Module3
Electrical Fundamentals

Compliant with EASA & DGCA Syllabus and Guidelines

AMEPREPARATION

SYLLABUS as per EASA

Electrical Fundamentals

Total Questions Category B1, B2 and B2L: 52 MCQ

Sub-Module 01-Electron Theory [Level-1,Exam B1& B2 ,No. of Questions-2]

Structure and distribution of electrical charges within: atoms, molecules, ions, compounds;

Molecular structure of conductors,

semiconductors and insulators.

INTRODUCTION

- It describes internal molecular forces of matter.

- It gives understanding of electricity and electronics.

ELECTRON THEORY

MATTER

- It is defined as anything that occupies space and has mass.

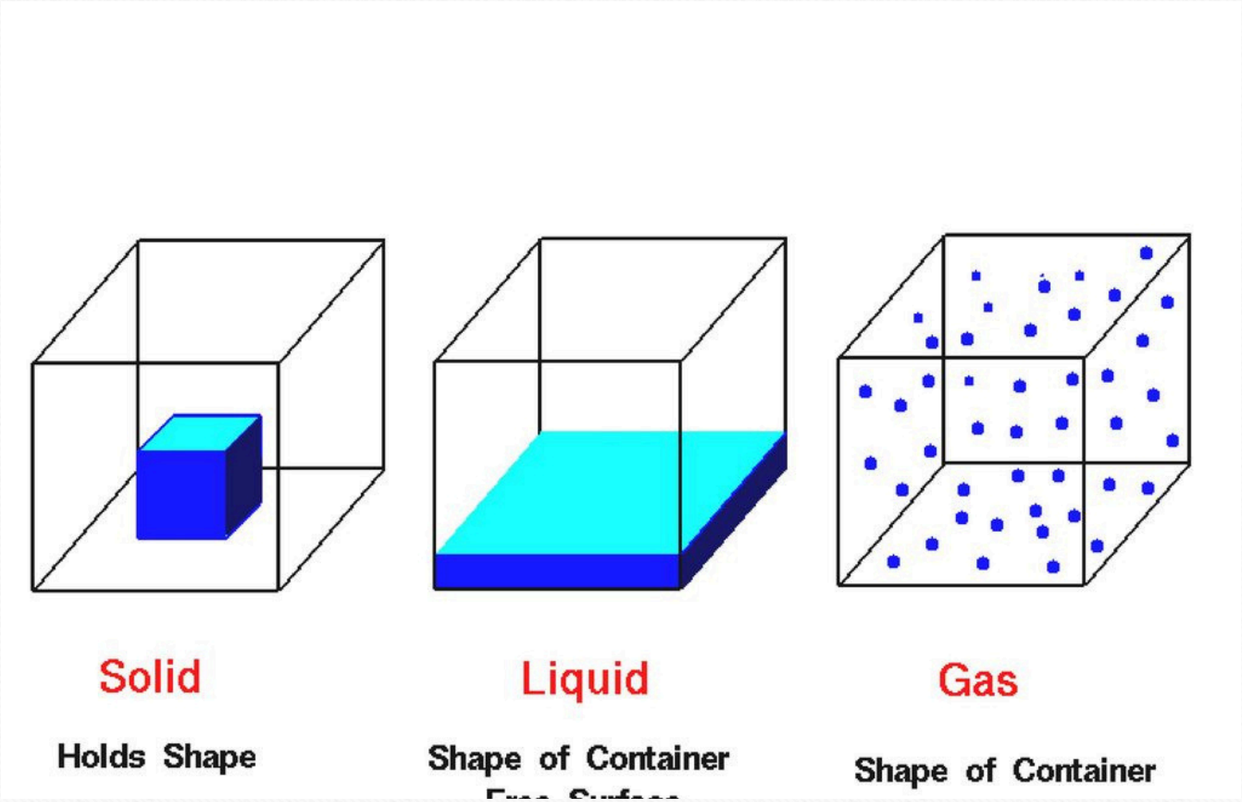
- It is composed of molecules which in turn are composed of atoms.

ELECTRON THEORY

STATE CLASSIFICATION OF MATTER

There are 3 physical states of matter.

- Solid
- Liquid
- Gas



ELECTRON THEORY

CHEMICAL CLASSIFICATION OF MATTER

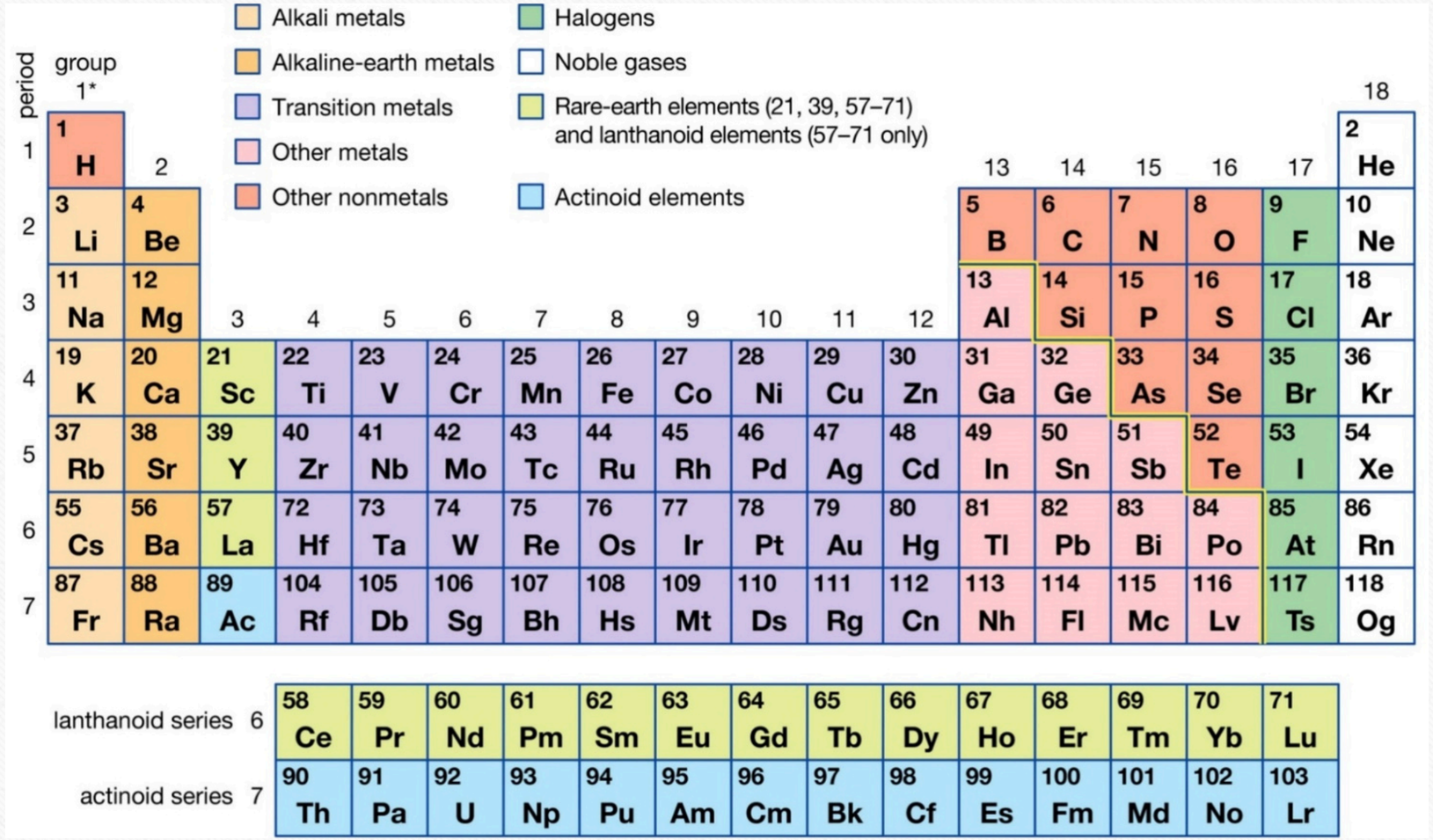
- Element
- Compound
- Mixtures

ELEMENT

- It is a single substance that can not be separated into different substance.
- There are more than 106 recognized elements.
- For example, hydrogen, sodium, lithium etc.

