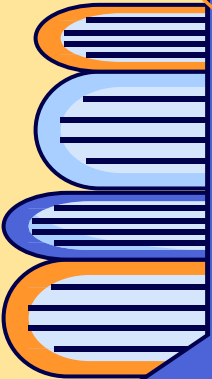
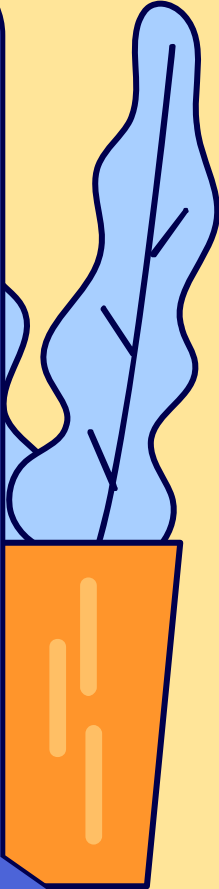


# CHAPTER 2 FORM 4 : MATTER AND THE ATOMIC STRUCTURE

By : Qistina Aryssa



# MATTER

Anything that occupies space & has mass.



**Solid**

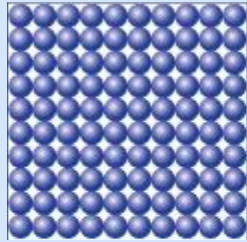


**Liquid**

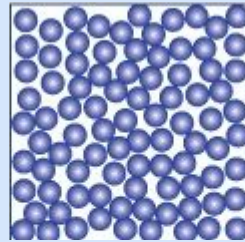


**Gas**

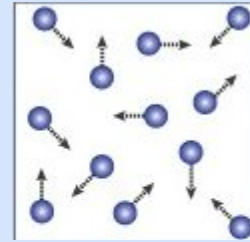
# Changes of Matter



**Solid**



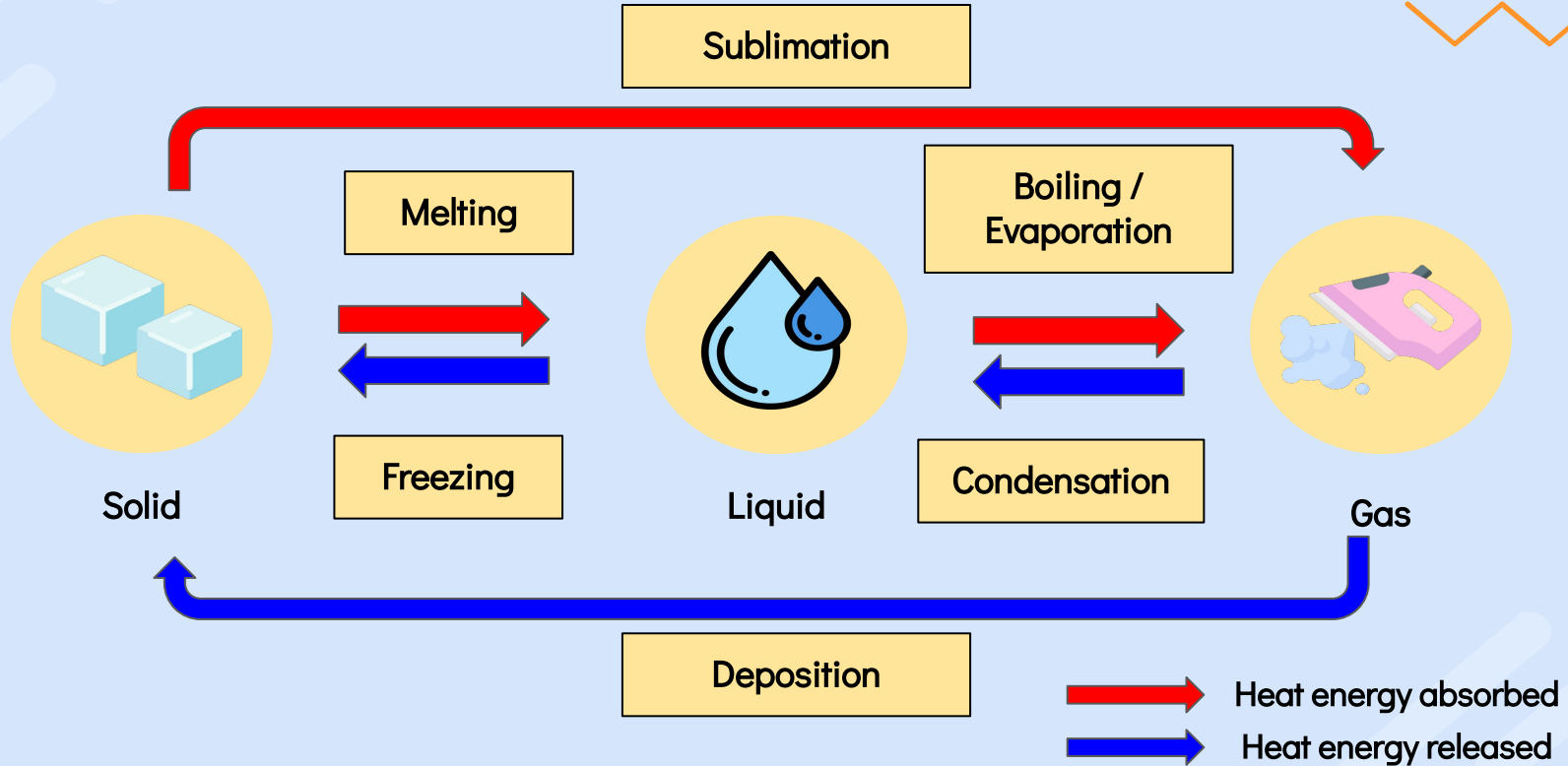
**Liquid**



**Gas**

Arrangement	Closely packed & in orderly manner	Closely packed & <b>not</b> in orderly manner	Far apart from each other
