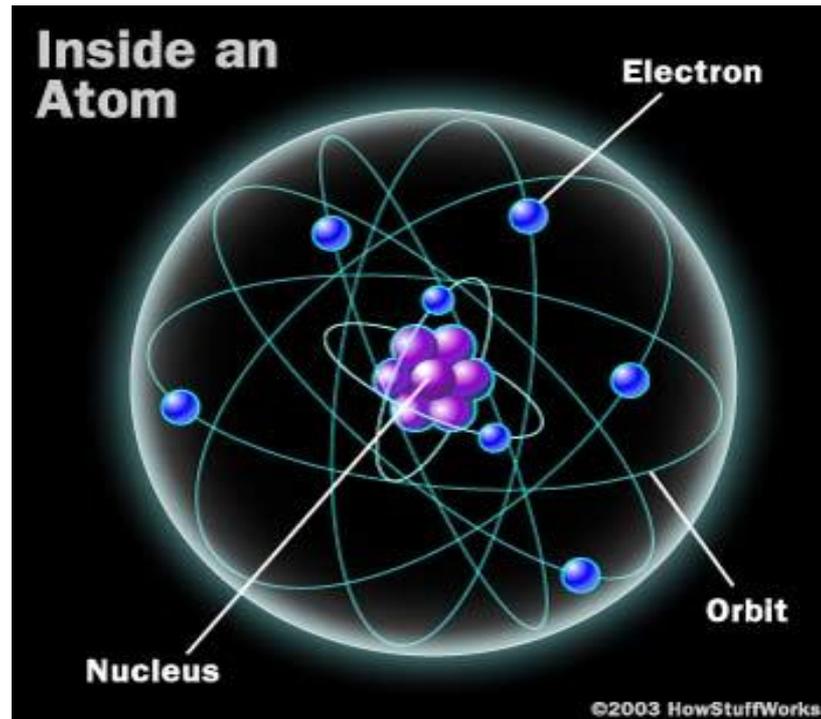


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# Atomic Structure

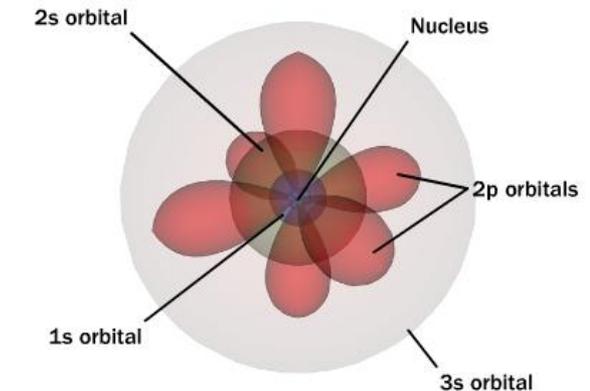


## Definitions:

**Compound**: a substance made from two or more simpler substances, which can be broken down into those simpler substances

**Element**: A substance that cannot be broken down into simpler substances

**Atom** : the smallest particle of an element, that retains the properties of that element



# Subatomic Particles:

the inner particles of an atom : 3 types

**Proton**: a positively charged subatomic particle that is found in the nucleus of an atom

\*  $1.674 \times 10^{-24} = 1$  atomic mass unit (amu)