ELECTRON THEORY

PERIODIC TABLE



ELECTRON THEORY

COMPOUND

- It is a chemical combination of two or more different elements.
- It can be separated by chemicals means.
- For example, NaCl, H_2O etc.

ELECTRON THEORY

ATOMIC CLASSIFICATION OF MATTER

- This is the atomic view of matter.
- It gives a better understanding of electrical and electronic phenomena.
- Molecule
- Atom

ELECTRON THEORY

MOLECULE

- It is the smallest particle into which any compound can be divided.
- It still retains its chemical identity.
- Atoms of molecules may be identical or different.
- For example O_2, H_2O, NaCl etc.

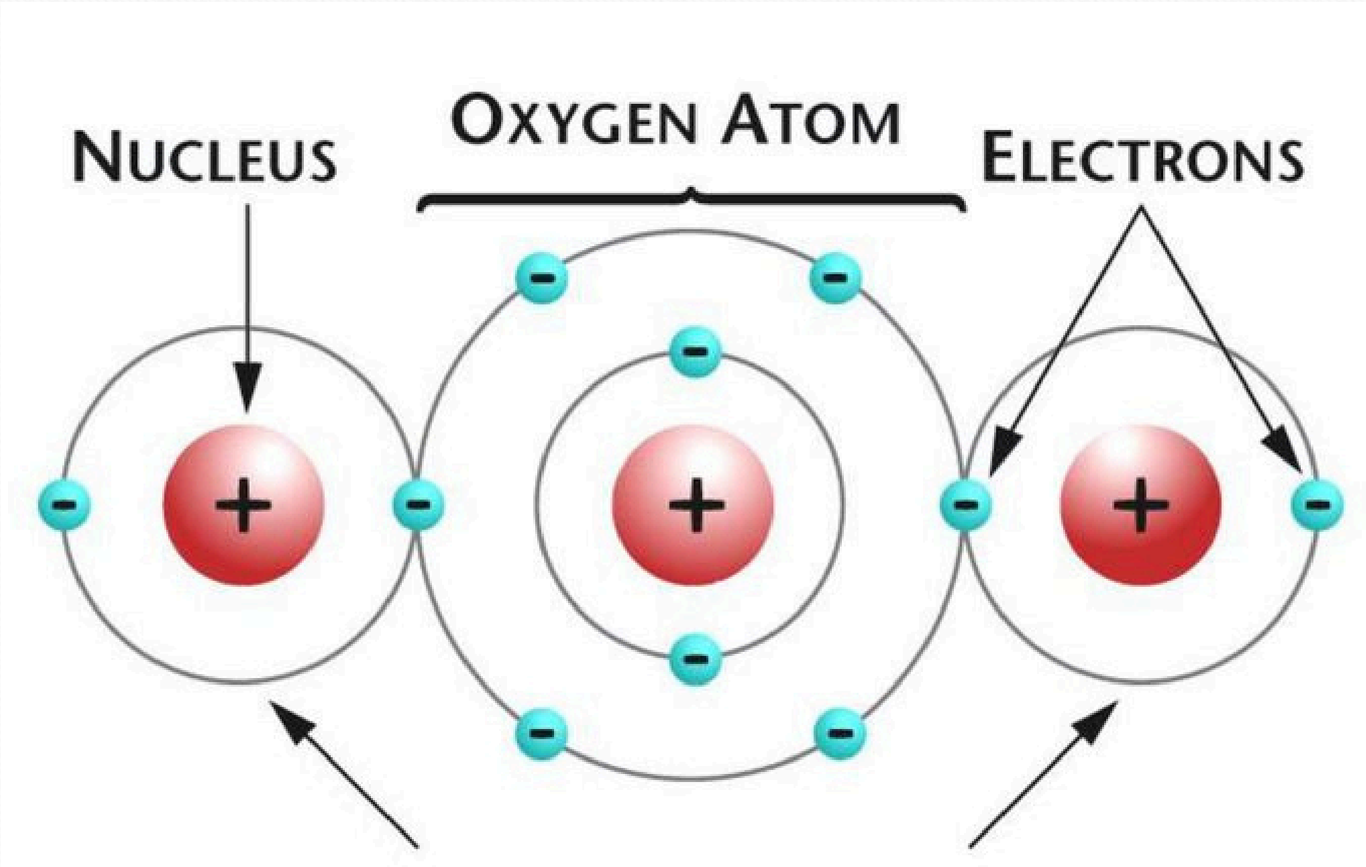
ELECTRON THEORY

MOLECULE

- Note: All compounds are molecule but all molecules are not compound.

ELECTRON THEORY

MOLECULE – H_2O



ELECTRON THEORY

DIFFERENCES

ELEMENT	COMPOUND	MOLECULES
It contains only one identical atoms	It contains more than one different atom chemically bonded	It contains more than one identical or different atom
Sodium, helium	Water, carbon dioxide	Oxygen, water

ELECTRON THEORY

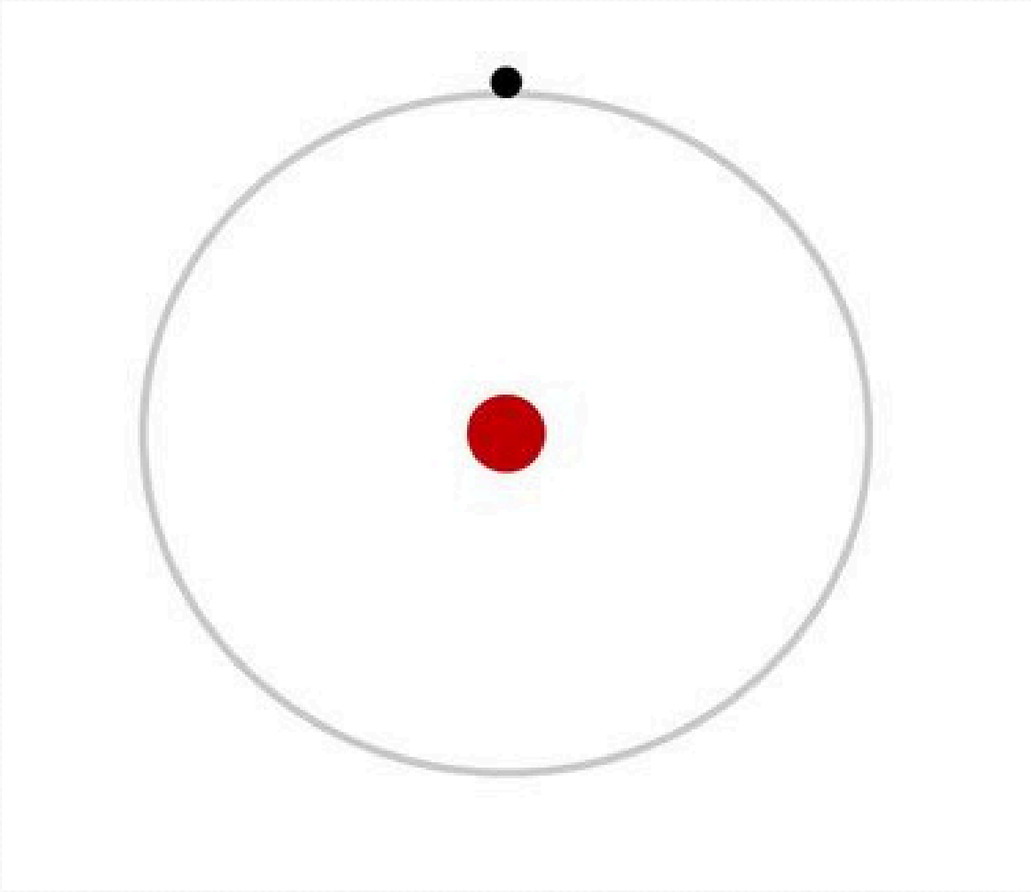
ATOM

- It is the smallest particle of an element that retains its chemical identity.

