# ENHANCING THE UNDERSTANDING OF VALENCY THROUGH SIMPLE ACTIVITIES AMONG VIII STANDARD STUDENTS

**ACTION RESEARCH REPORT**

Submitted By


**M. VIDHYA**, M.Sc., M.Ed., M.Phil.,

Lecturer,

District Institute of Education and Training,

Vadalur – 607303 Cuddalore District


Submitted to

STATE COUNCIL OF EDUCATIONAL RESEARCH AND TRAINING

CHENNAI – 600006

2023 - 2024

The Principal,

District Institute of Education and Training,

Vadalur – 607303

Cuddalore District.

CERTIFICATE

This is to certify that the action research entitled **“Enhancing the understanding of valency through simple activities among VIII standard students”** is the independent research work done by **Mrs. M. VIDHYA**, M.Sc., M.Ed., M.Phil., lecturer, District Institute of Education and Training, Vadalur, under my supervision at this institute during the period 2023-2024 as per the requirement of the State Council of Educational Research and Training, Chennai.

Station: Vadalur

Date :

Principal

District Institute of Education and Training

Vadalur

**ACKNOWLEDGEMENT**

*I sincerely acknowledge my gratitude to The Director, SCERT, Chennai for encouraging us to do this Action Research and for the financial support.*

*I express my heartfelt thanks to our principal Dr. G. Palani and former principal Mrs. G. Kala, DIET, Vadalur for their valuable guidance and constant encouragement throughout this study.*

*Its my great pleasure to thank all my colleagues for their critical evaluation and our office staff for extending all facilities to complete the work.*

*I am also thankful to the Headmaster, science BT and other teachers and VIII standard students of GHSS, Kanur for their help and co-operation for the successful completion of this research work.*

*I extend my thanks to SLT computers for the DTP work.*

(M. VIDHYA)

## CONTENT

I INTRODUCTION

Atoms are the extremely small particles that are the basic building blocks of ordinary matter. Atoms can join together to form molecules, which make up most objects. Different elements (e.g. oxygen, carbon, uranium) are made up of different types of atoms. An atom is the smallest unit of an element that will behave as that element.

Atoms consist of an extremely small, positively charged nucleus surrounded by a cloud of negatively charged electrons. Although typically the nucleus is less than one ten-thousandth the size of the atom, the nucleus contains more that 99.9% of the mass of the atom. Nuclei are made of positively charged protons and electrically neutral neutrons held together by a nuclear force. This force is much stronger than the electrostatic force that binds electrons to the nucleus, but its range is limited to distances of the order of $1 \times 10^{-15}$ meters.

The number of protons in the nucleus is called the atomic number (Z), the atomic number defines the element. The number of neutrons in the nucleus is denoted by N. The mass number (A) of the nucleus is equal to Z + N. The mass of the nucleus in atomic mass units (amu) is usually slightly different from the mass number.

At present there are 118 known elements which are typically displayed on the periodic table of the elements. Elements with atomic numbers 1 – 98 have all been shown to exist in nature while elements with atomic number 99 – 118 have only ever been produced artificially. Nuclides are often identified using the name of the element and the mass number (total number of protons and neutrons), i.e. lithium-7, uranium-238, etc. When referring to nuclides of the same element they are generally term isotopes i.e. uranium-238 & uranium-235. Radioactive nuclides or isotopes are called radionuclides or radioisotopes. Among the elements there are 253 stable nuclides, and more than 3000 radioisotopes. The majority of the radioisotopes (>2400) are artificially produced and not presently found in nature.

**NATURE OF ATOM**

Atom is the basic building block of all matter and chemistry. Atoms can combine with other atoms to form molecules but cannot be divided into smaller parts by ordinary chemical processes. Most of the atom is empty space. The rest consists of three basic types of subatomic particles: protons, neutrons and electrons. The protons and neutrons form the atom’s central nucleus. (The ordinary hydrogen atom is an exception; it contains one proton but no neutrons.) As their names suggest, protons have a positive electrical charge, while neutrons are electrically neutral, they carry no charge; overall, then, the nucleus has a positive charge. Circling the nucleus is a cloud of electrons, which are negatively charged. Like opposite ends of a magnet that attract one another, the negative electrons are attracted to a positive force, which binds them to the nucleus. The nucleus is small and dense compared with the electrons, which are the lightest charged particles in nature. The electrons circle the nucleus in orbital paths called shells, each of which holds only a certain number of electrons.

An ordinary neutral atom has an equal number of protons (in the nucleus) and electrons (surrounding the nucleus). Thus the positive and negative charges are balanced. Some atoms, however, lose or gain electrons in chemical reactions or in collisions with other particles. Ordinary atoms that either gain or lose electrons are called ions. If a neutral atom loses an electron, it becomes a positive ion. If it gains an electron, it becomes a negative ion. These basic subatomic particles protons, neutrons, and electrons are themselves made up of smaller substances, such as quarks and leptons.

More than 90 types of atoms exist in nature, and each kind of atom forms a different chemical element. Chemical elements are made up of only one type of atom gold contains only gold atoms and neon contains only neon atoms and they are ranked in order of their atomic number (the total number of protons in its nucleus) in a chart called the periodic table. Accordingly, because an atom of iron has 26 protons in its nucleus, its atomic number is 26 and its ranking on the periodic table of chemical elements is 26. Because an ordinary atom has the same number of electrons as protons, an element's atomic number also tells how many electrons its atoms have, and it is the number and arrangement of the electrons in their orbiting shells that determines how one atom interacts with another.

The key shell is the outermost one, called the valence shell. If this outermost shell is complete, or filled with the maximum number of electrons for that shell, the atom is stable, with little or no tendency to interact with other atoms. But atoms with incomplete outer shells seek to fill or to empty such shells by gaining or losing electrons or by sharing electrons with other atoms. This is the basis of an atom's chemical activity. Atoms that have the same number of electrons in the outer shell have similar chemical properties.

Most matter consists of an agglomeration of molecules, which can be separated relatively easily. Molecules, in turn, are composed of atoms joined by chemical bonds that are more difficult to break. Each individual atom consists of smaller particles—namely, electrons and nuclei. These particles are electrically charged, and the electric forces on the charge are responsible for holding the atom together. Attempts to separate these smaller constituent particles require ever-increasing amounts of energy and result in the creation of new subatomic particles, many of which are charged.

An atom consists largely of empty space. The nucleus is the positively charged centre of an atom and contains most of its mass. It is composed of protons, which have a positive charge, and neutrons, which have no charge. Protons, neutrons, and the electrons surrounding them are long-lived particles present in all ordinary, naturally occurring atoms. Other subatomic particles may be found in association with these three types of particles. They can be created only with the addition of enormous amounts of energy, however, and are very short-lived.

All atoms are roughly the same size, whether they have 3 or 90 electrons. Approximately 50 million atoms of solid matter lined up in a row would measure 1 cm (0.4 inch). A convenient unit of length for measuring atomic sizes is the angstrom (Å), defined as $10^{-10}$ metre. The radius of an atom measures 1–2 Å. Compared with the overall size of the atom, the nucleus is even more minute. It is in the same proportion to the atom as a marble is to a football field. In volume the nucleus takes up only $10^{-14}$ metres of the space in the atom—i.e., 1 part in 100,000. A convenient unit of length for measuring nuclear sizes is the femtometre (fm), which equals $10^{-15}$ metre.

The diameter of a nucleus depends on the number of particles it contains and ranges from about 4 fm for a light nucleus such as carbon to 15 fm for a heavy nucleus such as lead. In spite of the small size of the nucleus, virtually all the mass of the atom is concentrated there. The protons are massive, positively charged particles, whereas the neutrons have no charge and are slightly more massive than the protons. The fact that nuclei can have anywhere from 1 to nearly 300 protons and neutrons accounts for their wide variation in mass. The lightest nucleus, that of hydrogen, is 1,836 times more massive than an electron, while heavy nuclei are nearly 500,000 times more massive.

## ATOMIC NUMBER

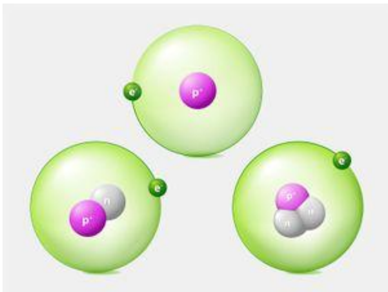
The single most important characteristic of an atom is its atomic number (usually denoted by the letter *Z*), which is defined as the number of units of positive charge (protons) in the nucleus. For example, if an atom has a *Z* of 6, it is carbon, while a *Z* of 92 corresponds to uranium. A neutral atom has an equal number of protons and electrons so that the positive and negative charges exactly balance. Since it is the electrons that determine how one atom interacts with another, in the end it is the number of protons in the nucleus that determines the chemical properties of an atom.