Kinetic Energy	Low	Higher than solid	Very high
Attraction force	Very strong	Strong, but less than solid state	Weak

# HEAT ABSORBED & RELEASED

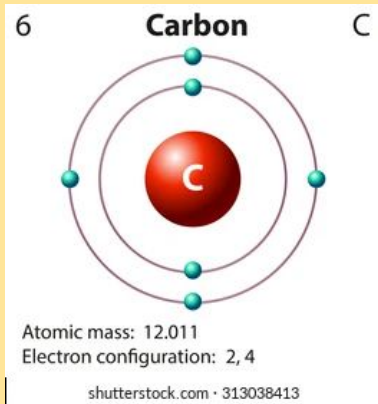


# Matter

Element

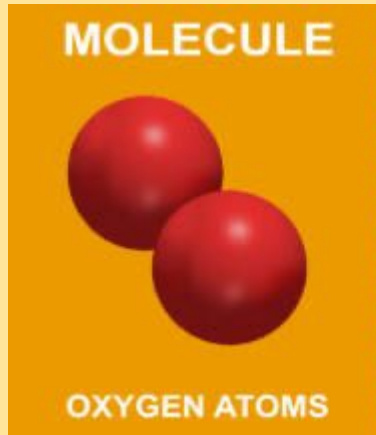
Compound

Atom



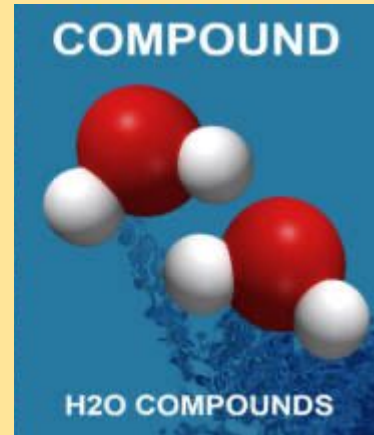
Eg : Carbon, C

Molecule



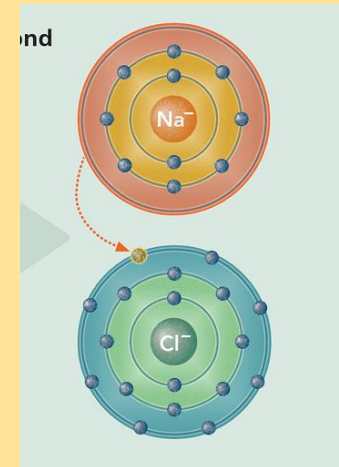
Eg : O<sub>2</sub>  
(Molecule with same atom)

Molecule



Eg : H<sub>2</sub>O  
(Molecule with different atom)

Ion



Eg : NaCl, Sodium chloride



# Past Year SPM Questions

4. [SPM17-11] Which substance consists of ions?