- It contains basic 3 sub-atomic particles:
- Proton
- Neutron
- Electron

ELECTRON THEORY

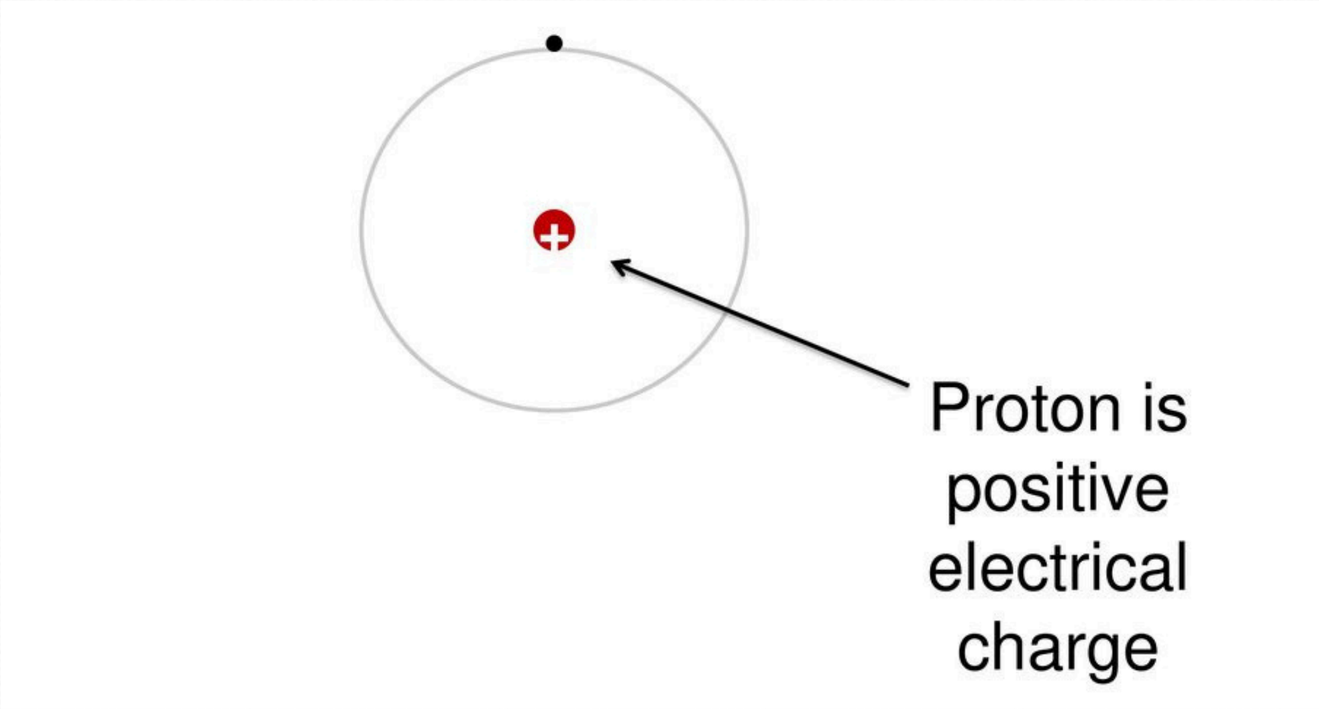
ATOM



ELECTRON THEORY

PROTON

- It has unit mass and carries a unit positive charge.

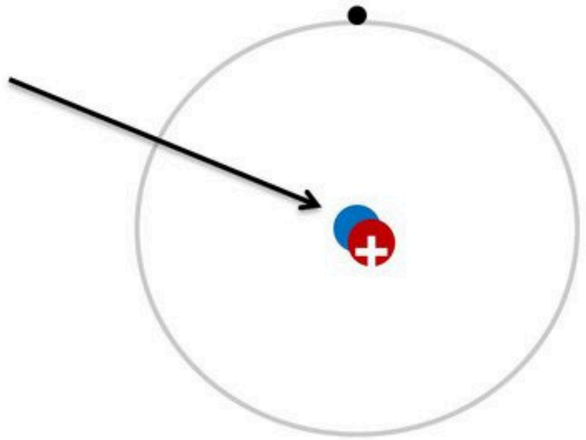


ELECTRON THEORY

NEUTRON

- It has unit mass but no electrical charge.