\* denote as  $p^+$

**Electron**: a negatively charged subatomic particle that is found in the space outside the nucleus

\*  $9.11 \times 10^{-28} = 1/1840 = 0$  amu = weightless

comparatively

\* denote as  $e^-$

**Neutron**: a neutral (no charge) subatomic particle that is found in the nucleus of an atom

\*  $1.674 \times 10^{-24} = 1$  amu

\* denote as  $n^0$

# Periodic Table of the Elements

1 H 1.01																	18 He 4.00
3 Li 6.94	4 Be 9.01											5 B 10.81	6 C 12.01	7 N 14.01	8 O 16.00	9 F 19.00	10 Ne 20.18
11 Na 22.99	12 Mg 24.30											13 Al 26.98	14 Si 28.09	15 P 30.97	16 S 32.07	17 Cl 35.45	18 Ar 39.95
19 K 30.10	20 Ca 40.08	21 Sc 44.96	22 Ti 47.88	23 V 50.94	24 Cr 52.00	25 Mn 54.94	26 Fe 55.85	27 Co 58.93	28 Ni 58.69	29 Cu 63.55	30 Zn 65.39	31 Ga 69.72	32 Ge 72.61	33 As 74.92	34 Se 78.96	35 Br 79.90	36 Kr 83.80
37 Rb 85.47	38 Sr 87.62	39 Y 88.91	40 Zr 91.22	41 Nb 92.91	42 Mo 95.94	43 Tc (97.91)	44 Ru 101.07	45 Rh 102.91	46 Pd 106.42	47 Ag 107.87	48 Cd 112.41	49 In 114.82	50 Sn 118.71	51 Sb 121.75	52 Te 127.60	53 I 126.90	54 Xe 131.29
55 Cs 132.91	56 Ba 137.33	57 La 138.91	72 Hf 178.49	73 Ta 180.95	74 W 183.85	75 Re 186.21	76 Os 190.23	77 Ir 192.22	78 Pt 195.08	79 Au 196.97	80 Hg 200.59	81 Tl 204.38	82 Pb 207.2	83 Bi 208.98	84 Po (208.98)	85 At (209.99)	86 Rn (222.02)
87 Fr (223.02)	88 Ra (226.03)	89 Ac (227.03)	104 Rf (261.11)	105 Ha (262.11)	106 Sg (263.12)												

58 Ce 140.12	59 Pr 140.91	60 Nd 144.24	61 Pm (144.91)	62 Sm 150.36	63 Eu 151.97	64 Gd 157.25	65 Tb 158.93	66 Dy 162.50	67 Ho 164.93	68 Er 167.26	69 Tm 168.93	70 Yb 173.04	71 Lu 174.97
90 Th 232.04	91 Pa 231.04	92 U 238.03	93 Np (237.05)	94 Pu (244.06)	95 Am (243.06)	96 Cm (247.07)	97 Bk (247.07)	98 Cf (251.08)	99 Es (252.08)	100 Fm (257.10)	101 Md (258.10)	102 No (259.10)	103 Lr (262.11)

Atomic  
Number

7

N

Element  
Symbol

Element Name

Nitrogen  
14.0067

Atomic  
Mass  
Number

**Atomic Number** : the **number of protons** in an atom of that element

: the atoms of any given element always have the same number of protons

: Atoms of different elements have different numbers of protons

**Atomic Mass**: the weighted average mass of all the atoms of an element (atomic weight)

**Mass Number**: the **sum** of the protons and the neutrons in the nucleus of that atom

**Mass Number – Atomic Number = the number of neutrons**

**In a Neutral Atom: the number of protons = the number of electrons**

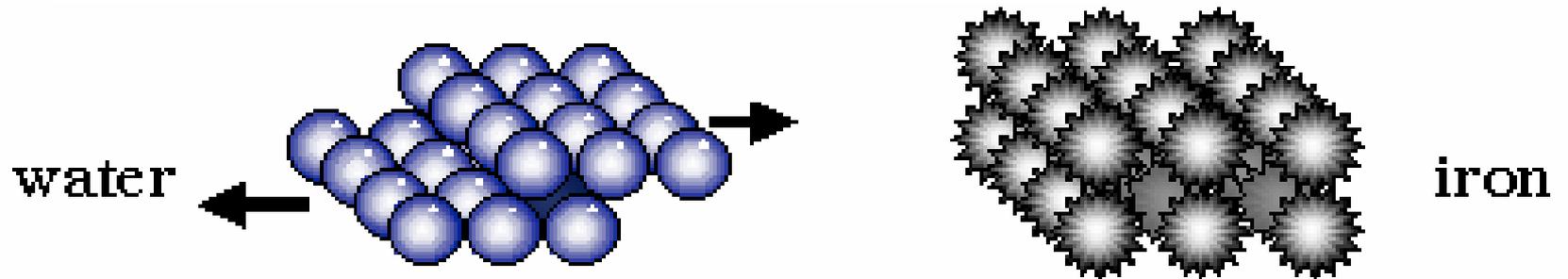
# Models Of The Atom

## Democritus

- All matter is made up of very small particles that cannot be divided
  - Called particles Atoms
  - Different types of atoms with specific sets of property
- Ex. Atoms in a liquid = Round  
Atoms in a solid = Rough and prickly