*Bahan yang manakah terdiri daripada ion?*

A Carbon dioksida  
*Karbon dioksida*

B Sulphur dioxide  
*Sulfur dioksida*

C Calcium chloride  
*Kalsium klorida*

D Hydrogen chloride  
*Hidrogen klorida*

5. [SPM12-16] Which of the following shows sublimation process?

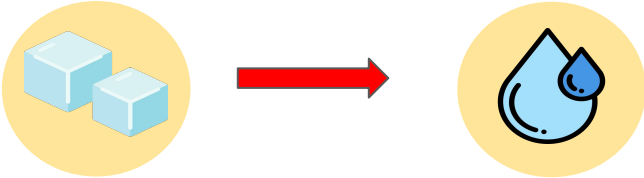
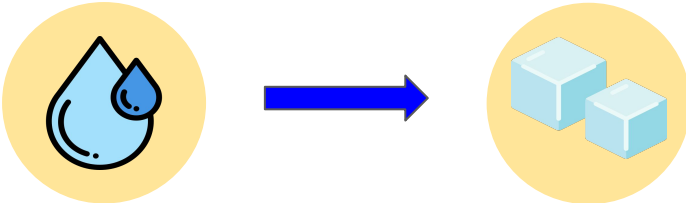
*Antara yang berikut, yang manakah menunjukkan proses pemejalwapan?*

A Bromine vapour spreads throughout gas jar  
*Wap bromin tersebar ke seluruh balang gas*

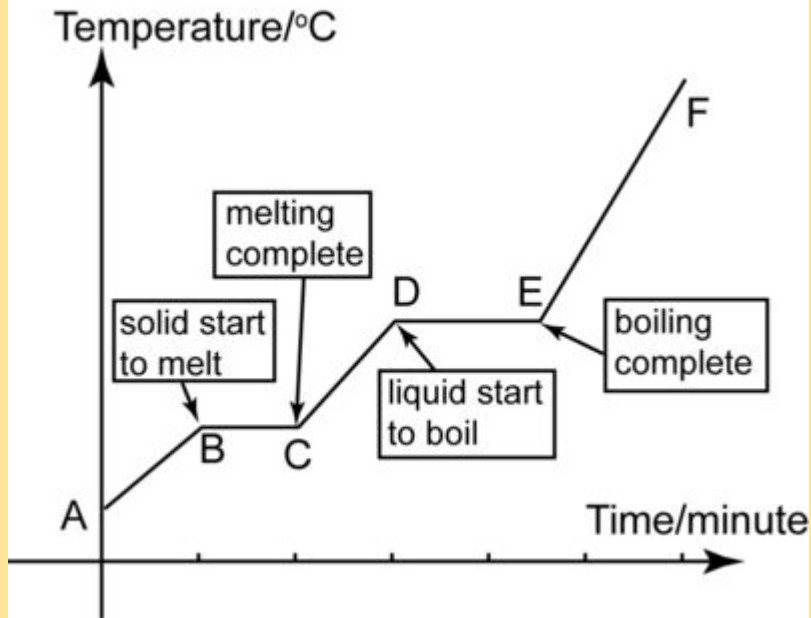
B Water changes into ice in the refrigerator  
*Air bertukar menjadi ais dalam peti sejuk*

C Naphthalene ball in cupboard becomes smaller  
*Bebola naftalena dalam almari menjadi lebih kecil*

D Volume of perfume decreases in an opened bottle  
*Isi padu minyak wangi berkurang dalam botol yang terbuka*

<b>Melting point</b>	<b>Freezing point</b>
<p>Constant temperature when a substance <b>changes from solid state to liquid</b> at a specific pressure.</p>	<p>Constant temperature when a substance <b>changes from liquid state to solid</b> at a specific pressure.</p>
 <p data-bbox="363 718 446 751">Solid</p> <p data-bbox="823 729 925 762">Liquid</p>	 <p data-bbox="1116 732 1219 765">Liquid</p> <p data-bbox="1605 732 1707 765">Solid</p>
<p><b>The stronger the attraction force between the particles, the higher the melting point.</b> More heat energy are needed to break the attraction.</p>	