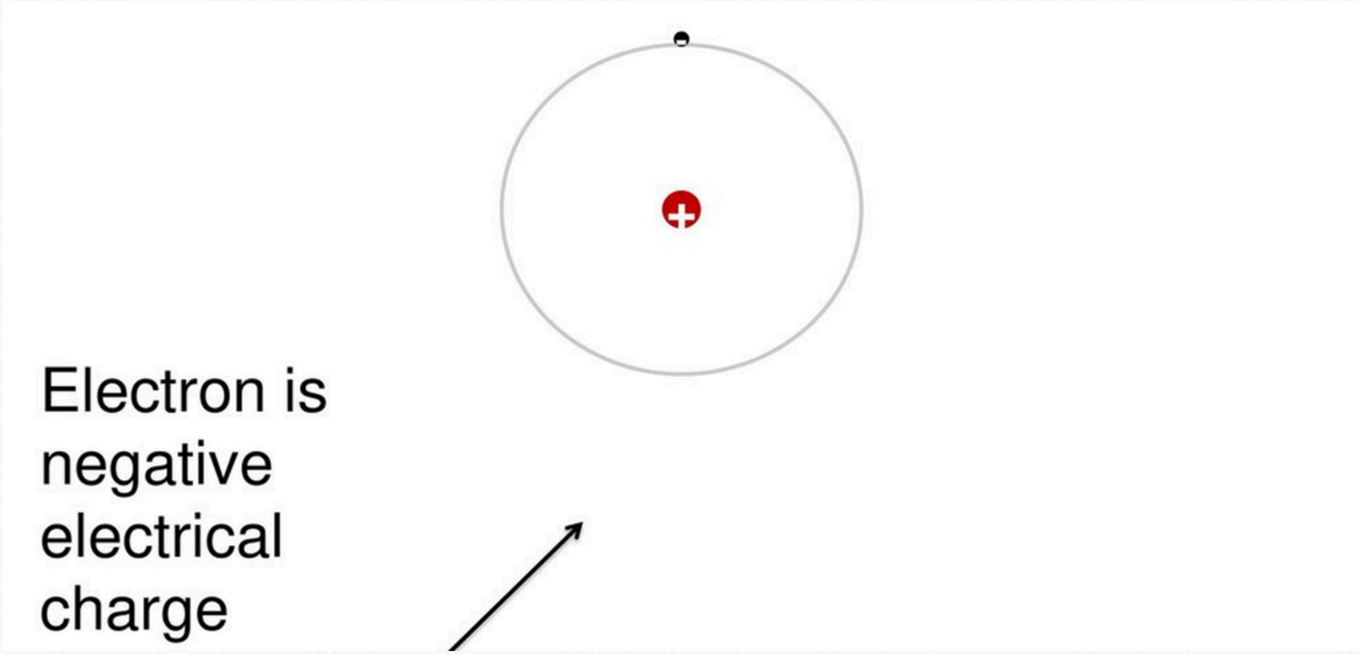
Neutron is neutral electrical charge



ELECTRON THEORY

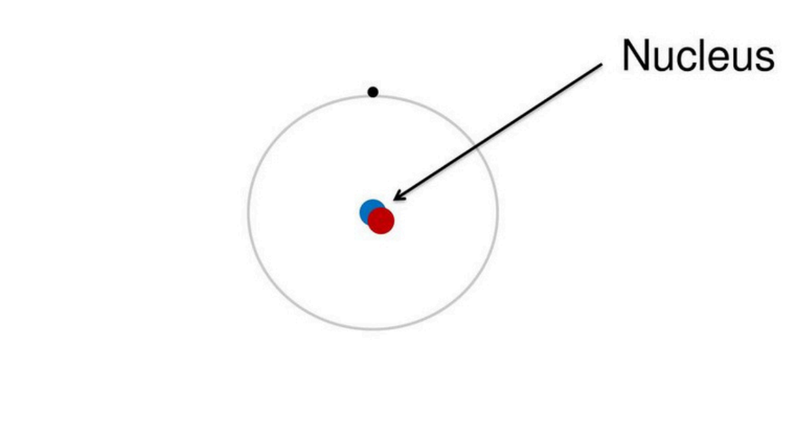
ELECTRON

- It has only unit of mass but it carries a unit negative charge.



ELECTRON THEORY

NUCLEUS



- It is the center of the atom.
- It contains protons and electrons.

ELECTRON THEORY

ATOMIC NO & MASS

- Atomic no = no of protons or no of electrons

- Atomic mass = no of proton + no of neutron

ELECTRON THEORY

ATOMIC STRUCTURE

Niels Bohr atomic structure.

- Nucleus made up of same no. of protons and same no. of neutrons.
- Electrons orbits in fixed elliptical orbits around nucleus called **SHELL**.

ELECTRON THEORY

ATOMIC SHELL AND ENERGY LEVELS

- Electron require certain energy to remain on its orbit.
- Electron capacity = $2n^2$ where n = no of shells.

ELECTRON THEORY

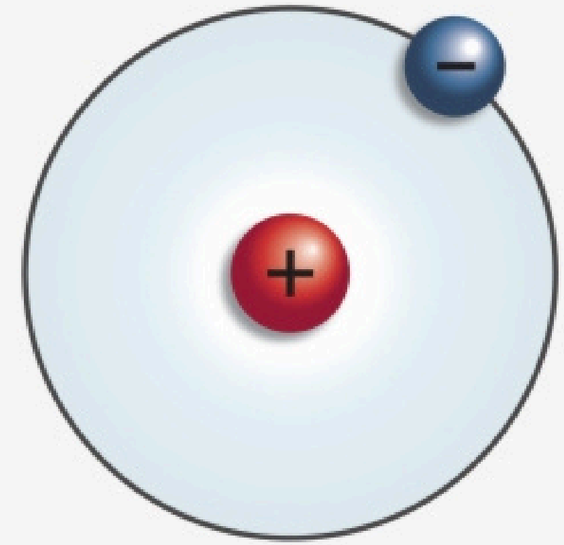
ATOMIC SHELL AND ENERGY LEVELS

No. of shells;