## ATOMIC MASS

The number of neutrons in a nucleus affects the mass of the atom but not its chemical properties. Thus, a nucleus with six protons and six neutrons will have the same chemical properties as a nucleus with six protons and eight neutrons, although the two masses will be different. The mass of atoms is measured in terms of the atomic mass unit, which is defined to be 1/12 of the mass of an atom of carbon-12, or $1.660538921 \times 10^{-24}$ gram. The mass of an atom consists of the mass of the nucleus plus that of the electrons, so the atomic mass unit is not exactly the same as the mass of the proton or neutron.

## ISOTOPES

Nuclei with the same number of protons but different numbers of neutrons are said to be isotopes of each other. All chemical elements have many isotopes. It is usual to characterize different isotopes by giving the sum of the number of protons and neutrons in the nucleus a quantity called the atomic mass number. In the above example, the first atom would be called carbon-12 or $^{12}C$ (because it has six protons and six neutrons), while the second would be carbon - 14 or $^{14}C$. As an example hydrogen has three (3) isotopes: hydrogen-1 (hydrogen), hydrogen-2 (deuterium) and hydrogen-3 (tritium).



The image shows the three isotopes of the element hydrogen. All three forms have one proton and one electron but differ in the number of neutrons in the nucleus. Protium, or ordinary hydrogen (top), has no neutrons. Deuterium, or hydrogen-2 (bottom left), has one neutron. Tritium, or hydrogen-3 (bottom right), has two neutrons.

## ATOMIC ORBITALS

Electrons fill in shell and subshell levels in a semi-regular process, as indicated by the arrows above. After filling the first shell level (with just an *s* subshell), electrons move into the second-level *s* subshell and then into the *p* subshell before starting on another shell level. Because of its lower energy state, the 4*s* orbital fills before the 3*d*, and later *s* orbitals fill similarly (for example, 6*s* fills before 4*f*).(more)

In the quantum mechanical version of the Bohr atomic model, each of the allowed electron orbits is assigned a quantum number *n* that runs from 1 (for the orbit closest to the nucleus) to infinity (for orbits very far from the nucleus). All of the orbitals that have the same value of *n* make up a shell. Inside each shell there may be subshells corresponding to different rates of rotation and orientation of orbitals and the spin directions of the electrons. In general, the farther away from the nucleus a shell is the more subshells it will have.

The arrangement of possible orbitals explains a great deal about the chemical properties of different atoms. The easiest way to see this is to imagine building up complex atoms by starting with hydrogen and adding one proton and one electron (along with the appropriate number of neutrons) at a time. In hydrogen the lowest energy orbit called the ground state corresponds to the electron located in the shell closest to the nucleus. There are two possible states for an electron in this shell, corresponding to a clockwise spin and a counter clockwise spin (or in the jargon of physicists, spin up and spin down).

The next most-complex atom is helium, which has two protons in its nucleus and two orbiting electrons. These electrons fill the two available states in the lowest shell, producing what is called a filled shell. The next atom is lithium, with three electrons. Because the closest shell is filled, the third electron goes into the next higher shell. This shell has spaces for eight electrons, so that it takes an atom with 10 electrons (neon) to fill the first two levels. The next atom after neon, sodium, has 11 electrons, so that one electron goes into the next highest shell.

In the progression thus far, three atoms hydrogen, lithium, and sodium have one electron in the outermost shell. As stated above, it is these outermost electrons that determine the chemical properties of an atom. Therefore, these three elements should have similar properties, as indeed they do. For this reason, they appear in the same column of the periodic table of the elements and the same principle determines the position of every element in that table. The outermost shell of electrons called the valence shell determines the chemical behaviour of an atom, and the number of electrons in this shell depends on how many are left over after all the interior shells are filled.

## ELECTRONIC CONFIGURATION

The electronic configuration of an element is a symbolic notation of the manner in which the electrons of its atoms are distributed over different atomic orbitals. While writing electron configurations, a standardized notation is followed in which the energy level and the type of orbital are written first, followed by the number of electrons present in the orbital written in superscript. For example, the electronic configuration of carbon (atomic number: 6) is $1s^2 2s^2 2p^2$.

Electron Configurations are useful for:

- Determining the valency of an element.
- Predicting the properties of a group of elements (elements with similar electron configurations tend to exhibit similar properties).
- Interpreting atomic spectra.

This notation for the distribution of electrons in the atomic orbitals of atoms came into practice shortly after the Bohr model of the atom was presented by Ernest Rutherford and Niels Bohr in the year 1913.

**Shells**

The maximum number of electrons that can be accommodated in a shell is based on the principal quantum number (n). It is represented by the formula $2n^2$, where 'n' is the shell number. The shells, values of n, and the total number of electrons that can be accommodated are tabulated below.

| Shell and 'n' value | Maximum electrons present in the shell |
|---|---|
| K shell, n=1 | $2*1^2 = 2$ |
| L shell, n=2 | $2*2^2 = 8$ |
| M shell, n=3 | $2*3^2 = 18$ |
| N shell, n=4 | $2*4^2 = 32$ |

**Subshells**

- The subshells into which electrons are distributed are based on the azimuthal quantum number (denoted by 'l').
- This quantum number is dependent on the value of the principal quantum number, n. Therefore, when n has a value of 4, four different subshells are possible.
- When n=4. The subshells correspond to l=0, l=1, l=2, and l=3 and are named the s, p, d and f subshells respectively.
- The maximum number of electrons that can be accommodated by a subshell is given by the formula 2*(2l + 1).
- Therefore, the s, p, d, and f subshells can accommodate a maximum of 2, 6, 10 and 14 electrons respectively.

All the possible subshells for values of n up to 4 are tabulated below. Thus, it can be understood that the 1p, 2d, and 3f orbitals do not exist because the value of the azimuthal quantum number is always less than that of the principal quantum number.

| Principle Quantum Number Value | Value of Azimuthal Quantum Number | Resulting Subshell in the Electron Configuration |
|---|---|---|
| n=1 | l=0 | 1s |
| n=2 | l=0 | 2s |
| | l=1 | 2p |
| n=3 | l=0 | 3s |
| | l=1 | 3p |
| | l=2 | 3d |
| n=4 | l=0 | 4s |
| | l=1 | 4p |
| | l=2 | 4d |
| | l=3 | 4f |

**Notation**

- The electron configuration of an atom is written with the help of subshell labels.
- These labels contain the shell number (given by the principal quantum number), the subshell name (given by the azimuthal quantum number) and the total number of electrons in the subshell in superscript.
- For example, if two electrons are filled in the ‘s’ subshell of the first shell, the resulting notation is ‘$1s^2$’.
- With the help of these subshell labels, the electron configuration of magnesium (atomic number 12) can be written as $1s^2$ $2s^2$ $2p^6$ $3s^2$.

**Filling of Atomic Orbitals**

**Aufbau Principle**

- This principle is named after the German word ‘Aufbeen’ which means ‘build up’.

- The Aufbau principle dictates that electrons will occupy the orbitals having lower energies before occupying higher energy orbitals.
- The energy of an orbital is calculated by the sum of the principal and the azimuthal quantum numbers.
- According to this principle, electrons are filled in the following order: 1s, 2s, 2p, 3s, 3p, 4s, 3d, 4p, 5s, 4d, 5p, 6s, 4f, 5d, 6p, 7s, 5f, 6d, 7p…

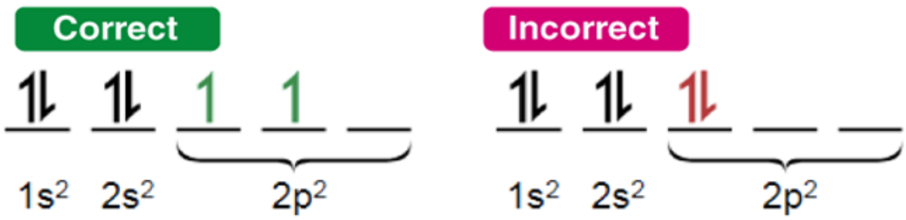
The order in which electrons are filled in atomic orbitals as per the Aufbau principle. It is important to note that there exist many exceptions to the Aufbau principle such as chromium and copper. These exceptions can sometimes be explained by the stability provided by half-filled or completely filled subshells.

**Pauli Exclusion Principle**

- The Pauli exclusion principle states that a maximum of two electrons, each having opposite spins, can fit in an orbital.
- This principle can also be stated as "no two electrons in the same atom have the same values for all four quantum numbers".
- Therefore, if the principal, azimuthal, and magnetic numbers are the same for two electrons, they must have opposite spins.