## Greeks: atoms determine properties



## John Dalton

- **Studied the behavior of gases**
- **Noticed that compounds have fixed compositions**
- **Theory:**
  - **All elements are composed of atoms**
  - **All atoms of the same element have the same mass, atoms of different elements have different masses**
  - **Matter is made of particles called atoms , which cannot be divided**





**Atoms are solid spheres**

## J.J. Thomson

- **Used electric current to study atoms**

- **Cathode Ray Tube**

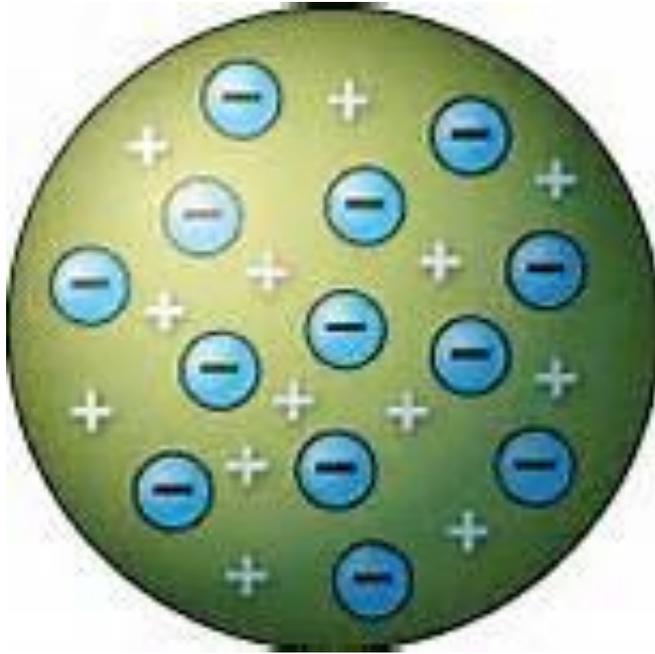
**Experiment : sent current through a sealed tube of**

**gas, produced a glowing beam that could be deflected by charged metal plates**

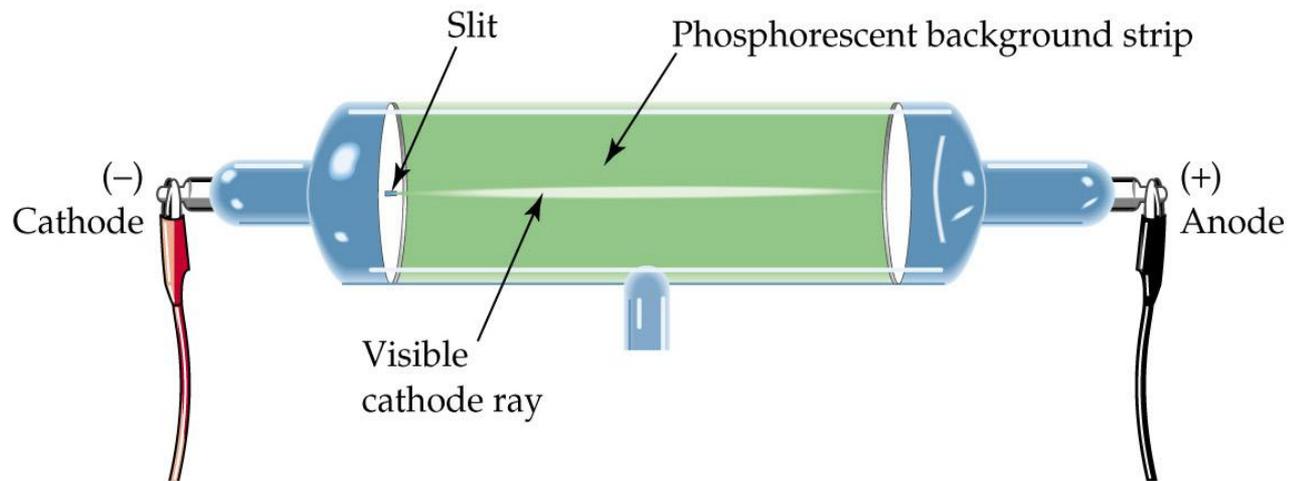
- **Atoms are filled with a positively charged mass that has negatively charged particles scattered throughout**