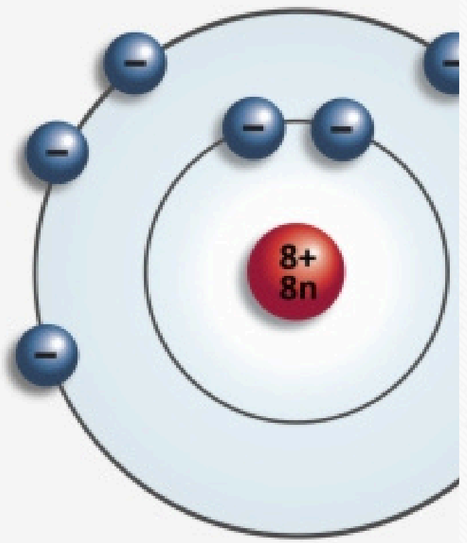
- K = 1
- L = 2
- M = 3
- N = 4

ELECTRON THEORY

ATOMIC STRUCTURE – HYDROGEN & OXYGEN



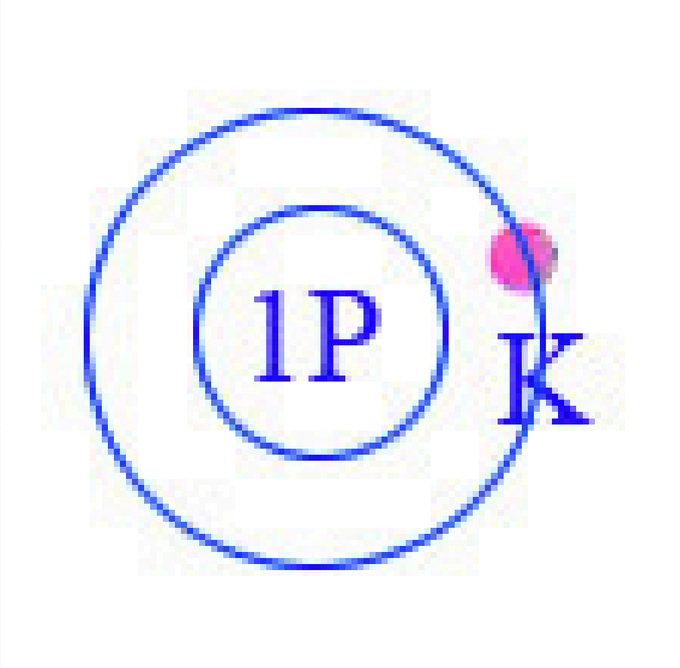
Hydrogen Atom



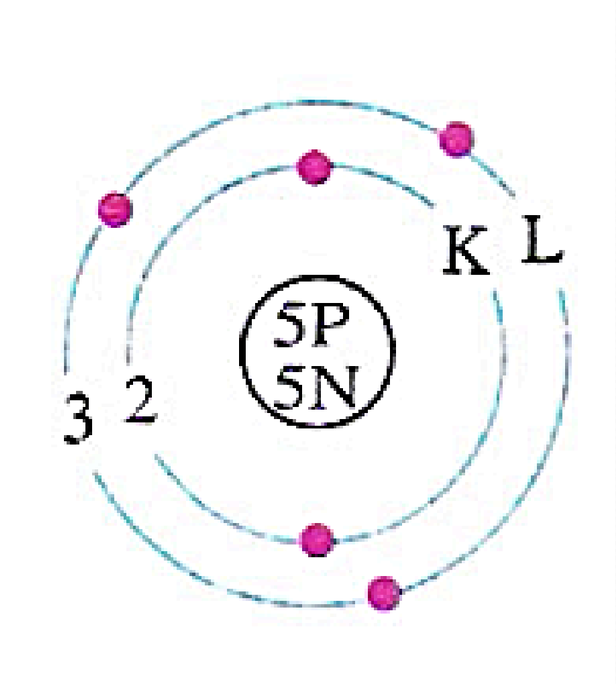
Oxygen Atom

ELECTRON THEORY

ATOMIC SHELL AND ENERGY LEVELS



HYDROGEN



BORON

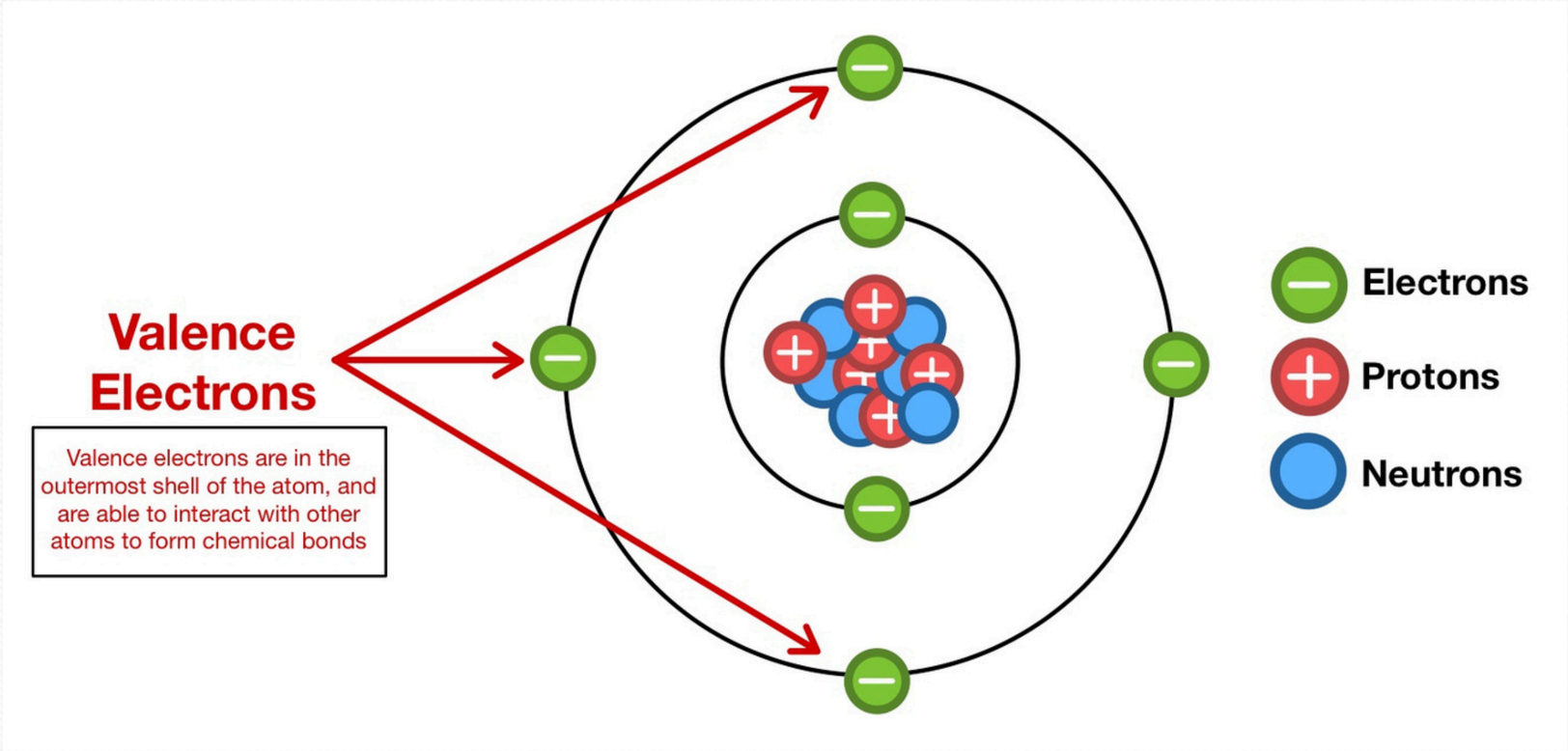
ELECTRON THEORY

VALENCE ELECTRONS

- These are the electrons occupying the outer most orbit or shell of an atom.
- They determine the electrical and chemical properties of the element.
- These electrons are can participate in chemical bonds with other atoms.

ELECTRON THEORY

VALENCE ELECTRONS



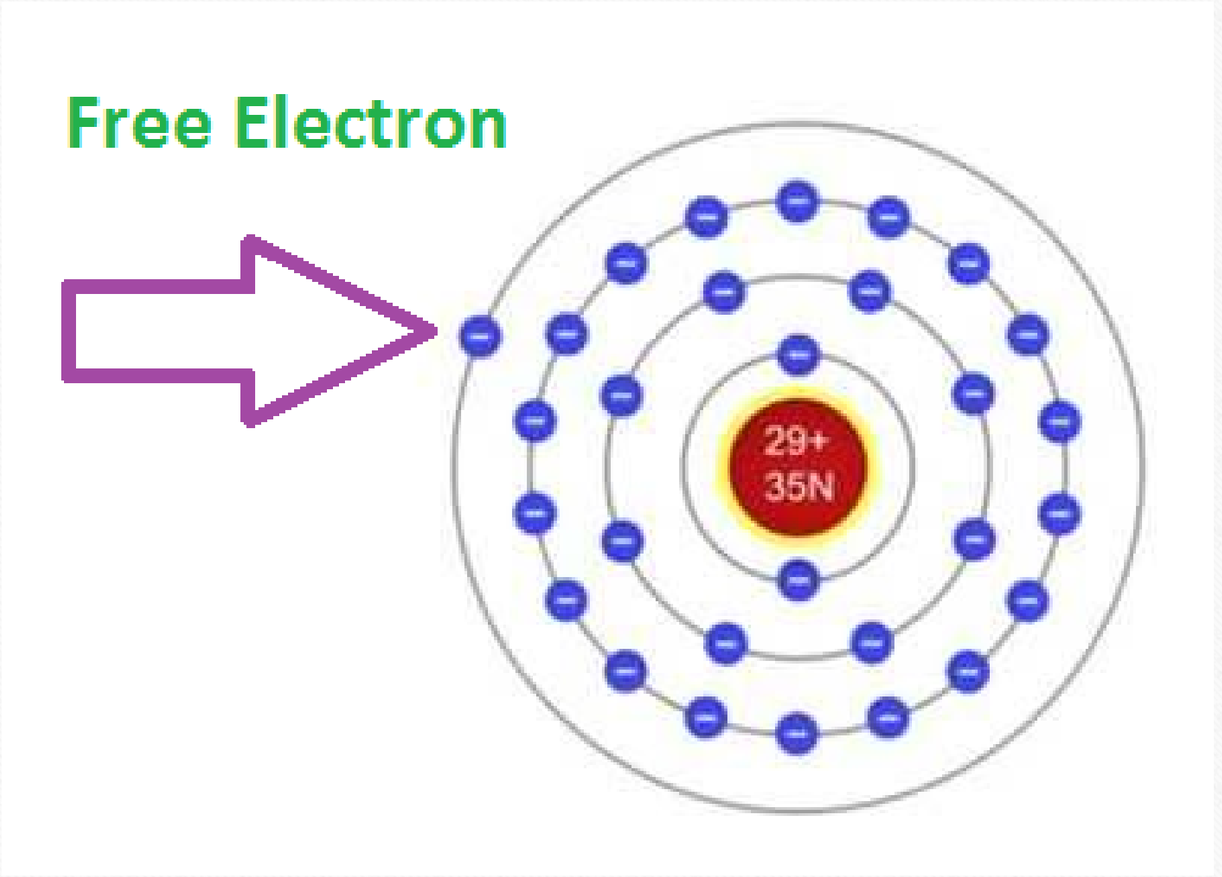
ELECTRON THEORY

FREE ELECTRONS

- They are more loosely bound and orbit at a greater distance from the nucleus.
- They can be easily dislodged from the attraction of the protons in the nucleus.
- They travel from atom to atom.
- Usually found in conductor