## Heating curve of Naphthalene



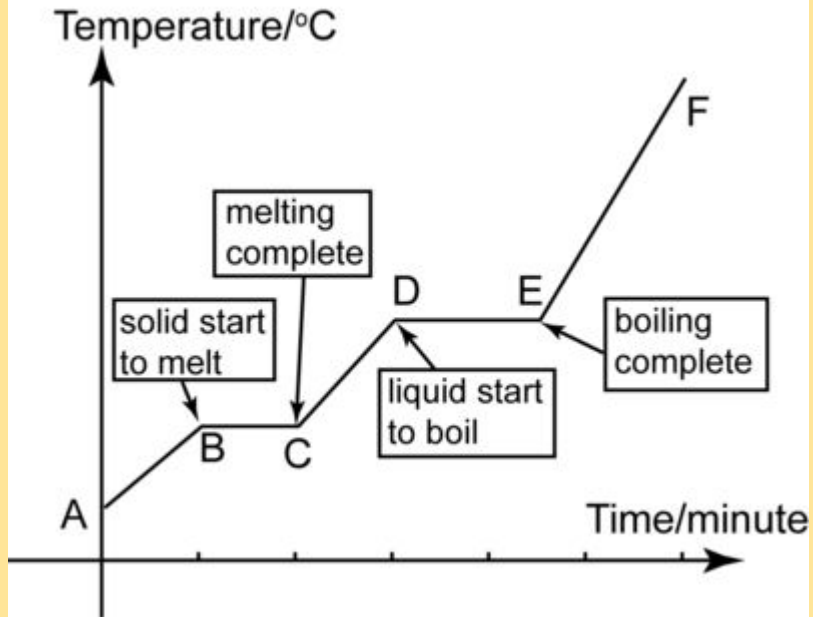
### A-B phase :

- Temperature increase
- In **solid state**
- Particles **absorb energy & vibrate faster** because **kinetic energy increase**

### B-C phase :

- **Melting** occurs
- Solid-liquid state
- **No increase in temperature from B to C**, heat energy is used to overcome the attraction force between particles until solid changes to liquid.

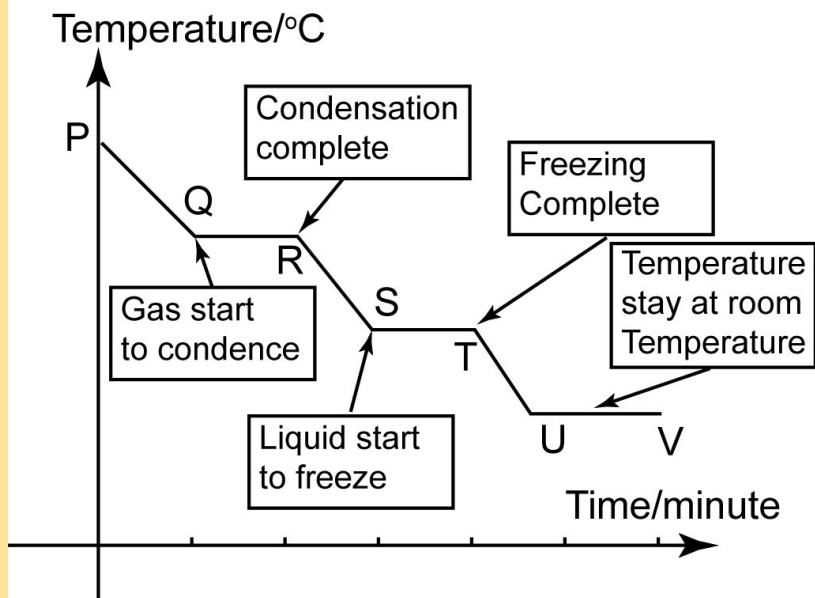
## Heating curve of Naphthalene



### C-D phase :

- Temperature increase
- In **liquid state**
- Particles **absorb energy & move faster** because **kinetic energy increase**