- **“Plum Pudding” Model**





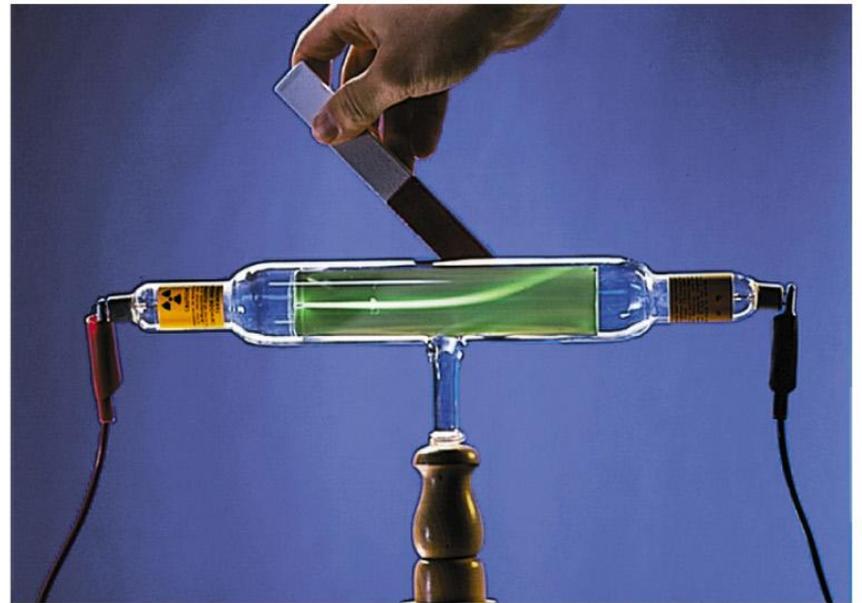
**1<sup>st</sup> evidence of subatomic particles!**



(a)



(b)



(c)

## Ernest Rutherford : 1909

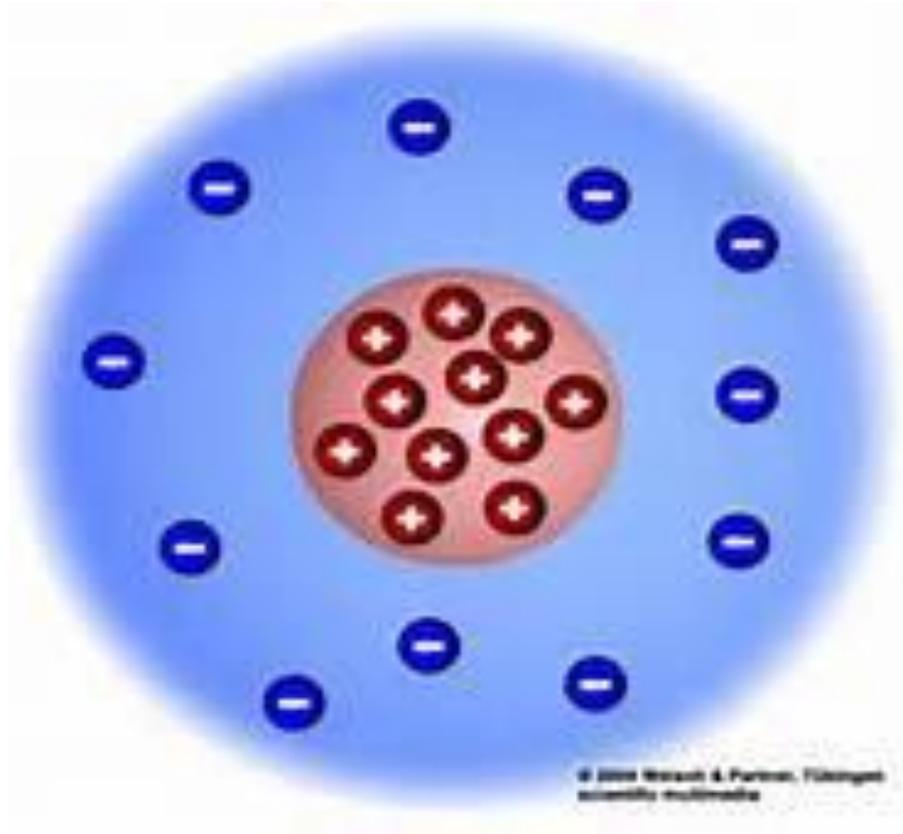
▪ **Discovered that Uranium emits fast moving particles with positive charges , called alpha particles**