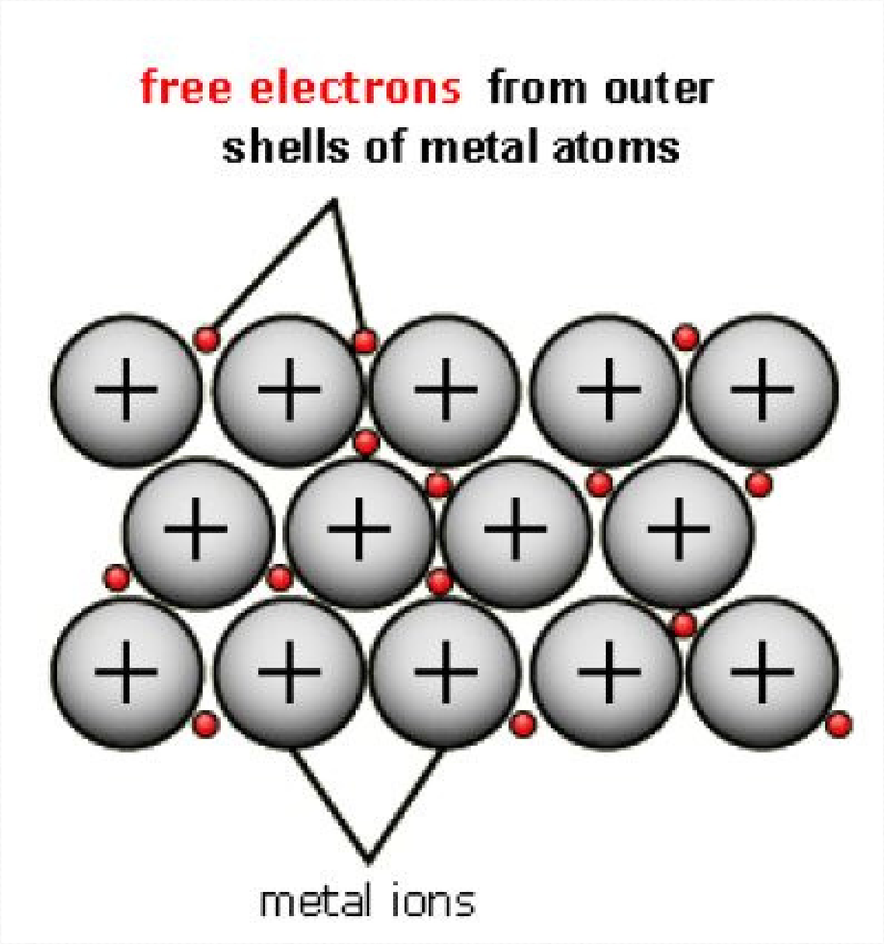
ELECTRON THEORY

FREE ELECTRONS



ELECTRON THEORY

FREE ELECTRONS



ELECTRON THEORY

ELECTRON MOVEMENT

- The valence of an atom determines its ability to gain or lose an electron.
- This determines the chemical and electrical properties of the atom.

ELECTRON THEORY

ELECTRON MOVEMENT

Depending on the ability of the material to produce free electrons can be categorized;

- Conductor
- Insulator
- Semiconductor

ELECTRON THEORY

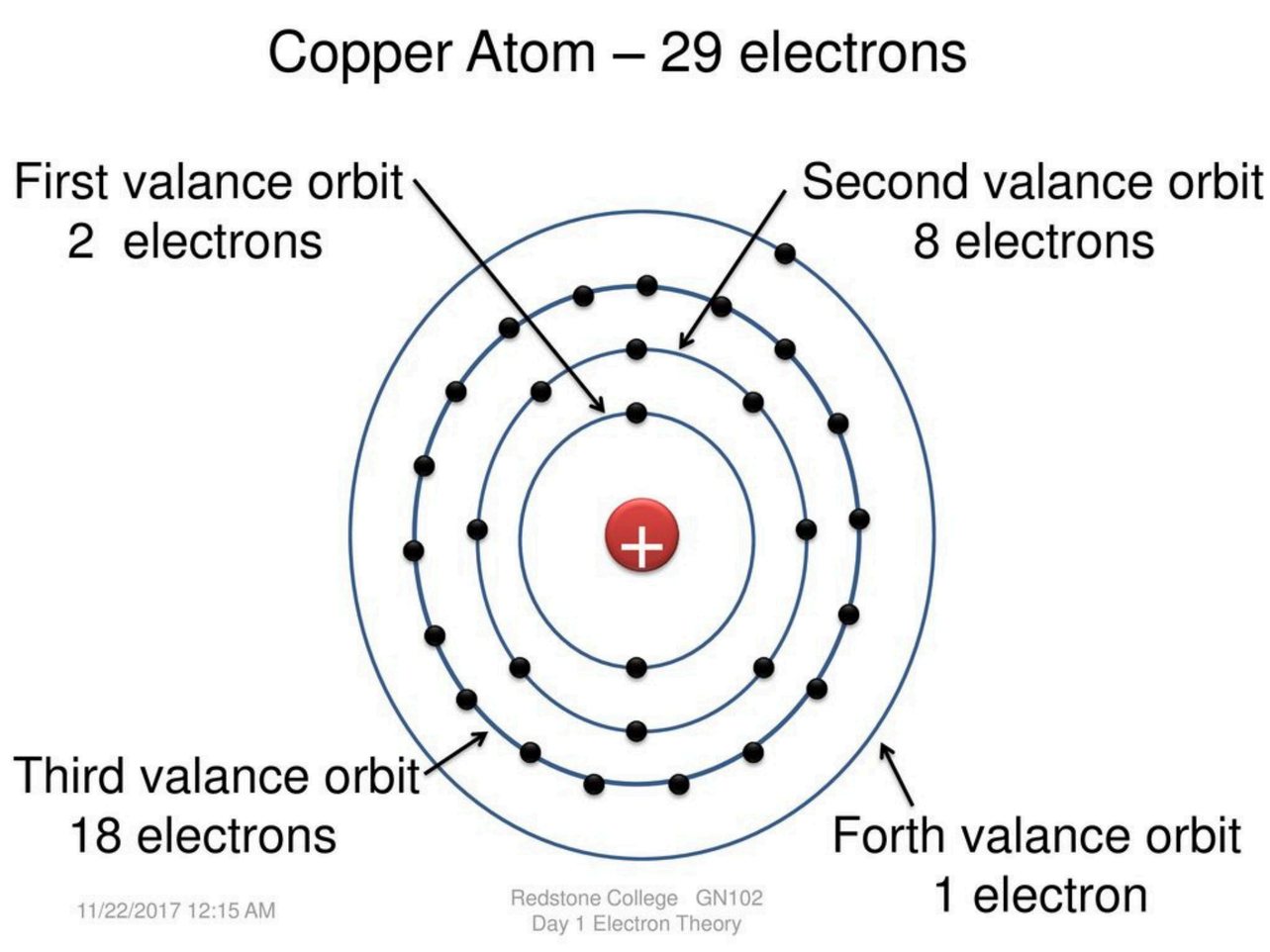
CONDUCTOR

- Valence electrons are lesser than 3 in number.

- It has lots of free electron so conduct electricity easily.
- Gold
- Silver
- Copper
- Aluminum.

ELECTRON THEORY

CONDUCTOR



ELECTRON THEORY

INSULATOR

- Outermost orbit is completely filled or
- Valence electrons are more than 4 in number.
- Electrons in are held to the atom with a relatively strong force.
- Electrons cannot be moved very easily.