## Cooling curve of Naphthalene



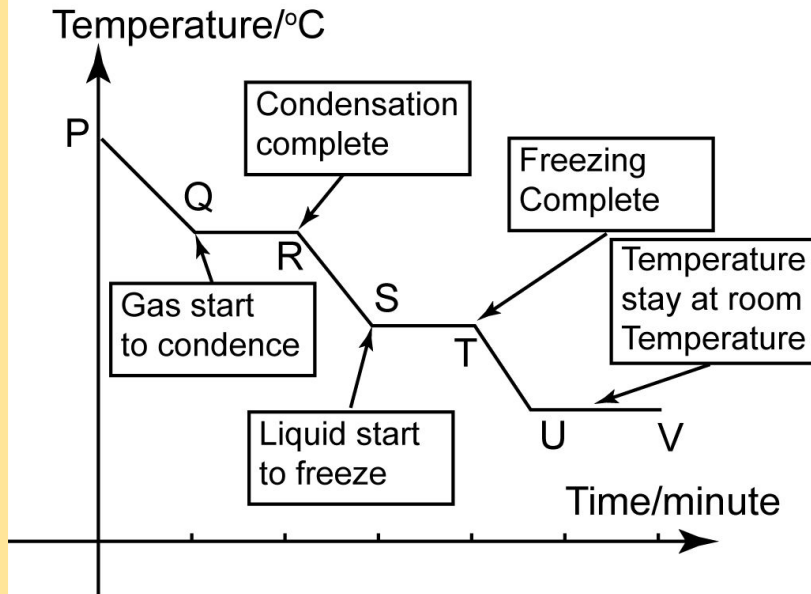
### Q-R phase :

- Temperature decrease
- In **liquid state**
- Particles **release energy & move slower** because **kinetic energy decrease**

### R-S phase :

- Freezing occurs
- **No decrease in temperature from Q to P**, heat energy is lost to surroundings, balanced by heat energy released when particles attract each other to form solid.

## Cooling curve of Naphthalene

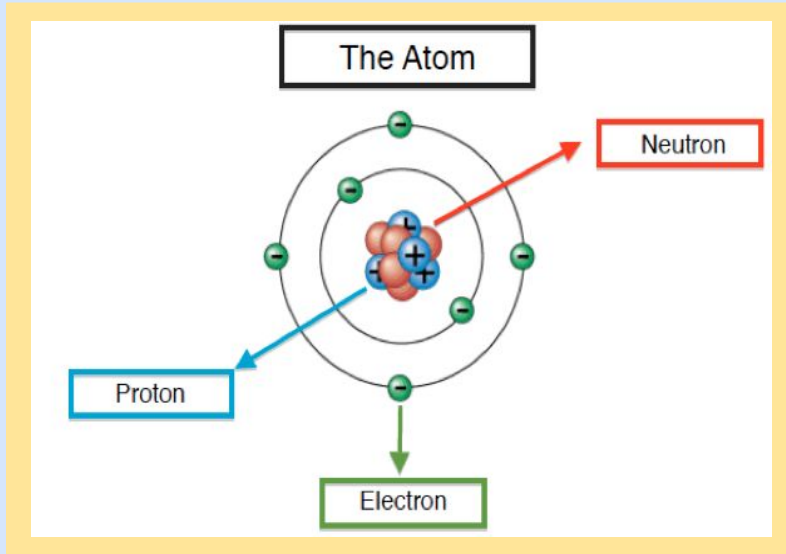


### S-T phase :

- Temperature decrease
- In **solid state**
- Particles **release heat energy & vibrate slower** because **kinetic energy decrease**



# Development of Atomic Structure Model



Subatomic	Symbol	Charge	Mass
Proton	p	+1	1
Neutron	n	0	1
Electron	e	-1	1/1840

# Development of Atomic Structure Model

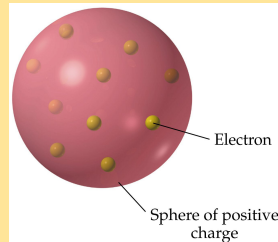
## JOHN DALTON

- Matter made up of **ATOM**.
- Smallest spherical body, cannot be created, destroyed nor further divided.
- Same elements have same atom.



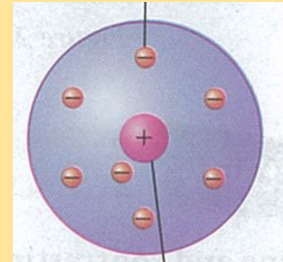
## J.J THOMPSON

- Negatively-charged particles = **ELECTRONS**.
- Atom is positively-charged sphere with several electrons in it.



## ERNEST RUTHERFORD

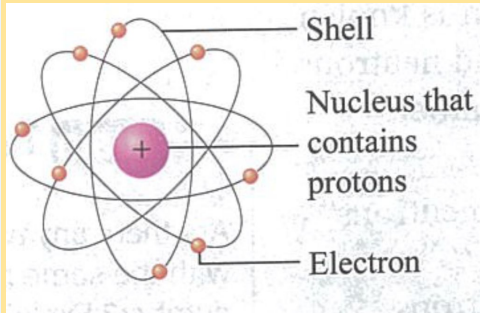
- Positively-charged particles = **PROTONS**
- Nucleus : centre of atom & whole atomic mass is concentrated inside it.