▪ **Gold Foil Experiment: Aimed alpha particles at piece of gold foil and recorded their pathways by flashes on a screen**

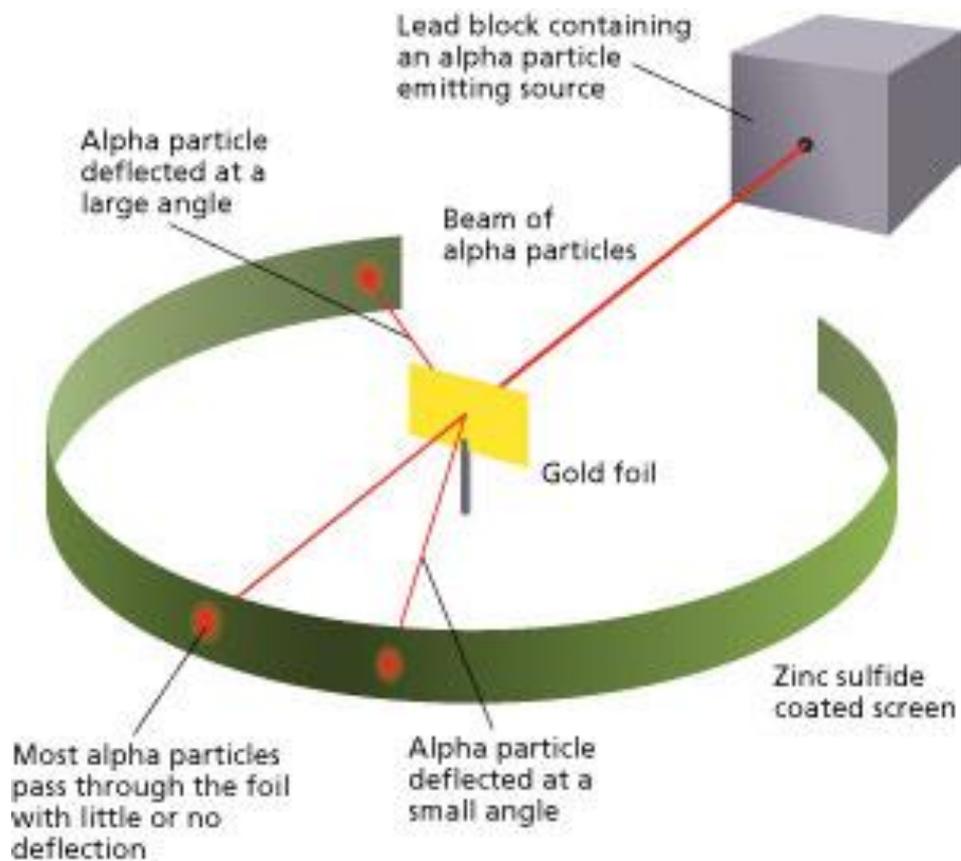
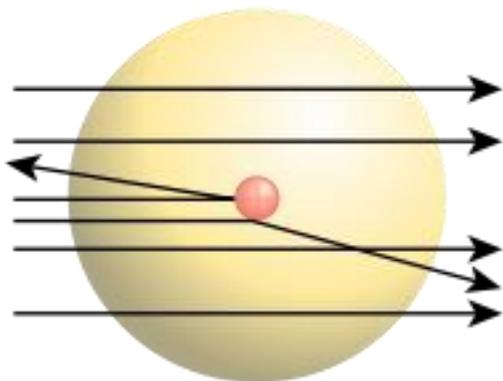
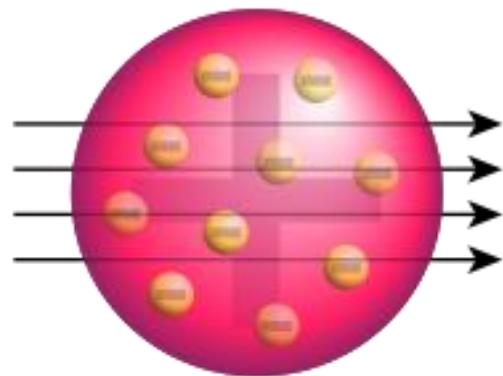
▪ **Results: some particles traveled straight through, but many were deflected**