ELECTRON THEORY

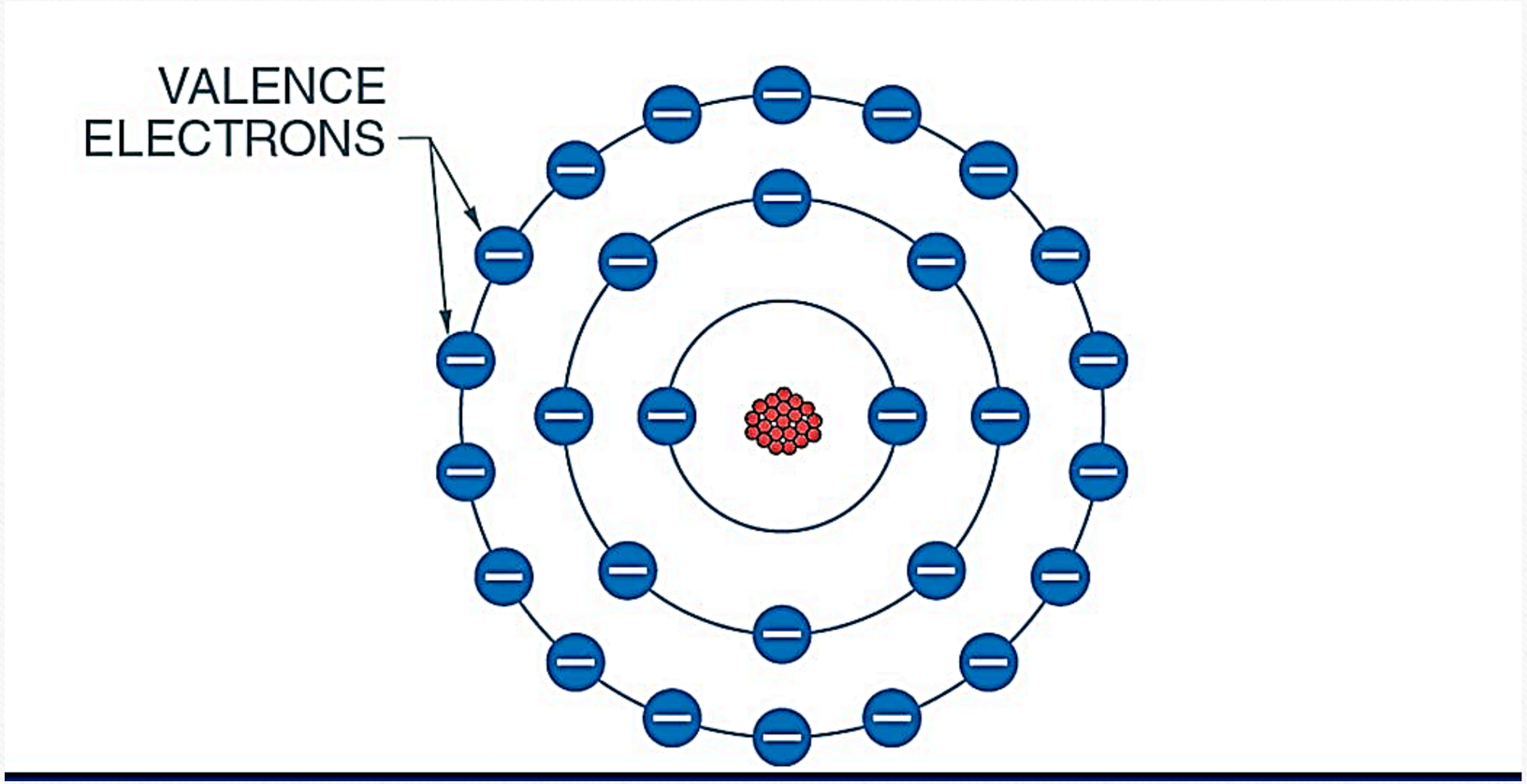
INSULATOR

Examples;

- Neon and Helium Gases,
- Paper
- Plastic
- Glass
- Mica

ELECTRON THEORY

INSULATOR



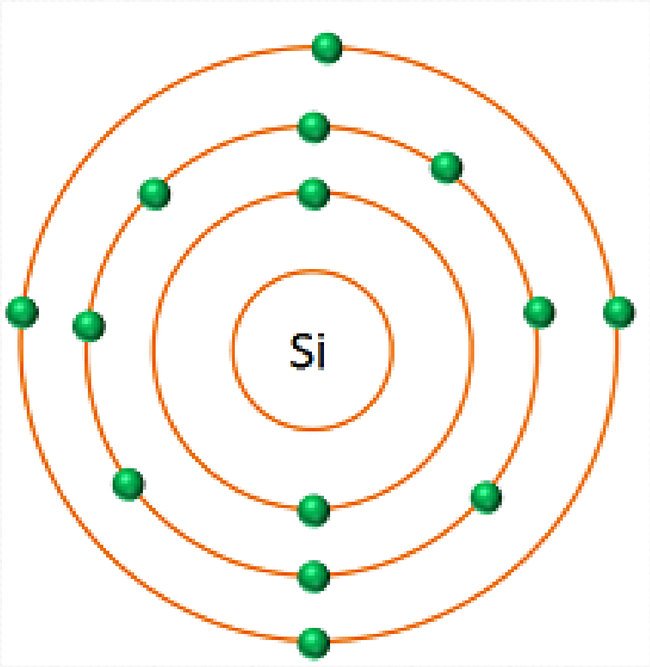
ELECTRON THEORY

SEMICONDUCTORS

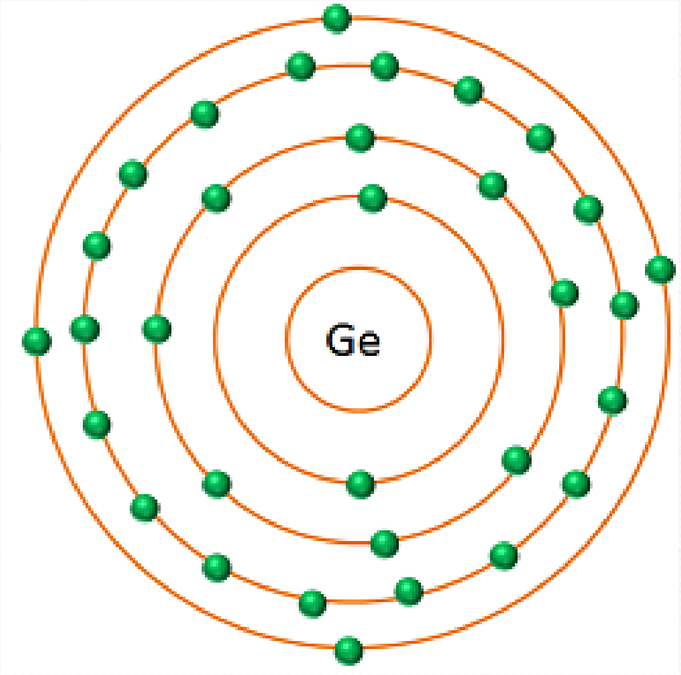
- Valence electrons are exactly four.
- They are neither good conductor or insulator.
- Example;
  - Germanium
  - Silicon

ELECTRON THEORY

SEMICONDUCTORS



SILICON



GERMANIUM

ELECTRON THEORY

IONS

- Ionization is the process by which an atom loses or gains electrons.
- Positive ions
- Negative ions