# Development of Atomic Structure Model

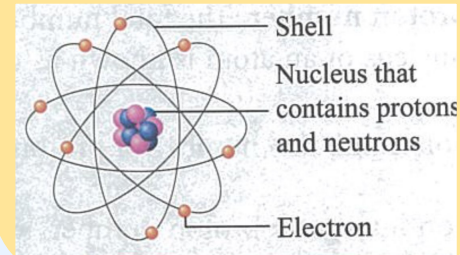
## NIELS BOHR

- Electrons in atom move in **SHELLS** around the nucleus.



## JAMES CHADWICK

- Discovered neutral particles = **NEUTRONS**.
- Neutrons contribute almost half the mass of an atom.



## **PROTON NUMBER**

Number of PROTONS in nucleus of an atom.

## **NUCLEON NUMBER**

TOTAL number of protons & neutrons in the nucleus of an atom.



## **CALCULATING NUCLEON NUMBER**

= number of protons + number of neutrons

**OR**

= proton number + number of neutrons.

# ATOM & ION

Type of particle	Chlorine atom, Cl	Chloride ion, Cl <sup>-</sup>
Number of proton	17	17
Number of neutron	18	18
Number of electron	17	18

1

Chlorine atom  
ACCEPTS 1 electron → Form chloride  
ion, Cl<sup>-</sup>

2

In formation of ion, number of protons & neutrons REMAIN THE SAME.

3

- Number of electron **INCREASE** = **ANION** is formed (-ve charged ion)
- Number of electron **DECREASE** = **CATION** is formed (+ve charged ion)

# Standard Representation of Atom

Nucleon number

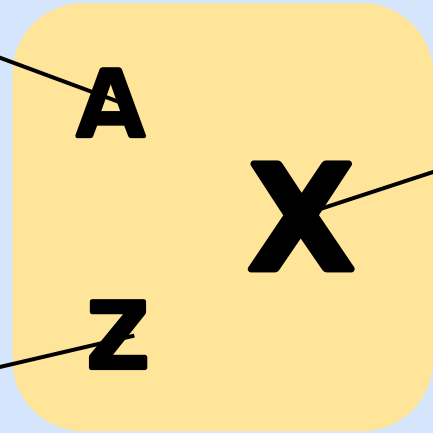
**A**

Symbol of element

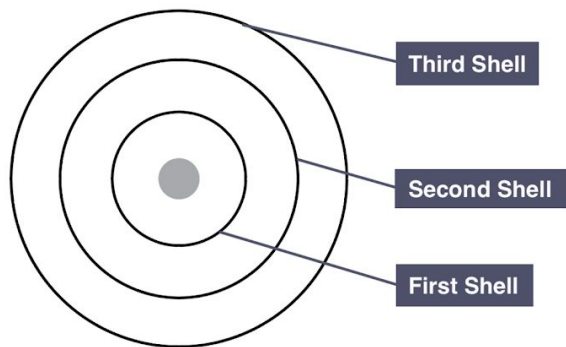
**X**

Proton number

**Z**



# Atomic Structure & Electron Arrangement



Each Electron Shell can Accommodate a Fixed Number of Electrons:

- **First Shell:** 2 Electrons
- **Second Shell:** 8 Electrons
- **Third Shell:** 8 Electrons

- Electrons orbit around nucleus in respective shells.
- They will fill the shell **closest to the nucleus first (1st shell)**.
- After the 1st shell is filled, the electrons will fill the next shell.

## VALENCE ELECTRONS

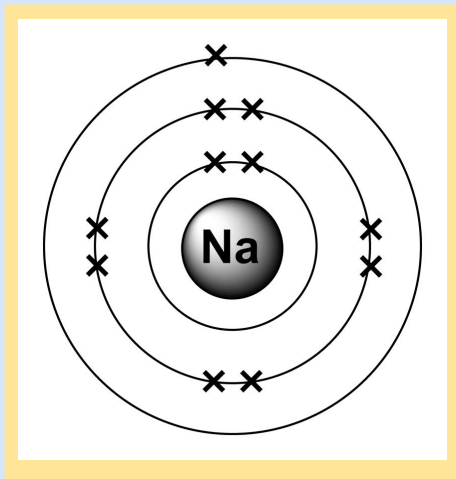
Electrons in the outermost shell.