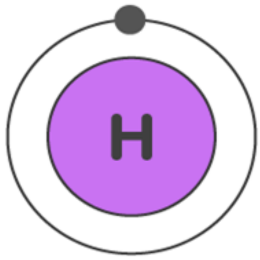
**Hund's Rule**

- This rule describes the order in which electrons are filled in all the orbitals belonging to a subshell.
- It states that every orbital in a given subshell is singly occupied by electrons before a second electron is filled in an orbital.
- In order to maximize the total spin, the electrons in the orbitals that only contain one electron all have the same spin (or the same values of the spin quantum number).



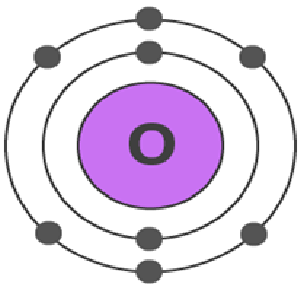
**Electron Configuration of Hydrogen**

The atomic number of hydrogen is 1. Therefore, a hydrogen atom contains 1 electron, which will be placed in the s subshell of the first shell/orbit. The electron configuration of hydrogen is $\mathbf{1s^1}$ illustrated below.



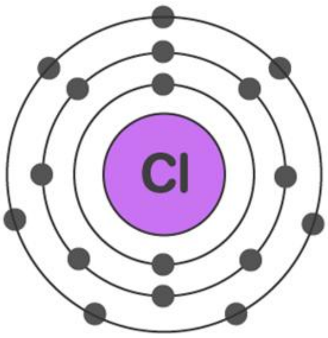

**Electron Configuration of Oxygen**

The atomic number of oxygen is 8, implying that an oxygen atom holds 8 electrons. Its electrons are filled in the following order: K shell – 2 electrons, L shell – 6 electrons. Therefore, the electron configuration of oxygen is $\mathbf{1s^2\ 2s^2\ 2p^4}$, as shown in the illustration provided below.




**Chlorine Electronic Configuration**

Chlorine has an atomic number of 17. Therefore, its 17 electrons are distributed in the following manner: K shell – 2 electrons, L shell – 8 electrons, M shell – 7 electrons. The electron configuration of chlorine is illustrated below. It can be written as $\mathbf{1s^2 2s^2 2p^6 3s^2 3p^5}$ or as [Ne]$3s^2 3p^5$



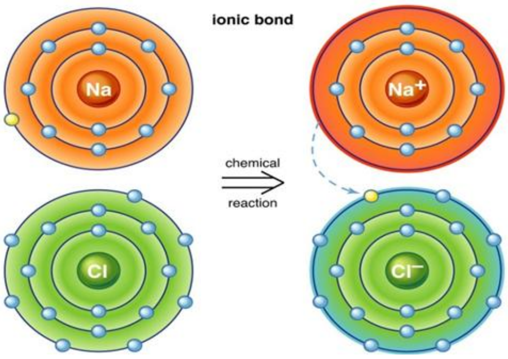
## ATOMIC BONDS

Once the way atoms are put together is understood, the question of how they interact with each other can be addressed in particular, how they form bonds to create molecules and macroscopic materials. There are three basic ways that the outer electrons of atoms can form bonds:

1. Electrons can be transferred from one atom to another.
2. Electrons can be shared between neighbouring atoms.
3. Electrons can be shared with all atoms in a material.

**Ionic bonding in sodium chloride.**

An atom of sodium (Na) donates one of its electrons to an atom of chlorine (Cl) in a chemical reaction, and the resulting positive ion ($Na^+$) and negative ion ($Cl^-$) form a stable ionic compound (sodium chloride; common table salt) based on this ionic bond.




As an example an atom of sodium, which has one electron in its outermost orbit, coming near an atom of chlorine which has seven. Because it takes eight electrons to fill the outermost shell of these atoms, the chlorine atom can be thought of as missing one electron. The sodium atom donates its single valence electrons to fill the hole in the chlorine shell, forming a sodium chloride system at a lower total energy level.

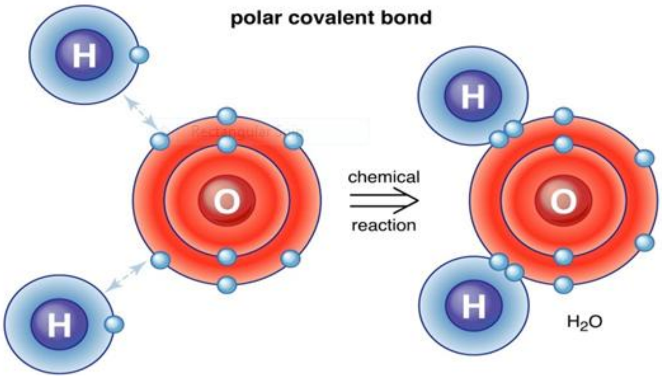
An atom that has more or fewer electrons in orbit than protons in its nucleus is called an ion. Once the electron from its valence shell has been transferred, the sodium atom will be missing an electron; it therefore will have a positive charge and become a sodium ion. Simultaneously, the chlorine atom, having gained an extra electron, will take on a negative charge and become a chlorine ion. The electrical force between these two oppositely charged ions is attractive and locks them together. The resulting sodium chloride compound is a cubic crystal commonly known as ordinary table salt.

**Covalent bond**

When two atoms come near each other, they can share a pair of outermost electrons (think of the atoms as tossing the electrons back and forth between them) to form a Covalent bond. Covalent bonds are particularly common in organic materials, where molecules often contain long chains of carbon atoms (which have four electrons in their valence shells). In some materials each atom gives up an outer electron that then floats freely in essence, the electron is shared by all of the atoms within the material. The electrons form a kind of sea in which the positive ions float like marbles in molasses. This is called the metallic bond and as the name implies, it is what holds metals together.

**Polar covalent bonds**

In polar covalent bonds such as that between hydrogen and oxygen atoms, the electrons are not transferred from one atom to the other as they are in an ionic bond. Instead, some outer electrons merely spend more time in the vicinity of the other atom. The effect of this orbital distortion is to induce regional net charges that hold the atoms together, such as in water molecules.




There are also ways for atoms and molecules to bond without actually exchanging or sharing electrons. In many molecules the internal forces are such that the electrons tend to cluster at one end of the molecule, leaving the other end with a positive charge. Overall, the molecule has no net electric charge it is just that the positive and negative charges are found at different places. For example, in water ($H_2O$) the electrons tend to spend most of their time near the oxygen atom, leaving the region of the hydrogen atoms with a positive charge. Molecules whose charges are arranged in this way are called polar molecules.

An atom or ion approaching a polar molecule from its negative side, for example, will experience a stronger negative electric force than the more-distant positive electric force. This is why many substances dissolve in water: the polar water molecule can pull ions out of materials by exerting electric forces. A special case of polar forces occurs in what is called the hydrogen bond. In many situations, when hydrogen forms a covalent bond with another atom, electrons move toward that atom and the hydrogen acquires a slight positive charge. The hydrogen, in turn, attracts another atom, thereby forming a kind of bridge between the two. Many important molecules, including DNA, depend on hydrogen bonds for their structure.

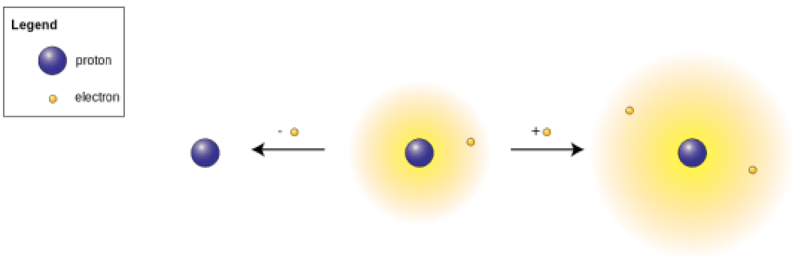
VALENCY

Valency is the combining power of an element, especially as measured by the number of hydrogen atoms it can displace or combine with. It is a measure of the reactivity of a chemical element. However, it only describes the connectivity of atoms and does not describe the geometry of a compound. Valency and charge are closely related terms as both these terms describe the reactivity of a chemical element. Valency is the combining power of an element, especially as measured by the number of hydrogen atoms it can displace or combine with. On the other hand, a charge of an atom is the number of protons minus the number of electrons in an atom.

**Charge**

A charge is the number of protons minus the number of electrons in an atom. Usually, these two numbers are equal to each other and the atom occurs in neutral form. However, if an atom has an unstable electron configuration, then it tends to form ions by either gaining or removing electrons. Here, if an atom gains electrons, then it gets a negative charge since an electron has a negative charge. When an atom gains an electron, there aren't enough protons in the atom to balance this charge; thus, the charge of the atom is -1. But, if the atom removes an electron, then there is one proton in extra; thus, the atom gets +1 charge.