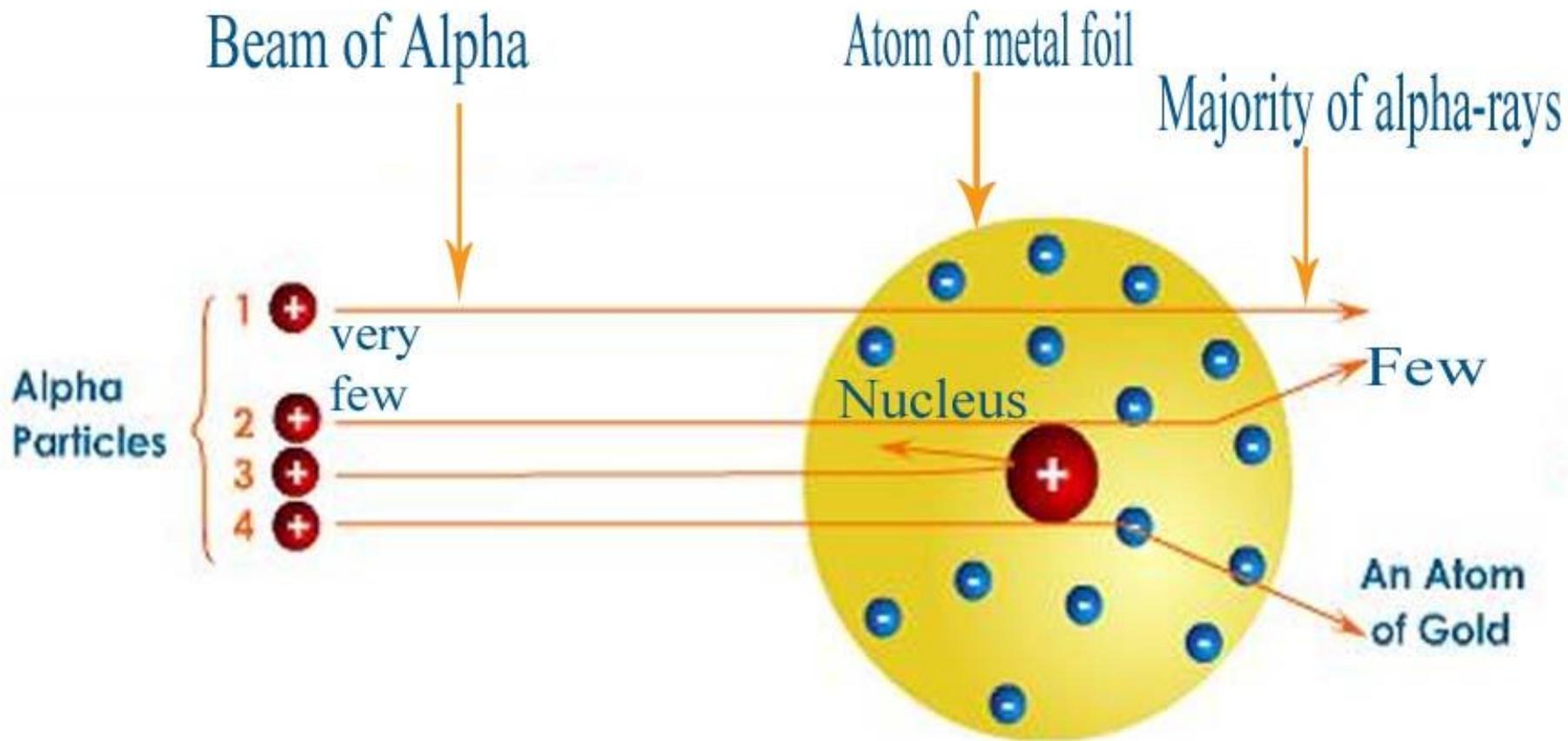
▪ **Concluded: an atoms positive charge is concentrated in a small area in the center of atom called a nucleus**





