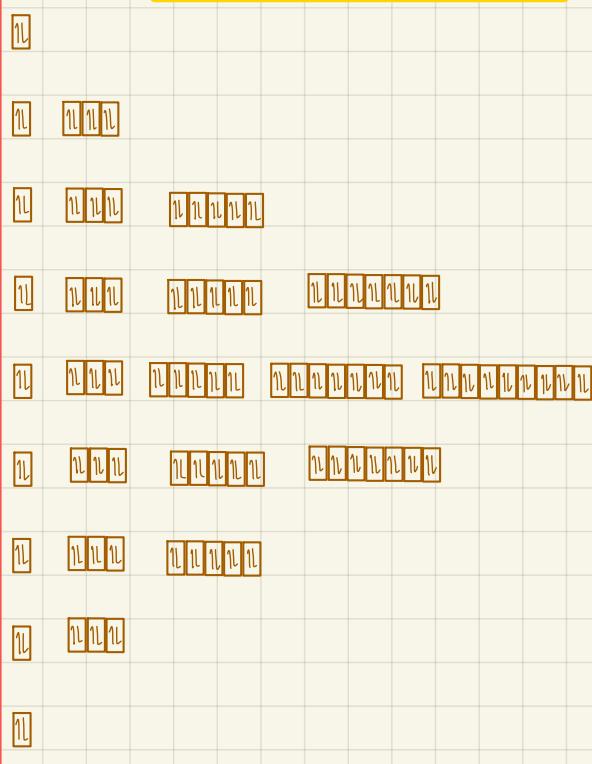
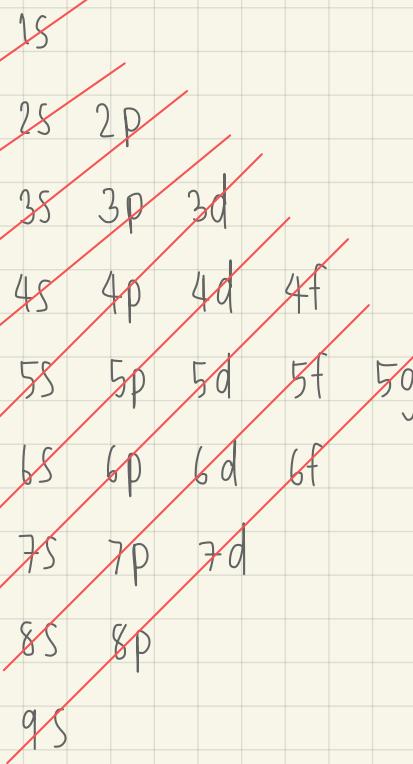
P ( $n=6$ ) 72

Q ( $n=7$ ) 98

R ( $n=8$ )

S ( $n=9$ )

► Ex.  $_{11} \text{Na} \rightarrow 1s^2 2s^2 2p^6 3s^1$



EXCEPT

$\text{Cr} \rightarrow 1s^2 2s^2 2p^6 3s^2 3p^6 4s^1 3d^5$  stably

24

$\text{Cu} \rightarrow 1s^2 2s^2 2p^6 3s^2 3p^6 4s^1 3d^9$  stably

29

- โครงสร้าง e<sup>-</sup> แบบชั้นๆ

↳ ธาตุที่มี 8

เลขประดิษฐ์	ชื่อ	จำนวน
2	He	1
10	Ne	2
18	Ar	3
36	Kr	4
54	Xe	5
86	Rn	6
118	Og	7

ตั้งมาตรฐาน 1 ตัว

เพื่อให้ d เส็จจะ

(โดย d จะเส็จจะที่ 5 ห้อง 10 )

half full



→ สุดค่าบ 3

(นัย) : ในโครงสร้าง e<sup>-</sup> ของ s และ d มากกว่ากัน

$$\therefore 1+5=6 \text{ B}$$

แต่จะไปอยู่ใน หน่วย B (กลุ่ม Transition)  $\therefore 6 \text{ B}$

(ค่าบ) : จำนวนค่าบ = 4



→ สุดค่าบ 3

เพื่อให้ d เส็จจะ

(โดย d จะเส็จจะที่ 5 ห้อง 10 )

half full

(นัย) : ในโครงสร้าง e<sup>-</sup> ของ s และ d มากกว่ากัน

$$= 1+10=11$$

ตาม transition

$$\begin{array}{l} \text{ถ้า } 11 = 1 \text{ B} \\ \text{ถ้า } 12 = 2 \text{ B} \end{array}$$

$\therefore 1 \text{ B}$

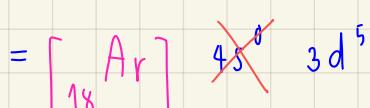
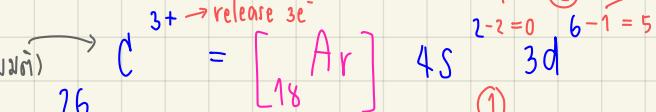
(ค่าบ) : จำนวนค่าบ = 4