Charge of a Hydrogen Atom

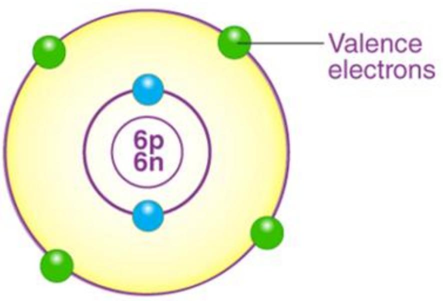


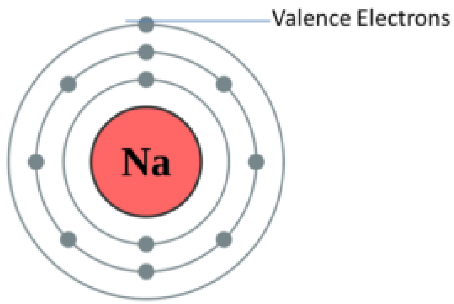

| | | | |
|---|---|---|---|
| No. of protons | 1 | 1 | 1 |
| No. of electrons | 0 | 1 | 2 |
| Charge | +1 | 0 | -1 |
| Notation | $H^+$ | H | $H^-$ |
| Classification | cation | neutral (not an ion) | anion |

**Difference Between Valency and Charge**

Valency indicates the reactivity of an atom, while charge indicates how an atom has reacted. So, the key difference between valency and charge is that valency indicates the ability of a chemical element to combine with another chemical element, whereas charge indicates the number of electrons either gained or removed by a chemical element. Moreover, the value for valency has no plus or minus signs, while the charge has plus sign if the ion has formed by removing electrons and has the minus sign if the atom has gained electrons.

The Valence, or known as valency, in Chemistry, is the characteristics of an element that indicates the number of other atoms with which an atom of a particular element can form a covalent bond. Introduced in 1868, the term is used for the expression of both the possibility of combination of an element in general and the numerical value of the power of combination. Thus valence meaning is the number of electrons as most of the bonds are formed by the exchange of the valence electrons. The valence electrons determine the valency.




**Importance of Valency**

The valency of an element is important because it determines how strong the bond between the atoms will be. The higher the valency, the stronger the bond. This is why elements with a high valency are often used in chemical reactions - they form strong bonds with other atoms. Valency is also an important concept in chemistry because it helps us understand how atoms join together to form molecules. By understanding valency, we can better predict how chemicals will react with each other. This makes it easier to create new compounds for use in various industries. Valency is a fundamental concept that helps us understand the world around us.

Valency is an important measure of the combining power of atoms. The valency of an atom is determined by the number of electrons in its outermost shell. The valency of an element can be increased either by gaining or losing electrons. Valency is important because it gives us information about how atoms combine and why certain chemicals react the way they do. Valency also helps us predict the properties of new compounds that we create. Valence is fundamental to chemistry!

**Valence Chemistry**

The explanation and the systematization of the concept of valence or valency was one of the major challenges for 19th-century chemists. As there was no satisfactory theory for the cause of valency, most of the efforts were done on making empirical rules for the determination of the valencies of the elements. The characteristic valence of elements was measured in terms of the number of atoms of hydrogen with which an atom of the element can merge or that it can replace in a compound. It later was quite evident, however, that the valencies of many of the elements varied in different compounds.

The first great step in the development of a satisfactory explanation of valence and chemical combination was made by the American chemist G. N. Lewis in 1916 with the identification of the chemical bond present in the organic compounds as a pair of electrons was held jointly by two atoms which were holding them together. In the same year, the nature of the chemical bond between electrically charged atoms, or also known as ions, was discussed by the German physicist W. Kossel.

The valence theory was reformulated and described incorporating electronic structures and interatomic forces after significant development in the field of electronic theory of periodicity of elements. Due to this several new concepts were introduced which included ionic valence, covalence, oxidation number, coordination number and metallic valence which also explain the different modes of atomic interactions.

Most of the definitions in Chemistry are defined by IUPAC. Hence, the definitions in valence chemistry are also given by IUPAC. As per the IUPAC valence meaning is defined as the maximum number of single valence atoms that can possibly merge with an atom of the particular element under study, or with a fragment, or for which an atom of this element can be substituted.

Another description used to define valence in modern times is - The number of possible hydrogen atoms that can merge with an element in a binary hydride or twice the number of oxygen atoms that combine with an element in its oxide or oxides forms. This definition differs from the IUPAC definition as an element can be said to have more than one valence possible.

Modern valence definition stating the valence meaning is that the valence of a particular atom present in a molecule is the number of electrons that an atom uses in the formation of a bond. This is represented by the formulas for calculating the valence electrons that can also be used to define valence is:

Valence = number of electrons in the last/valence shell of a free atom - Number of electrons on an atom in molecules that are not bonded. Hence, valency definition in chemistry can be shown by the formula as

Valence or Valency = Number of bonds formed + Formal charge of the atom.

**Valency and Number of Electrons**

The Rutherford Model of the nucleus of an atom shows that the outside of an atom is filled by electrons, suggesting that the electrons are the ones responsible for the interaction of the atoms and the formation of the chemical bonds. Later, G. N. Lewis explained the valence and chemical bonding in terms of the nature of atoms to acquire a stable octet of eight valence-shell electrons. According to the theory proposed by Lewis, covalent bond formation leads to octet structure by sharing of the electrons, while ionic bonding leads to octet structure by the transfer of electrons from one atom to the other.

Another term related to valence is covalence, which is the number of electron pairs shared by one atom with another atom. Also, by name co- means together, indicating that a covalent bond is that bond in which the atoms share a valence. Hence, it is now more common to say covalent bonds rather than using valence and valence meaning in Chemistry in high-level work done in advancing the theory of chemical bonding although it is widely used in the understanding of the basic concepts which provide an introduction to the topic.

**Valency is Applied in Various Areas:**

**1) In Medicine:** valency is used to determine the efficacy of a drug. Valency predicts how much drug will be needed in order to treat a patient. Valency also determines how easily a drug can cross biological membranes such as the placenta (for pregnant women), blood-brain barrier (for patients with neurodegenerative diseases like Alzheimer's or Parkinson's), and intestinal wall (for patients who need treatment for infections).

**2) In Genetics:** valency results from the binding of two alleles at a single loci, where each allele may have a different valence depending on its own gene product and that of another allele present at the same locus.

**3) In Environmental Sciences:** valency indicates the degree to which chemicals will interact with each other and the potential for chemical reaction.

**4) In Industrial Chemistry:** valency is used to predict the properties of compounds and their suitability for particular applications.

**5) In Predicting the Properties of the Compound-** valency helps in predicting the physical and chemical properties of the valency.

**6) In Synthetic Organic Chemistry:** valency is used to plan the construction of molecular structures.

**7) In Studying the Structure of Inorganic Materials:** valency provides a simple way of classifying complex inorganic materials.

**8) In Studying the Bonding in Metals:** valency is used to understand why some alloys have better mechanical properties than others.

**9) In Solid-State Physics:** valency is used to classify solids on the basis of their bonding arrangements.

10) Valency has wide applicability across many scientific disciplines. By understanding valency, we can better predict how chemicals will react with each other and create new compounds for various applications.

**Valence electrons**

Valence electrons are those electrons which are present in the outermost orbit of the atom. From the Bohr-bury scheme, we can say that the outermost shell can contain a maximum of 8 electrons. Only a little chemical activity is observed when the outermost shell is completely filled. We can also say that it's combining capacity becomes zero. For example, nitrogen forms a number of compounds with hydrogen such as $NH_3$, $N_2H_4$, $N_3H$ in which nitrogen atoms have valencies of 3, 2 and 1/3 respectively. Thus, this concept of valency as a mere number was not clear. Therefore, later on valency was defined as the number of chemical bonds formed by an atom in a molecule.

**Noble gases**

Noble gases have a completely filled outermost shell and that's why they are least reactive. Other element's reactivity depends upon their ability to attain the noble gas configuration. If the outermost orbit is completely filled then very little to no chemical activity is observed in the particular element. Their combining capacity becomes negligible or zero. This is why noble gases are least reactive because their outermost orbit is completely filled. However, the reactivity of other elements depends upon their capacity to gain noble gas configuration. It will also help to determine the valency of an atom.

## How to Find Valency of Elements?

The number of electrons in the outermost shell of hydrogen is 1, and in magnesium it is 2. Therefore, the valency of hydrogen is 1 as it can easily lose 1 electron and become stable. On the other hand, that of magnesium is 2 as it can lose 2 electrons easily and also attain stability. Furthermore, it is not only determined when an atom loses an electron. For example, fluorine has 7 electrons in its outermost orbital. It is hard to lose 7 electrons and so it completes its octet by gaining 1 electron. Since it gains 1 electron, its valency is 1. In the periodic table, the elements in the same group have the same valency. For example, all the elements in group 8 have 8 electrons and completely filled orbitals, that is why the valency of all the elements in this group is zero.