**Nucleus: dense positively charged mass located at the center of atoms**



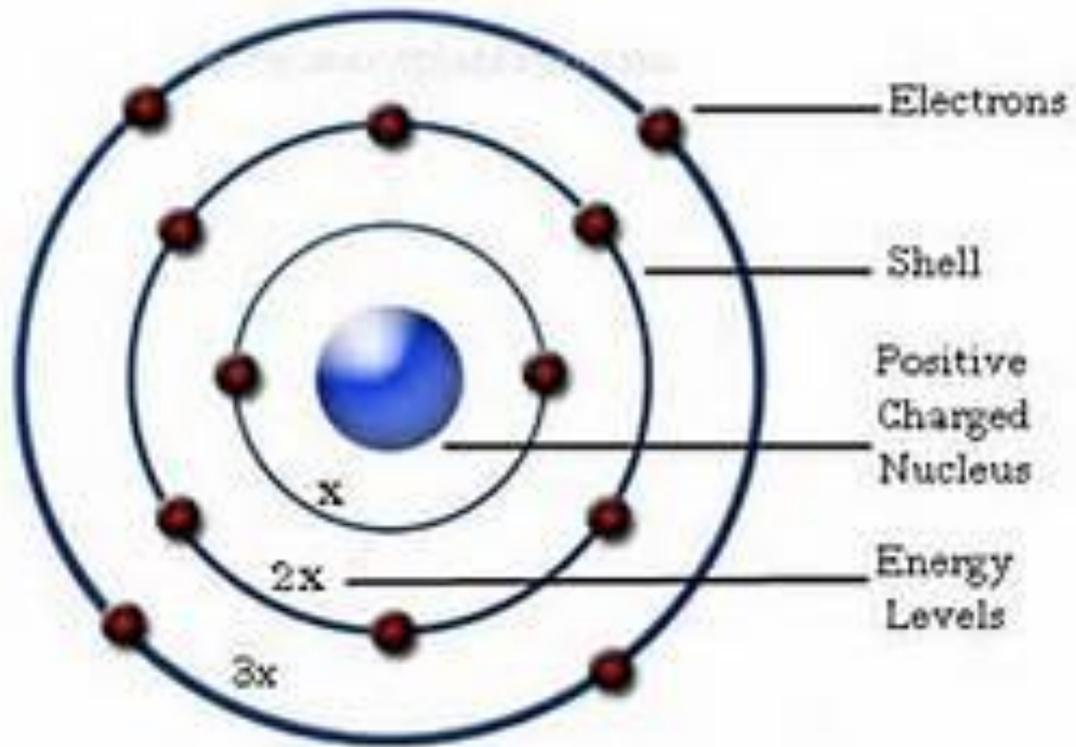


*Rutherford's experiment of Gold metal foil*

## Niels Bohr : 1913

- **Studied negative charged particles called electrons**
- **Believed that electrons moved with constant speed in fixed orbits around the nucleus, like planets around a sun**
- **Each electron has a certain amount of energy**
- **Electrons can gain or lose energy by moving up or down energy levels like steps in a staircase**
- **Different elements have different sets of energy levels**