Transition  
ตั้ง Atomic number  
21-30

- โครงสร้าง e<sup>-</sup> ของไออกอน → จัดเป็น 1 ชั้น แล้วคือ ชั้นๆ ไออกอน

Ex.3 (จัดที่แบบชั้นๆ และไออกอน)

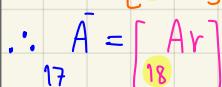
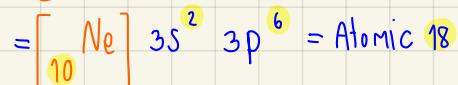
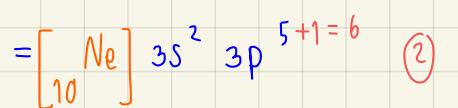
(ธาตุสมมติ)



Ex.4 (จัดที่แบบชั้นๆ และไออกอน)

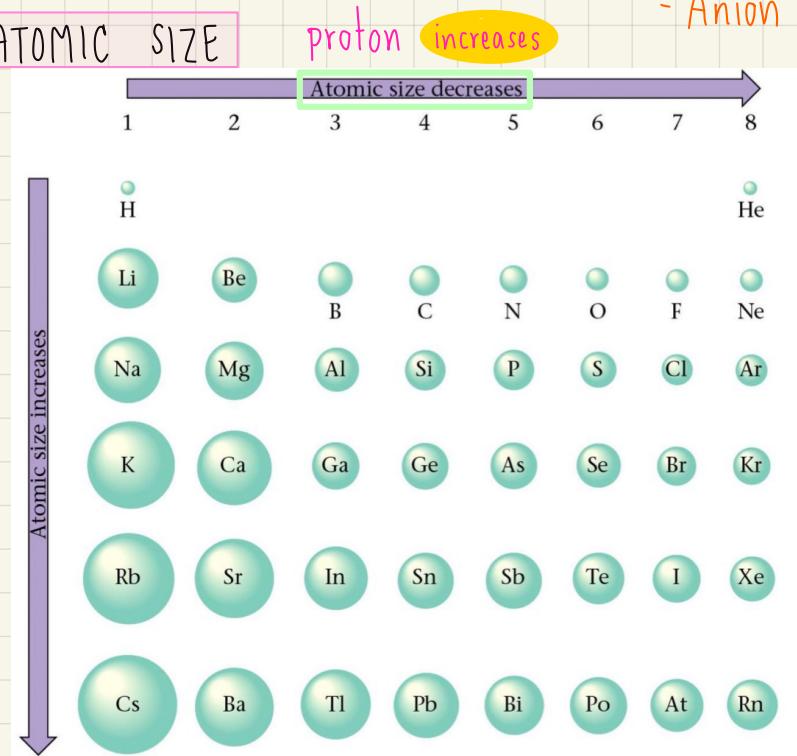


→ สุดค่าบ 2



## ATOMIC SIZE & IONIC SIZE

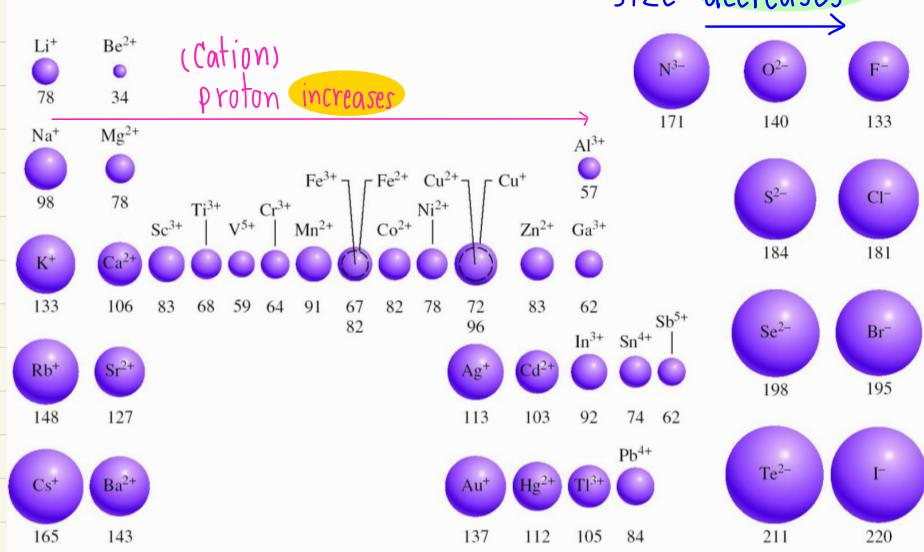
- Cation is always smaller than atom.
- Anion is always larger than atom.