## Difference between Valency and Oxidation Number

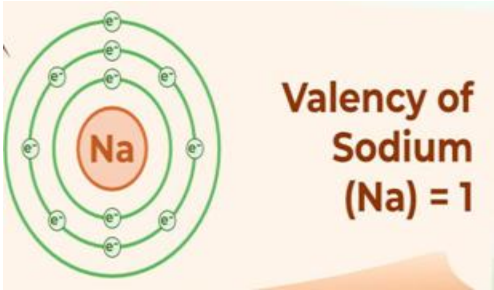
Valency is different from the oxidation number, and it has ***NO SIGN***. Thus, the valency of nitrogen is 3, whereas it can have oxidation numbers from -3 to +5. The oxidation number is the hypothetical charge of an atom in a molecule or ion, and it is a measure of its apparent capacity to gain or lose electrons within that species.

## Achieving Complete Octet

If the outermost shell of an atom has a total of 8 electrons then the atom is said to have attained a complete octet. An atom has to gain, lose or share a particular number of electrons from its outermost orbit to obtain complete octet. Therefore, a capacity of an atom is the total number of electrons gained, lost, or shared to complete its octet arrangement in the outermost atom. This capacity of an atom will also determine the valency of an atom.

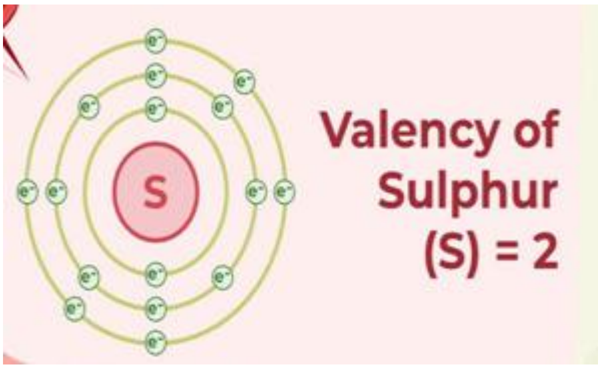
For instance, hydrogen has 1 electron in its outermost orbit so it needs to lose 1 electron to attain stability or octet. Thus, the valency of hydrogen is 1. Similarly, magnesium has 2 electrons in its outermost orbit and it needs to lose them to attain octet and obtain stability. Therefore, the valency of magnesium is 2. Stability is also determined by the ability of atoms to gain electrons. For instance, Fluorine has 7 electrons in its outermost orbit. It is difficult to lose 7 electrons but it is easy to gain one electron. Thus, it will gain one electron to obtain octet so the valency of fluorine is 1.

## Valency of Sodium

The atomic number of sodium is 11 (Z=11). The electronic configuration of sodium can be written as 2, 8, 1. 2, 8, 1 electrons are distributed in the shells K, L, M respectively. Therefore, valence electron in sodium is 1 and it needs to lose 1 electron from the outermost orbit to attain octet. Hence, the valency of sodium is 1. 


**Valency of Sulphur**

The Atomic number of S is 16 (K = 2; L = 8; M = 6). They have 6 electrons in their outermost shell and it needs to gain 2 electrons from the outermost orbit to attain octet. So, the valency of Sulphur is 2, 8 – 6=2 as shown below:




**Examples of Valency on the basis of Chemical Formula**

**Ammonia ($NH_3$)**

Valency is the capacity of an atom to combine with a particular number of atoms of another element. In the case of ammonia, one nitrogen atom combines with 3 hydrogen atoms. The atomic number of hydrogen is 7. The electronic configuration is 2, 5. 2, 5 electrons are distributed in the orbits K, L. Therefore, a nitrogen atom needs to gain 3 electrons in its outermost orbit to complete octet. The nitrogen atom combines with 3 hydrogen atom in the case of NH3. Therefore, its valency is 3. However, the hydrogen atoms present in ammonia combines with one nitrogen atom. Therefore, the valency of hydrogen is one. This is how chemical formulae of compounds are formed by swapping the valencies.

**Uses of Valency**

- It helps to determine a chemical formula.

- It helps to determine how many atoms of an element will combine with another element to form any chemical formula.

**Methods of Determining Valency**

The valency of the same group of the element present in the periodic table is the same. If we consider group 8 in the periodic table, all the elements of group 8 have completely filled outermost orbit and have attained octet arrangement. So, the elements of group 8 have zero valencies. The valency of any element can be determined primarily by 3 different methods:

1) The Octet Rule

If we cannot use the periodic table to determine valency then the octet rule is followed. This rule states that atoms of an element or chemicals have a tendency to obtain 8 electrons in their outermost orbit either by gaining or losing electrons in whatever form of compound it is present. An atom can have a maximum of 8 electrons in its outermost orbit. The presence of 8 electrons in the outermost shell indicates stability of an atom.

An atom tends to lose electron if it has one to four electrons in its outermost orbit. When an atom donates these free electrons it has positive valency. An atom will gain electrons if it has four to seven electrons in its outermost orbit. In such cases, it is easier to accept electron rather than donating it. Therefore, we determine the valency by subtracting the numbers of electrons from 8. All noble gases have 8 electrons in its outermost orbit except helium. Helium has 2 electrons in its outermost orbit.

2) Using the Periodic Table

In this method, valency is calculated by referring to the periodic table chart. For example, all the metals, be it hydrogen, lithium, sodium and so on, present in column 1 have valency +1. Similarly, all the elements present in column 17 have valency -1 such as fluorine, chlorine, and so on. All the noble gases are arranged in column 18. These elements are inert and have valency 0.

However, there is an exception to this method of valency determination. Certain elements like copper, iron, and gold have multiple active shells. This exception is usually noticed in transitional metals from column 3 through 10. It is also observed in heavier elements from column 11 through 14, lanthanides (57-71), and actinides (89-103).

3) On the Basis of the Chemical Formulae

This method is based on the octet rule. The valencies of many transitional elements or radicals can be determined in a particular compound by observing how it chemically unites with elements of known valency. In this case, the octet rule is followed where the elements and radicals combine and try to attain eight electrons in the outermost shell in order to become stable. For instance, consider the compound NaCl. We know that the valency of sodium (Na) is +1 and Chlorine (Cl) is -1. Both sodium and chlorine have to gain one electron and lose one electron respectively to achieve stable outermost orbit. Therefore, sodium donates an electron and chlorine accept the same electron. This is how the valency is determined. It is the classic example of ionic reaction as well.

**Valency Chart of Ions**

There are many ions that show valency similar to elements, some of them as follows:

| **Valency: 1** | | **Valency: 2** | | **Valency: 3** | |
|---|---|---|---|---|---|
| **Name of Ions** | **Symbol** | **Name of Ions** | **Symbol** | **Name of Ions** | **Symbol** |
| Sodium | $Na^{+}$ | Magnesium | $Mg^{+2}$ | Aluminium | $Al^{+3}$ |
| Potassium | $K^{+}$ | Calcium | $Ca^{+2}$ | Iron (III) | $Fe^{+3}$ |
| Copper (I) | $Cu^{+}$ | Copper (II) | $Cu^{+2}$ | Nitride | $N^{-3}$ |
| Hydrogen | $H^{+}$ | Iron (II) | $Fe^{+2}$ | Phosphate | $PO_4^{-3}$ |
| Hydride | $H^{-}$ | Zinc | $Zn^{+2}$ | Gold (III) | $Au^{+3}$ |
| Chloride | $Cl^{-}$ | Oxide | $O^{-2}$ | Titanium (III) | $Ti^{+3}$ |
| Bromide | $Br^{-}$ | Sulphide | $S^{-2}$ | | |

| Valency: 1 | | Valency: 2 | | Valency: 3 | |
|---|---|---|---|---|---|
| **Name of Ions** | **Symbol** | **Name of Ions** | **Symbol** | **Name of Ions** | **Symbol** |
| Ammonium | $Al^{-}$ | Carbonate | $CO_2^{-2}$ | | |
| Hydroxide | $OH^{-}$ | Sulphite | $SO_3^{-2}$ | | |
| Nitrate | $NO_3^{-}$ | Sulphate | $SO_4^{-2}$ | | |
| Oxalate | $CH_3COO^{-}$ | | | | |

**Relation Between Valency and Valence Electrons**

Valency explains the bond formation of atoms. Whereas, valence electrons are related to elemental characters. Valency is only a concept or idea and doesn't involve the transmission of electrons. Whereas, valence electron involves the transmission of electrons in the formation of bonds. Both valency and valence electrons are applied to any chemical element.

Since only the valence electrons (outermost electrons) participate in chemical bonding, an element's valency is determined by the number of valence electrons (outermost electrons) in its atom. The amount of valence electrons in an element's atom or the number of electrons necessary to complete eight electrons in the valence shell determines the element's valency. Sodium, for example, contains one valence electron and thus a valency of one. As a result, the valency of sodium is equal to the number of valence electrons in its atom. A metal element's valency is equal to the number of valence electrons in its atom in general.