## VALENCE SHELL

Outermost shell of an atom.

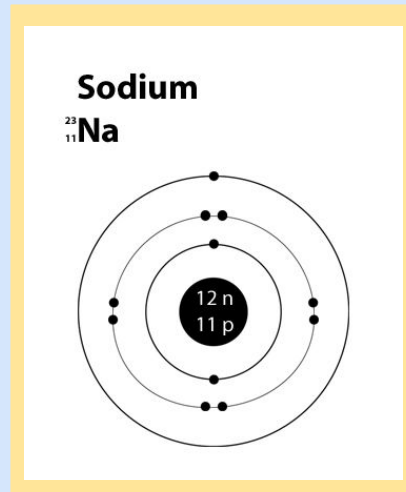
### Electron arrangement

Shows nucleus & electron arrangement of an atom.



### Atomic structure

Shows the number of protons & neutrons in the nucleus & electron arrangement.



**27**

**Mg**  
**13**

Before drawing electron arrangement / atomic structure, you must know :

Number of proton	
Number of neutron	
Number of electron	

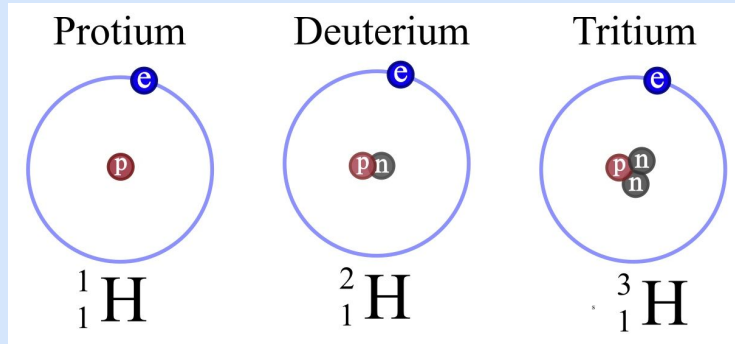
Number of proton =  
number of electron

Electron arrangement

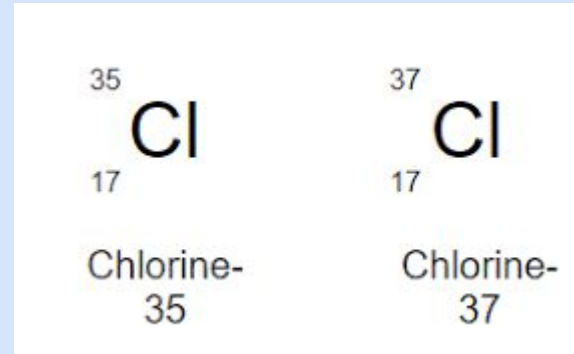
Atomic structure

# ISOTOPES

Atoms of the same element, same number of protons but **DIFFERENT NUMBER OF NEUTRONS**.



Another example of isotopes :  
Chlorine atom with different number of neutrons.



protons	17	17
neutrons	18	20
electrons	17	17

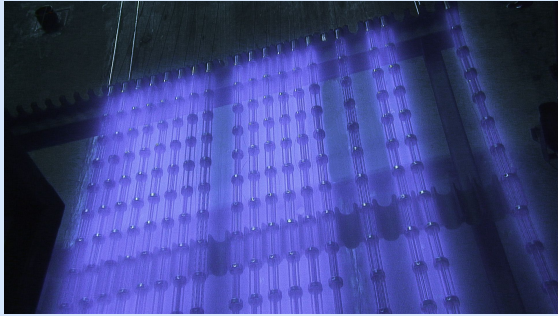
# RELATIVE ATOMIC MASS OF ISOTOPES

$$\text{Relative atomic mass} : \frac{\sum (\% \text{ Isotope} \times \text{Mass isotope})}{100}$$

Example : (Textbook page 38)

Chlorine consist of 2 isotopes, Cl-35 and Cl-37. The natural abundance of Cl-35 is 75% and Cl-37 is 25%. Calculate the relative atomic mass of chlorine.

# USES OF ISOTOPES



**COBALT-60**

1. Radiotherapy to kill cancer cells
2. Sterilising surgical tools.



**URANIUM-235**

1. Generating electricity through nuclear power generator.



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