## energy level

increases

## IONIC SIZE (RADII)



Size increases  
because shell increases

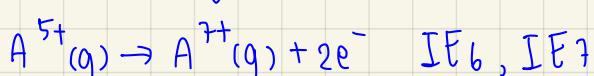
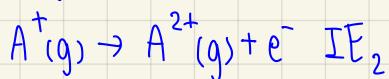
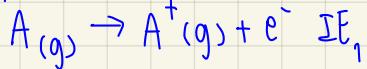
**IONIZATION ENERGY**  $\Rightarrow$  Concept: 

- » Outer shell is easy to fall out and use low IE
- » Inner shell is hard to fall out and use high IE

pulls  $e^-$  out of atoms (in gas form)  $\downarrow$  Inner shell is more stable than outer shell because they near the nucleus

IF crossing the shell, it will more difficult to fall out.

Symbol:



Ex. Al 283

$$IE_1 = 0.584$$

$$= 11.584$$

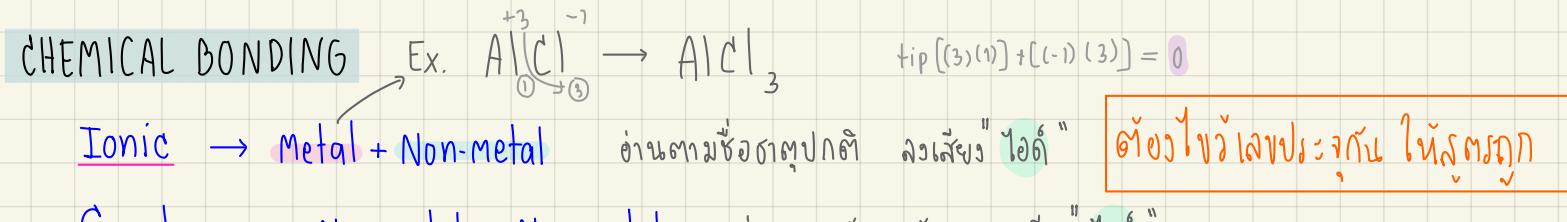
$\triangleright$   $IE_1, IE_2, IE_3$  are in the same shell, IE are close to each other.

$\triangleright$   $IE_3$ ,  $IE_4$  are in different shell.

IE increase a lot.

$$\text{IE}_4 > \text{IE}_3 \approx 5 \text{ times}$$

11.584    2.751



1 - Mono

2 - di

3 - Tri

4 - Tetra

5 - Penta

6 - Hexa

7 - Hepta

8 - Octa

9 - Nona

10 - deca

ex.  $\text{CO}_1 \Rightarrow \text{Carbon monoxide}$

ตัวนี้ห้ามเป็น 1 {  
ไม่ใช่ mono }  $\text{PCl}_3 \Rightarrow \text{Phosphorus trichloride}$

$\text{N}_2\text{O}_1 \Rightarrow \text{Dinitrogen monoxide}$

ตามตัวนี้ก็จะ เสือดาวธาตุคับ ผิดจะนัก!

ใช้ตัวง่ายๆ เลยปะ!

### OTHER NOTES

4  
 $\text{Be}$   
9.012

→ เลขอะตอม (Atomic number) = จำนวน proton

→ ธาตุ (Element)

จำนวน proton = electron

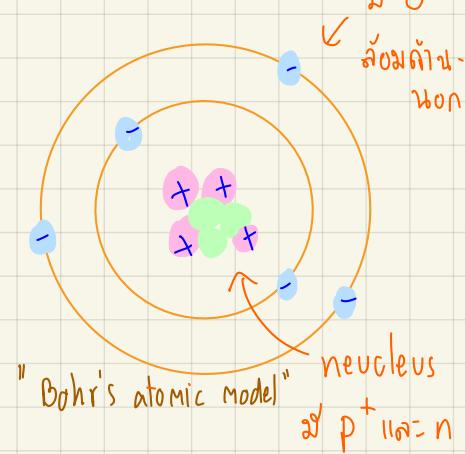
$e^-$

เลขมวล (Atomic Mass) amu = จำนวน proton + neutron

การคำนวณ AMU แยกน้ำหนักมวลของแต่ละธาตุ แล้วมาบวกกัน

เช่น  $\text{CO}_2 \rightarrow$  เลขมวล C (carbon) = 12  
→ เลขมวล O (oxygen) = 16

$$\begin{aligned} \text{CO}_2 &= 12 + 2(16) \\ &= 12 + 32 = 44 \text{ amu} \end{aligned}$$



### การเขียน Atomic Notation

(Nuclear)  
4  
 $\text{Be}$   
9.012

ส่วนในวงลูปเป็นเลขลงตัว  
9.012 → 4 Be ตั้งนั้น →

→ เลขมวล ( $p^+ + n$ )

9 Be

4 → เลขอะตอม ( $p^+$ )

ลับตอน กัน

+1	+2	+3	-3	-2	-1	
1A	2A	3A	5A	8A	7A	8A
1						2
H		B	N	O	F	He
Li	Be	C	N	O	F	Ne
Na	Mg	P	S	Cl	Ar	
K	Ca	transition				