***Valency of a Metal = Number of Valence Electrons in its Atom***

A valence electron, like an electron in an inner shell, may receive or release energy in the form of a photon. Atomic excitation occurs when an electron gains enough energy to migrate (jump) to an outer shell. Ionization occurs when an electron breaks away from its associated atom's valence shell, resulting in the formation of a positive ion. When an electron loses energy (and so emits a photon), it might migrate to an inner shell that isn't completely occupied.

***Valency of a Non-Metal = 8 – Number of Valence Electrons in its Atom***

A valence electron is an electron that is associated with an atom, and that can participate in the formation of a chemical bond; in a single covalent bond, both atoms in the bond contribute one valence electron in order to form a shared pair. The presence of valence electrons can determine the element's chemical properties and whether it may bond with other elements: For a main group element, a valence electron can only be in the outermost electron shell.

An atom with a closed shell of valence electrons tends to be chemically inert. An atom with one or two valence electrons more than a closed shell is highly reactive, because the extra valence electrons are easily removed to form a positive ion. An atom with one or two valence electrons fewer than a closed shell is also highly reactive, because of a tendency either to gain the missing valence electrons (thereby forming a negative ion), or to share valence electrons (thereby forming a covalent bond).

Like an electron in an inner shell, a valence electron has the ability to absorb or release energy in the form of a photon. An energy gain can trigger an electron to move (jump) to an outer shell; this is known as atomic excitation. Or the electron can even break free from its associated atom's valence shell; this is ionization to form a positive ion. When an electron loses energy (thereby causing a photon to be emitted), then it can move to an inner shell which is not fully occupied.

**The number of valence electrons**

The number of valence electrons of an element can be determined by the periodic table group (vertical column) in which the element is categorized. With the exception of groups 3–12 (the transition metals), the units digit of the group number identifies how many valence electrons are associated with a neutral atom of an element listed under that particular column.

**1.1 SCOPE OF THE STUDY**

Chemistry has influenced our life so much that we do not even realise that we come across many molecules at every moment. We ourselves are beautiful chemical creations and all our activities are controlled by chemicals. Hence study of chemistry and its combination with other materials is essential. Knowing the chemical reactions and how they combine with elements to form the molecules would help the students to learn more about the chemical combinations in our life.

Valency is a difficult concept in chemistry where children need to remember the atomic number of an atom and should understand the electronic configuration of the elements. The valency of certain atoms varies according to their combination with other atoms. Since the students lack the knowledge of valency, the educator intended to action research on it. The researcher made an attempt to remember the atomic number of atoms and formation of molecules by the valence electrons through simple activities.

**1.2 TITLE OF THE STUDY**

"ENHANCING THE UNDERSTANDING OF VALENCY THROUGH SIMPLE ACTIVITIES AMONG VIII STANDARD STUDENTS".

**1.3 NEED OF THE STUDY**

Valency is a fundamental concept in chemistry. The combining capacity of an atom is known as its valency. The number of bonds that an atom can form as part of a compound is expressed by the valency of the element. The students should know how electrons in an atom are arranged in shells/orbitals. In chemistry learning the periodic table and the atomic number would help the children to understand the valency of atoms. Each element has its own binding nature and based on that the valency differs. There is a particular way of writing electronic configuration. Hence the educator is intended to enhance the knowledge of valency among the eighth standard students.

**1.4 OBJECTIVES**

The study has been carried out with the following objectives:

- To develop the knowledge of valence electrons.
- Make the students to understand the valency.
- To enhance the knowledge of types of valency.
- Make the students to calculate the valency of different atoms.
- Motivate the students to know the variable valency of atoms.

**1.5 PROBABLE CAUSES**

The following reasons might have been the probable causes for the poor knowledge on the concept taken.

- Traditional method of teaching may be the cause.
- Students are unaware of the atomic number of atoms.
- More practice might have not been given to the students.
- Lack of knowledge about valency.
- The concept might not have been taught effectively.

- Teacher might have not adopted activity based evaluation strategy in assessing the knowledge.
- Student might have not interested in learning the valence electrons.
- Teacher might not have enough knowledge on the concept if he/ she is from other branch of sciences.
- Learning experience may not be given to the students.

## II ACTION PLAN

This chapter contains the core component of action research like the nature of the sample, time budget, design of activities and the tools used. The number of sample involved has been given in the sample. The time chart spells about the number of days spent for each activity. The innovative strategies generated for teaching the concept have been described in detail under the design of activities. A brief sketch on tools used has been given at the end of this chapter.

### 2.1 SAMPLE

Eighth standard students numbering about 20 in the academic year 2023- 2024 from GHSS, Kanur in Srimushnam block has been taken as sample.

### 2.2 TIME CHART

45 days were spent to procure materials and to carry out the action plan making use of the innovative strategies. The number of days allotted for each activity is listed below.

| | |
|---|---|
| Preparatory work | - 7 days. |
| Preparation for intervention | -15 days. |
| Execution of strategies | - 8 days |
| Report preparation | - 15 days. |
| **Total** | **- 45 days** |

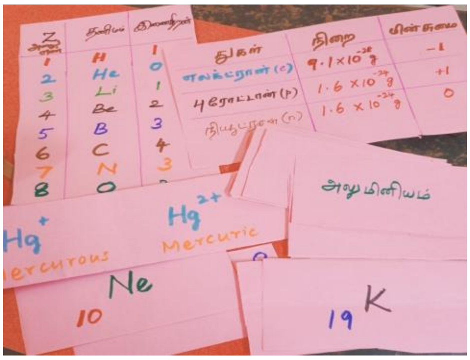
### 2.3 DESIGN OF ACTIVITY

**Activity 1**

Valency chart and periodic table were given to the students study the valency of first 20 elements and the nature of elements group.

**Activity 2**

Flash cards are used for knowing the symbols and atomic number of the elements. The students were made to pronounce them and their nature were dealt. They were encouraged to say the number electrons in the given atom.




**Activity 3**

Children actively participated in drawing the atomic structure in blackboard and chart. Peer group helped the students while drawing the structure.

**Activity 4**

The students were given practice to draw the atomic structure of the first 10 elements and made to find the valence electrons in the outermost shell.

**Activity 5**

The students involved in asking questions among themselves regarding symbols, compounds, etc. This kindred the enthusiasm of the students and motivated the students to discuss on atoms and their valency. This helped the students to know more about the compound formation.


**Activity 6**

Chalk and talk method also adopted where interaction is more possible. The students were made to pronounce the atoms and their symbol and their doubts were clarified. Evaluation was done then and there.

## 2.4 TOOLS USED

A brief test questionnaire was prepared with objective types of question for 25 marks. Section I consists of five questions on choose the correct answer for five marks carrying one mark each. Section II consists of five fill in the blank questions each carrying one mark and section III consists of five match the following each carrying five marks and section IV consisted of five yes or no questions with one mark each. Section V consisted of five find the valency questions with one mark each.

## III ANALYSIS AND INTERPRETATION

Before adapting the new methodology to find the improvement in the performance of the students pre- test was conducted. After the intervention post test was conducted. The performance of the students in the pre test and post test is given in appendix A. The mean, median and mode were calculated for both the pre-test and post test.

### ANALYSIS OF THE PRE-TEST

From the pre-test it is evident that overall performance of 20 students was not satisfactory. The marks scored by the students in the pre test out of 25 are given below in an ascending order.

16, 16, 20, 24, 24, 24, 24, 24, 28, 28,

28, 28, 28, 28, 28, 32, 32, 36, 40, 44

Mean, median and mode were calculated for the pre-test values are given below.

Mean - 27.6

Median - 28

Mode - 28

The average of the pre – test score was very low and the marks scored by the students in the pre –test ranged from 16 to 44.

**Table 1**

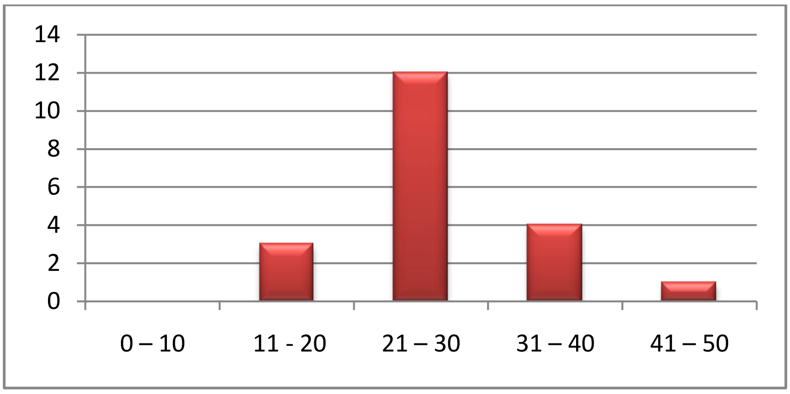
**Frequency distribution based on the marks scored by the students in pre-test**

| Class Interval | Frequency |
|---|---|
| 0 – 10 | 0 |
| 11 – 20 | 3 |
| 21 – 30 | 12 |
| 31 – 40 | 4 |
| 41 – 50 | 1 |
| Total | 20 |

From the table one could observe the fact that out of 20 students maximum 12 students have scored the marks in 21-30 range. Only 5 students scored the marks above 30 and below 50.