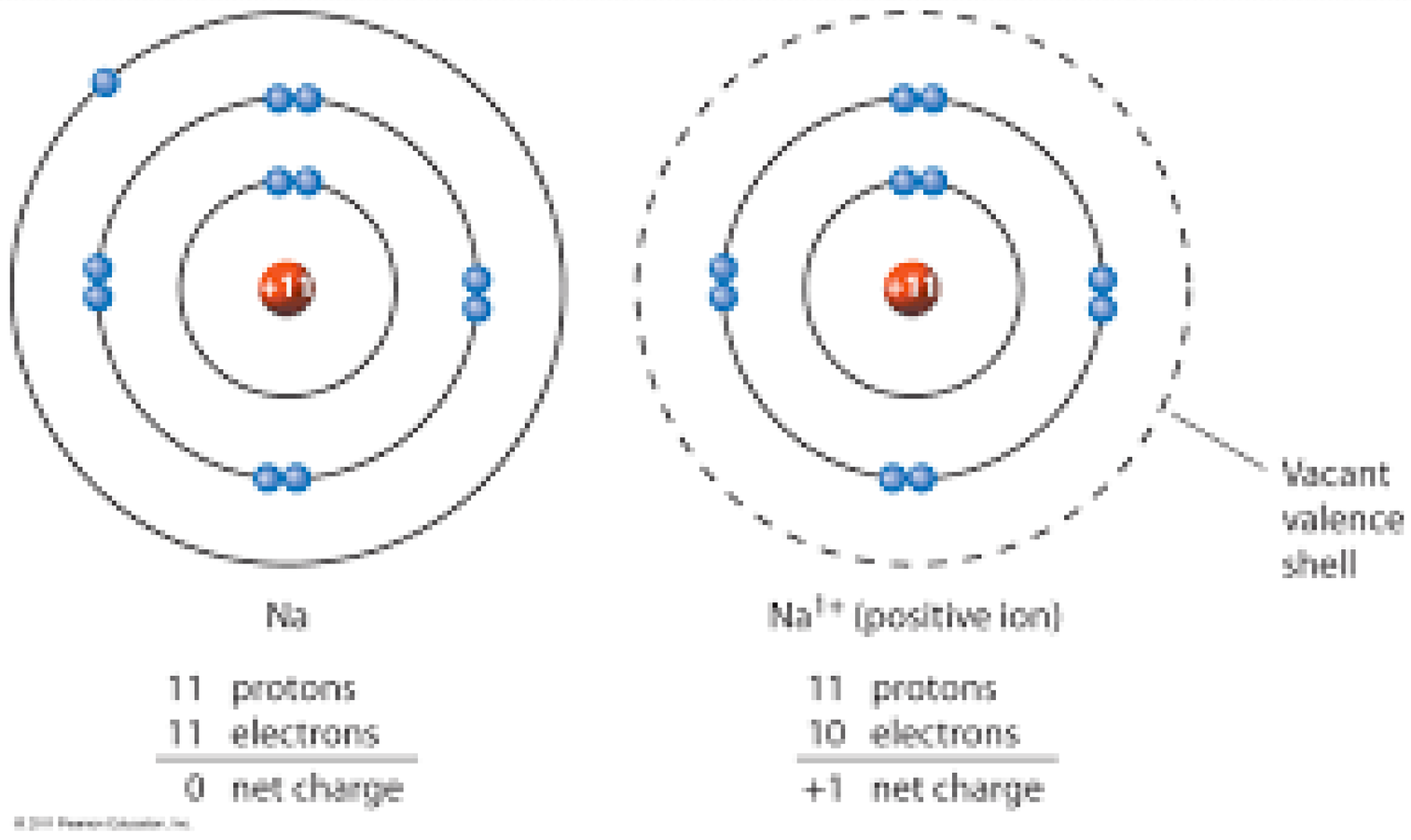
ELECTRON THEORY

POSITIVE IONS

- Atom loses electrons.
- Atom becomes positively charged.
- Protons number are more than electrons.

ELECTRON THEORY

POSITIVE IONS



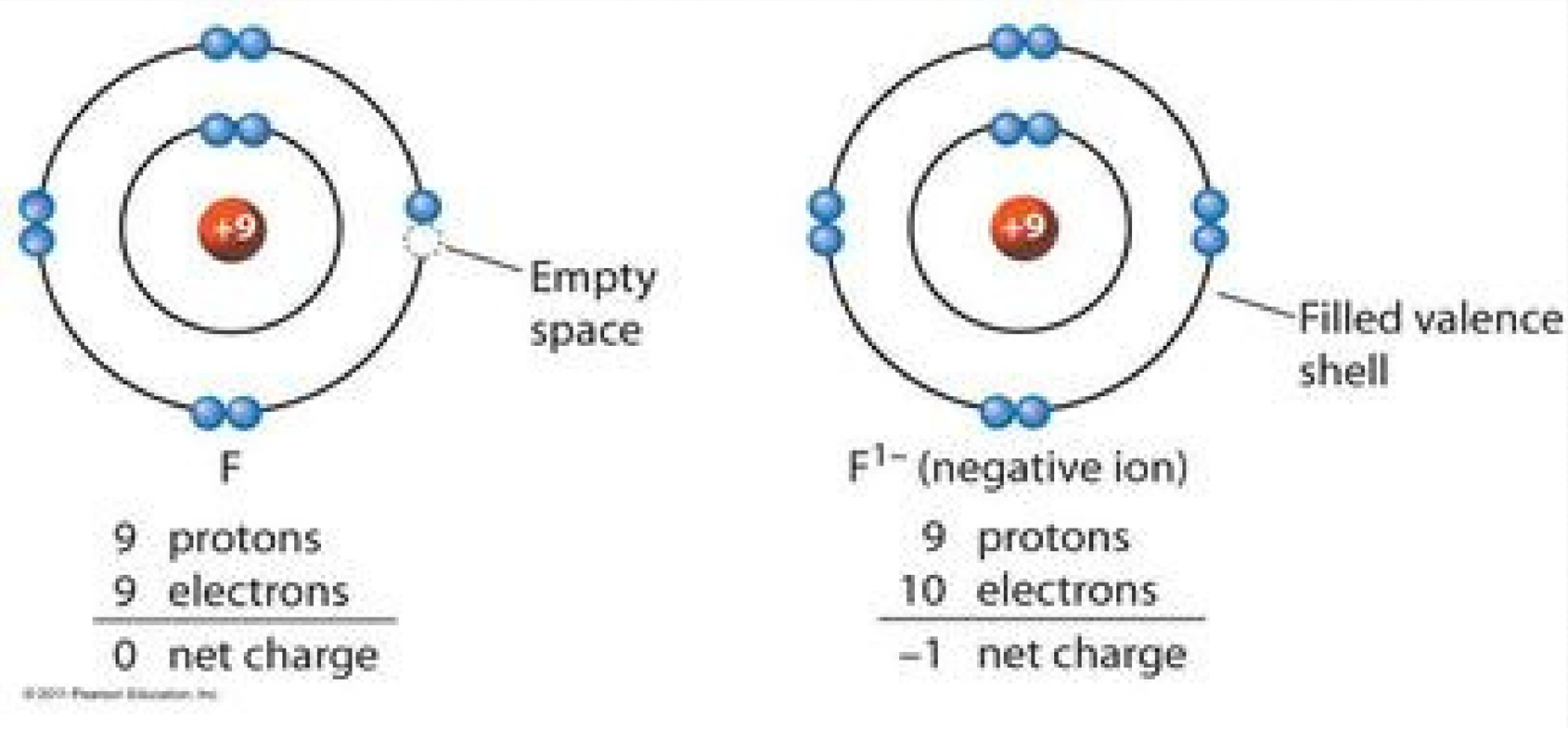
ELECTRON THEORY

NEGATIVE IONS

- Atom gains electrons.
- Atom becomes negatively charged.
- Electrons number are more than protons.

ELECTRON THEORY

NEGATIVE IONS



THANKS