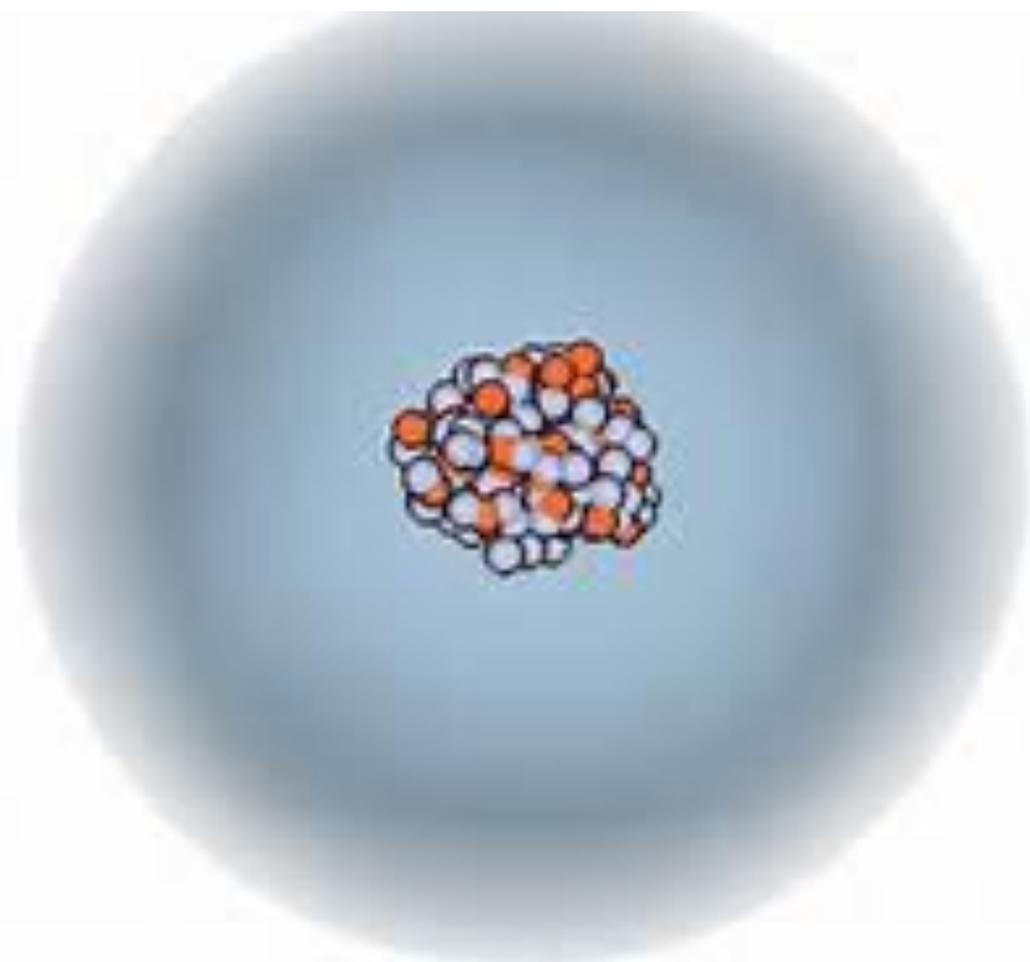




## Erwin Schrodinger – 1926

- **Developed mathematical equations to describe the motion of electron**
  - **Nucleus contains protons and neutrons**
  - **Electrons travel in Orbitals (regions of space) around nucleus**
  - **Different Energy levels have different numbers of Orbitals**
- Each Orbital can contain two electrons at most**





<http://www.youtube.com/watch?v=kHaR2rsFNhg>