

Chem "Structure of Matter" Summary

Tuesday, January 03, 2023 10:32 PM

1. Definition of atom:

Atom is the tiniest particle in an object that can't be divided anymore.

2. Elements:

- Identical atoms joined together.
- All elements are composed of identical atoms.
- All elements that are made up of same atoms are identical.

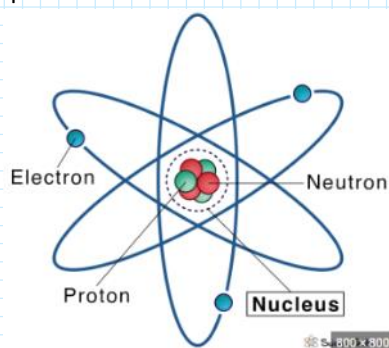
3. Structure of an atom:

→ Atom is mostly an empty space that is made up of 2 parts.

- Nucleus (in the center)
- Electron cloud (space between energy levels)

→ The nucleus is made up of 2 sub-atomic particles:

- Protons:
 - Symbol: p^+
 - Positively charged particles
- Neutrons:
 - Symbol: n^0
 - Don't have any charge



The nucleus is surrounded by a structure called electron cloud.

Contains sub-atomic particle: electrons

- Symbol: e^-
- Negatively charged particles

4. Fundamental particles of an atom:

- ✓ Protons (p^+)
- ✓ Electrons (e^-)
- ✓ Neutrons (n^0)

5. The atom is electrically neutral

⇒ Number of protons = number of electrons

Sub-atomic particles	Symbol	Relative charge	Location
Protons	p^+	$1 p^+ \rightarrow 1 +$	Inside the nucleus
Neutrons	n^0	0	Inside the nucleus
Electrons	e^-	$1 e^- \rightarrow 1 -$	Outside the nucleus, in the electron cloud on the energy level

5. Charge of the atom:

$$Q_{\text{atom}} = Q_{\text{nucleus}} + Q_{\text{electron cloud}}$$

$$Q_{\text{atom}} = Q_{\text{protons}} + Q_{\text{neutrons}} + Q_{\text{electrons}}$$

But the atom is electrically neutral, $Z = \text{atomic number} = \text{number of protons} = \text{number of electrons}$

⇒ $Q_{\text{atom}} = 0$

6. Charge of Nucleus (Nuclear charge):

$$Q_{\text{nucleus}} = Q_{\text{protons}} + Q_{\text{neutrons}}$$

$$\Rightarrow Q_{\text{nucleus}} = Q_{\text{protons}}$$

$$\Rightarrow Q_{\text{electron cloud}} = \text{number of protons} \times \text{relative charge of 1 proton}$$

7. Charge of electron cloud:

$$\Rightarrow Q_{\text{electron cloud}} = Q_{\text{electrons}}$$

$$\Rightarrow Q_{\text{electron cloud}} = \text{number of electrons} \times \text{relative charge of 1 electron}$$

8. Atomic Number:

→ Symbolized by letter "Z"

→ Identifies the atom

→ Atomic number = number of protons

→ But, in a neutral atom, number of protons = number of electrons

$$\Rightarrow Z = \text{atomic number} = \text{number of protons} = \text{number of electrons}$$

9. Mass number:

→ Symbolized by letter "A"

→ Mass number = atomic number + number of neutrons

$$\Rightarrow A = Z + N$$

$$\Rightarrow Z = A - N$$

$$\Rightarrow N = A - Z$$

But, the atomic number = number of protons

$$\Rightarrow A = \text{number of protons} + \text{number of neutrons}$$

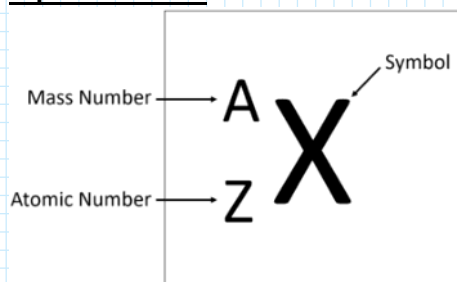
$$\Rightarrow A = \text{number of nucleons}$$

↓
Number of neutrons + number of protons,
where both are located in the nucleus.

★ REMARK!!!

In an atom, there is number of neutrons, but charge of the nucleus = 0

10. Chemical symbol/ atomic symbol/ nuclear symbol/ chemical representation:



11. Electron configuration:

→ Definition:

Arrangement of electrons on energy levels around the nucleus.

The maximum number an energy level can occupy is known by the following rule: Stoner's Rule: $2n^2$

↓
Number of energy levels

→ Energy levels:

K: 1st energy level

$$* n=1 \rightarrow 2n^2 = 2(1)^2 = 2 \text{ electrons}$$

⇒ Maximum number of electrons K can occupy = 2 electrons

L: 2nd energy level

$$* n=2 \rightarrow 2n^2 = 2(2)^2 = 4 \text{ electrons}$$

⇒ Maximum number of electrons L can occupy = 4 electrons

L: 2nd energy level

* $n=2 \rightarrow 2n^2 = 2(2)^2 = 4$ electrons

⇒ Maximum number of electrons L can occupy = 4 electrons

M: 3rd energy level

* $n=3 \rightarrow 2n^2 = 2(3)^2 = 8$ electrons

⇒ Maximum number of electrons M can occupy = 8 electrons

N: 4th energy level

* $n=4 \rightarrow 2n^2 = 2(4)^2 = 8$ electrons

⇒ Maximum number of electrons N can occupy = 8 electrons

Maximum number of electrons L, M and N
can occupy = 8 electrons

12. Valance electrons and Valance shell:

Number of electrons
On the outer energy level

⇒ Number of electron on
the valance shell

Outer energy level
Or
Outer shell
Or
Last energy level

13. Lewis dot symbol:

Representation of the valance electrons by dots.

→ To write the Lewis dot symbol:

1st. Place the symbol of the atom

2nd. Surround it by the valance electrons represented by dots in a clock wise manner.

14. Stability:

Duet rule

Stability by 2 electrons

Octet rule

Stability by 8 electrons

→ All the atoms do their best to resemble the nearest noble gases. stable gases since they have full outer energy levels

Helium (He)

Neon (Ne)

Argon (Ar)

by duet rule : 2 valance electrons

By octet rule : 8 valance electrons