**Figure 1**

**Bar diagram showing the pre-test score of the students**




## ANALYSIS OF THE POST TEST

By adopting simple strategies a remarkable progress has been noticed from the scores of the post test. The marks scored by the students in the post test are given below in an ascending order.

36, 40, 40, 44, 44, 44, 48, 48, 52, 52,

56, 60, 60, 60, 60, 64, 68, 72, 76, 80

Mean, median and mode were calculated for the above values which are given below.

Mean - 55.2
Median - 54
Mode - 60

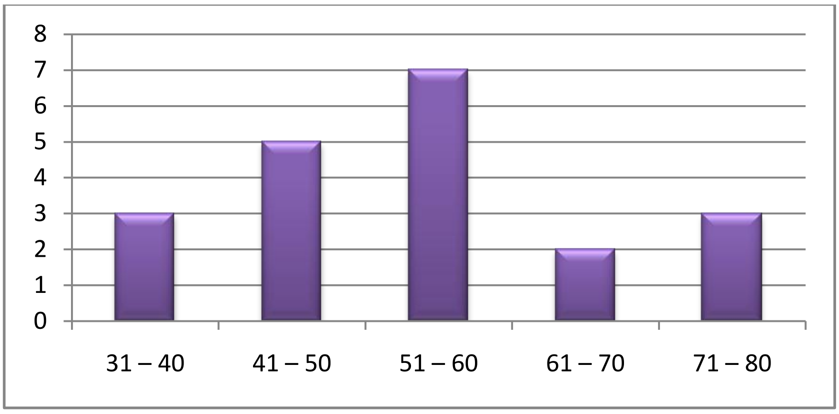
**Table 2**

**Frequency distribution based on the marks scored by the students in post test**

| Class Interval | Frequency |
|---|---|
| 31 – 40 | 3 |
| 41 – 50 | 5 |
| 51 – 60 | 7 |
| 61 – 70 | 2 |
| 71 – 80 | 3 |
| Total | 20 |

**Figure 2**

**Bar diagram showing the post test score of the students**




The average of the post test score was 55.2. The mark scored by the students in the post test was from 36 to 80. It is evident that the entire sample has scored above 35 %. Maximum 7 students have scored between 51- 60.

## COMPARISON OF PRE-TEST AND POST TEST SCORE

The mean, median and mode values of pre-test and post test has given below and their comparative study has been carried out.

**Table 3**

**Mean, Median and Mode of the samples' score in pre-test and post test**

| **Size of the sample** | **Pre- Test Marks** | | | **Post Test Marks** | | |
|---|---|---|---|---|---|---|
| | Mean | Median | Mode | Mean | Median | Mode |
| 20 | 27.6 | 28 | 28 | 55.2 | 54 | 60 |

It is clear from the table that the mean score of the sample in pre – test and post test were 27.6 and 55.2 respectively which shows an improvement in their performance. The post test mean score leads to the conclusion that after the interventions the learning difficulties of the students have got reduced. The median and mode value of the pre-test has considerably increased which prove that the learning has been improved.

**Table 4**

**Frequency distribution based on the percentage scored by the students in pre and post test**

| Class Interval | Frequency | |
|---|---|---|
| | Pre-test | Post test |
| 11 - 20 | 3 | 0 |
| 21 - 30 | 12 | 0 |
| 31 – 40 | 4 | 3 |
| 41 - 50 | 1 | 5 |
| 51 – 60 | 0 | 7 |
| 61 – 70 | 0 | 2 |
| 71 – 80 | 0 | 3 |
| 81 – 90 | 0 | 0 |
| 91 - 100 | 0 | 0 |
| Total | 20 | 20 |

**Figure 3**
**Bar diagram showing the pre-test and post test score percentage of the students**

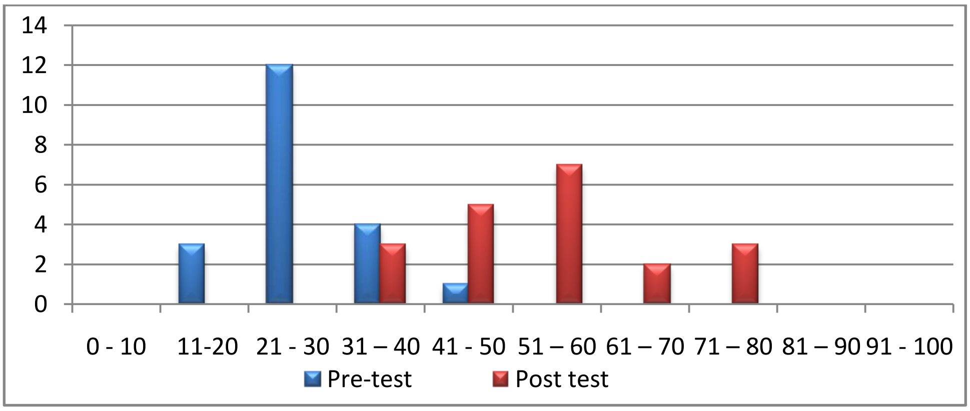
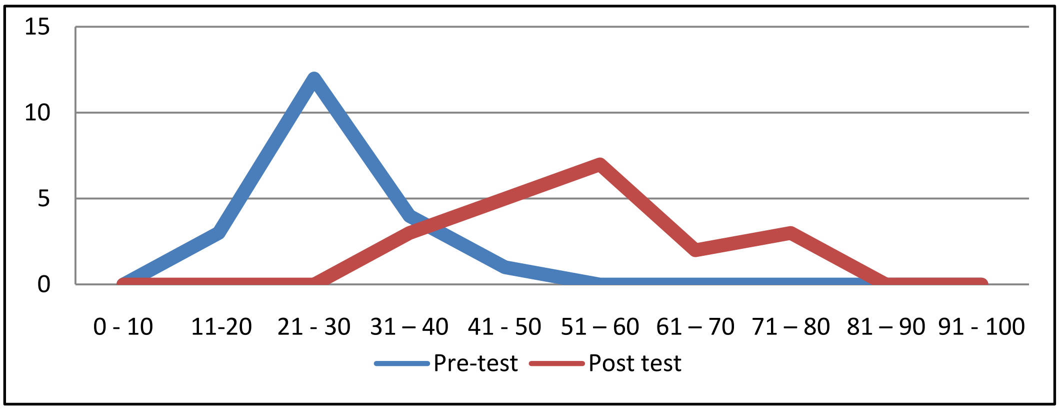



**Figure 4**
**Frequency curve showing pre-test and the post test score percentage of the Students**



The figure 3 and 4 shows that the post test scores of the students are better than the pre-test scores. The curve clearly depicts that the pre-test range is from 11 to 50 which indicates that half of the students had difficulties in learning the concept whereas the post test curve spreads from 31 to 80 which indicates the impressive performance of the students.

The low scorers in the pre-test have scored above 36 in the post test. The maximum mark 44 in the pre-test has been increased to 80 in post test. This shows the reliability of the study and it is proven that the activity method adopted by the researcher helped the slow learners to become an average achiever. 5 students scored the marks in the range of 41-50 in the post test and 7 students have scored in the range of 61-70. It is a clear indication that usage of simple activities has motivated the students to achieve the high score. Still the overall performance of the students could be improved a lot if continuous practice is adopted.

## IV SUMMARY

The performance of the students was better in the post test. The study revealed the fact that simple activities motivated the students and brought a change in the learning process. During activities the students showed much enthusiasm. This filled the gap in the regular class room practices. The average of the test score of students has raised from 27.6 to 55.2 in the post test. This showed that the execution of activities has made an improvement in the attainment.

- The students gained motivation to know more about valency.
- The study enhanced their understanding towards knowing the outermost electrons in the shell.
- The students understood valency in chemical composition.
- Use of flash cards and activities are proved to be effective and the concept is well understood by the students.
- They were able to comprehend and apply the knowledge of chemical composition and the production of various materials in the industries.

## V SUGGESTIONS

In the present scenario, activity - oriented motivation is needed for both learners and teachers. Hence the learning environment is made conducive to the students. The simple activities provided connectivity among the students and enhanced the level of attainment of concepts.

- The teacher should have indepth knowledge on the topic irrespective of his/her major subject.
- The courses and studies related to the content should be provided.
- The teacher should make the students to participate in the classroom discussion.
- Some videos and animations could be viewed for better understanding.
- The teacher should be competent enough to provide learning experience to the students with innovative strategy.
- The scientific inquiry of the students should be enhanced.
- The teacher should undergo various training programmes to learn and adopt new innovative methods.

## BIBLIOGRAPHY


Tamilnadu Government textbook, VIII standard, Science, SCERT, 2019

www.textbookonline.tn.nic.in

https://ncert.nic.in/ncerts/l/lech207.pdf

https://byjus.com/chemistry/electron-configuration/

*https://www.britannica.com/science/atom/Atomic-mass-and-isotopes*

https://www.differencebetween.com/difference-between-valency-and-charge/

https://www.vedantu.com/chemistry/valency

https://www.toppr.com/guides/chemistry/structure-of-atom/valency/

https://www.geeksforgeeks.org/valency/

APPENDIX A

Marks scored by the students in the pre-test and post test

| Sl.No. | Name of the students | Pre-test | Post test |
|---|---|---|---|
| 1 | Aaron M | 24 | 88 |
| 2 | Aravind Kumar R | 24 | 88 |
| 3 | Bala D | 28 | 92 |
| 4 | Dibakar V | 28 | 84 |
| 5 | Dinesh Kumar J | 28 | 76 |
| 6 | Harish R | 44 | 92 |
| 7 | Prasanna M | 32 | 76 |
| 8 | Sanjay S | 24 | 92 |
| 9 | Shanmugabalan P | 28 | 80 |
| 10 | Venkatesan S | 36 | 84 |
| 11 | Yuvaraj M | 28 | 92 |
| 12 | BlessinSudharsia S | 16 | 92 |
| 13 | Charu P | 28 | 84 |
| 14 | Durga V | 24 | 88 |
| 15 | Helen DeepshithaaT | 40 | 72 |
| 16 | Mallika M | 20 | 80 |
| 17 | Monika A | 16 | 92 |
| 18 | Ragini S | 32 | 80 |
| 19 | Sathana M | 28 | 80 |
| 20 | Sangeerthana S | 24 | 80 |
| | Total | 552 | 1104 |
| | Average | 27.6 | 55.2 |
| | Difference | | 27.6 |

# APPENDIX B

மாவட்ட ஆசிரியர் கல்வி மற்றும் பயிற்சி நிறுவனம், வடலூர்,
கடலூர் மாவட்டம்-607303
செயல்ஆராய்ச்சி
முன்தேர்வு/ பின்தேர்வு

பெயர்: வகுப்பு: 8 பாடம்:அறிவியல்
மதிப்பெண்கள்: 25

I சரியான விடையைத் தேர்ந்தெடுக்க.

1. கீழே கொடுக்கப்பட்டுள்ள தனிமங்களில் எதிர்மறை இணைதிறன் கொண்டது.
அ சோடியம் ( குளோரின் (ஆ மெக்னீசியம் (இ ஈகால்சியம் (

2. குப்ரிக் ஆக்சைடில் தாமிரத்தின் இணைதிறன்
அ (1 ஆ (2 இ (3 ஈ(4

3. மாறக்கூடிய இணைதிறனைப்பெற்றிறாத தனிமம்.
அஇரும்பு ( ஆபாதரசம் ( இஆக்சிஜன் ( டின் (ஈ

4ஆக்சிஜ .ன் அணு நிலையான அமைப்பைப் பெற எத்தனை எலக்ட்ரான்களை ஏற்க வேண்டும்?
அ (1 ஆ (2 (இ 3 (ஈ 0

5. எவ்வகை வேதிவினையிலும் ஈடுபடாத தனிமம்.
அமெர்குரி ( ஆஹீலியம் ( மெக்னீசியம் (இ ஈகால்சியம் (

II கோடிட்ட இடங்களை நிரப்புக.

6. ஓர் அணுவினால் ஏற்றுக் கொள்ளப்பட்ட அல்லது இழக்கப்பட்ட அல்லது பகிர்ந்து கொள்ளப்பட்ட .ஆகும் இணைதிறன் அவ்வணுவின் எண்ணிக்கை ன்.......................................

7. ஹீலியம் முறையே எலக்ட்ரான்கள் வெளிக்கூட்டு காரணமான தன்மைக்குக் நிலைப்புத் நியானின் , . ................. மற்றும் ...................

8.இரும்பு (II) ஆக்சைடின் வேறு பெயர். .................................................

9. நிலைத்த எலக்ட்ரான் அமைப்பை பெற்றதனிமங்கள் . .......................................

10.நேர்மறை இணைதிறன் கொண்ட அணுக்கள் எலக்ட்ரான்களை. .........................

III பொருத்துக:

| தனிமம் | இணைதிறன் |
|---|---|
| 11 கார்பன் . | 0 |
| 12 நைட்ரஜன் . | 1 |
| 13 ஆக்ஸிஜன் . | 2 |
| 14 நியான் . | 3 |
| 15குளோரின் . | 4 |

IV சரியா .கூறுக எனக் தவறா /

16. சல்பேட்.கொண்டவை இணைதிறன் நேர்மறை போன்றவை பாஸ்பேட் ,நைட்ரேட் ,

17. பொட்டாசியம்கால்ச ,மெக்னீசியம் ,ியம் ஆகியவற்றின் இணைதிறன் இரண்டு.

18. மெர்குரி மாறும் இணைத்திறனைக் கொண்ட உலோகம்.

19. நீர் மூலக்கூறில் ஆக்ஸிஜனின் இணைதிறன் ஒன்று.

20. ஓர் அணுவின் இணைதிறன் எலக்ட்ரான்களே அவ்வணுவின் வேதிப்பண்புகளை தீர்மானிக்கின்றன.

V அடிக்கோடிட்ட தனிமங்களின் இணைதிறனைக் கண்டறிக.

21. $\underline{Na}Cl$ 22. $\underline{Al}PO_4$ 23. $\underline{Ba}(NO_3)_2$ 24. $\underline{Ca}Cl_2$ 25. $\underline{N}H_3$

# ACTION RESEARCH 2023-2024

## ABSTRACT

### THE TOPIC

"Enhancing the understanding of valency through simple activities among VIII standard students".

### TARGET GROUP

20 VIII standard students in the academic year 2023 - 2024 from GHSS, Kanur.

### PROBLEM IDENTIFIED

Valency is a fundamental concept in chemistry. The combining capacity of an atom is known as its valency. The number of bonds that an atom can form as part of a compound is expressed by the valency of the element. The students should know how electrons in an atom are arranged in shells/orbitals. In chemistry learning the periodic table and the atomic number would help the children to understand the valency of atoms. Each element has its own binding nature and based on that the valency differs. There is a particular way of writing electronic configuration. Hence the educator is intended to enhance the knowledge of valency among the eighth standard students.

### OBJECTIVES

The study has been carried out with the following objectives:

- To develop the knowledge of valence electrons.
- Make the students to understand the valency.
- To enhance the knowledge of types of valency.
- Make the students to calculate the valency of different atoms.
- Motivate the students to know the variable valency of atoms.

### METHODOLOGY

- Administering Pre – Test
- Providing Instructional Strategy through simple activities
- Administering Post Test
- Analysis of data to find out differences between pre and post test

## INTERVENTION

### Activity 1

Valency chart and periodic table were given to the students study the valency of first 20 elements and the nature of elements group.

### Activity 2

Flash cards are used for knowing the symbols and atomic number of the elements. The students were made to pronounce them and their nature were dealt. They were encouraged to say the number electrons in the given atom.

### Activity 3

Children actively participated in drawing the atomic structure in blackboard and chart. Peer group helped the students while drawing the structure.

### Activity 4

The students were given practice to draw the atomic structure of the first 10 elements and made to find the valence electrons in the outermost shell.

### Activity 5

The students involved in asking questions among themselves regarding symbols, compounds, etc. This kindred the enthusiasm of the students and motivated the students to discuss on atoms and their valency. This helped the students to know more about the compound formation.

### Activity 6

Chalk and talk method also adopted where interaction is more possible. The students were made to pronounce the atoms and their symbol and their doubts were clarified. Evaluation was done then and there.

## OUTCOME

The performance of the students was better in the post test. The study revealed the fact that simple activities motivated the students and brought change in the learning process. While using activities the students showed much enthusiasm. This technique filled the gap in the regular class room practices. The average of the test score of students has raised from 27.6 to 55.2 in the post test.

## RECOMMENDATIONS

- The teacher should have indepth knowledge on the topic irrespective of his/her major subject.
- The courses and studies related to the content should be provided.
- The teacher should make the students to participate in the classroom discussion.
- Some videos and animations could be viewed for better understanding.
- The teacher should be competent enough to evaluate the students with innovative strategy.
- The scientific inquiry of the students should be enhanced.
- The teacher should undergo various training programmes to learn and adopt new innovative methods.

## CONCLUSION

In the present scenario, external motivation is needed for both learners and teachers. Discussion in the learning environment is essential. The conversation among the students provided connectivity between teachers and students and enhanced the level of attainment of concepts.