



SCIENCE TEXTBOOK

Veda Bhushan IV Year / Purva Madhyama - I Year / Class IX

MAHARSHI SANDIPANI RASHTRIYA VEDA SANSKRIT SHIKSHA BOARD

(Established and Recognized by the Ministry of Education, Government of India)

ये त आरण्याः पशवो मृगा वने हिताः सिंहा व्याघ्राः पुरुषादश्चरन्ति।

नोत स्ववृष्टि मदे अस्य युध्यत एको अन्यचक्रुषे विश्वमानुषक् ।

अणुद्वौ परमाणुः स्यात्तसरेणुस्रयः स्मृतः ।

जालार्कैरदभ्यवगतः खमेवानुपतन्नगात् ॥

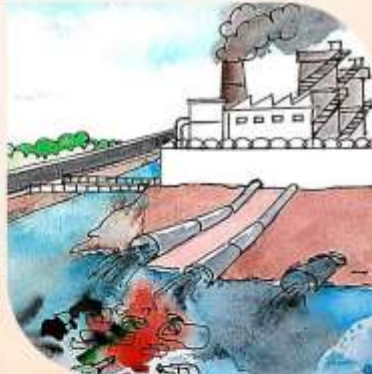
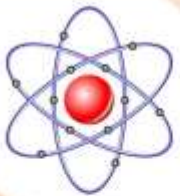
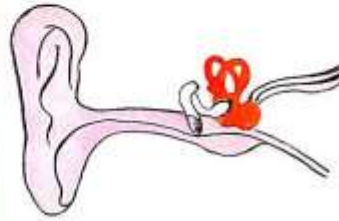
गतं च आगतं च द्वयोः समाहारं यातायातम्।

मित्रं हुवे पूतदक्षं वरुणं च रिशादसम्।

धियं घृताचीं साधन्ता।

बलमसि बलं मे दाः स्वाहा ।

मातेवास्मा अदिते शर्म यच्छ ।



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PREFACE

(In the light of NEP 2020)

The Ministry of Education (Department of Higher Education), Government of India established Rashtriya Veda Vidya Pratishthan in Delhi under the Chairmanship of Hon'ble Education Minister (then Minister of Human Resource Development) under the Societies Registration Act, 1860 (XXI of 1860) on 20th January, 1987. The Government of India notified the resolution in the Gazette of India vide no 6-3/85- SKT-IV dated 30-3-1987 for establishment of the Pratishthan for preservation, conservation, propagation and development of oral tradition of Vedic studies (Veda Samhita, Padapatha to Ghanapatha, Vedanga, Veda Bhashya etc), recitation and intonation of Vedas etc and interpretation of Vedas in scientific lines. In the year 1993 the name of the organization was changed to Maharshi Sandipani Rashtriya Veda Vidya Pratishthan (MSRVVP) and it was shifted to Ujjain, Madhya Pradesh.

The National Education Policy of 1986 and Revised Policy Formulations of 1992 and also Programme of Action (PoA) 1992 have mandated Rashtriya Veda Vidya Pratishthan for promoting Vedic education throughout the country. The importance of India's ancient fund of knowledge, oral tradition and employing traditional Guru's for oral education was also emphasized in the PoA.

In accordance with the aspirations of the nation, national consensus and policy in favour of establishing a Board for Veda and Sanskrit Education at national level, the General Body and the Governing Council of MSRVVP under the Chairmanship of Hon'ble Education Minister, Government of India, have set up "Maharshi Sandipani Rashtriya Veda Sanskrit Shiksha Board" (MSRVSSB) in tune with the mandate of the Pratishthan and its implementation strategies. The Board is necessary for the fulfillment of the objectives of MSRVVP as envisioned in the MoA and Rules. The Board has been approved by the Ministry of Education, Government of India and recognized by the Association of Indian

Universities, New Delhi. The bye-laws of the Board have been vetted by Central Board of Secondary Education and curriculum structure have been concurred by the National Council of Educational Research and Training, New Delhi.

It may also be mentioned here that the committee “Vision and Roadmap for the Development of Sanskrit - Ten year perspective Plan”, under the Chairmanship of Shri N. Gopaldaswamy, former CEC, constituted by the Ministry of Education Govt. of India in 2015 recommended for establishment of a Board of Examination for standardization, affiliation, examination, recognition, authentication of Veda Sanskrit education up to the secondary school level. The committee was of the opinion that the primary level of Vedic and Sanskrit studies should be inspiring, motivating and joyful. It is also desirable to include subjects of modern education into Vedic and Sanskrit Pathashalas in a balanced manner. The course content of these Pathashalas should be designed to suit to the needs of the contemporary society and also for finding solutions to modern problems by reinventing ancient knowledge.

With regard to Veda Pathashala-s it is felt that they need further standardization of recitation skills along with introduction of graded materials of Sanskrit and modern subjects so that the students can ultimately acquire the capabilities of studying Veda bhashya-s and mainstreaming of students is achieved for their further studies. Due emphasis may also be given for the study of Vikriti Patha of Vedas at an appropriate level. The members of the committee have also expressed their concern that the Vedic recitation studies are not uniformly spread all over India; therefore, due steps may be taken to improve the situation without in anyway interfering with regional variations of recitation styles and teaching method of Vedic recitation.

It was also felt that since Veda and Sanskrit are inseparable and complementary to each other and since the recognition and affiliation problems are same for all the Veda Pathashalas and Sanskrit Pathashalas throughout the country, a Board may be constituted for both together. The committee observed that the examinations conducted by the Board

should have legally valid recognition enjoying parity with modern Board system of education. The committee observed that the Maharshi Sandipani Rashtriya Veda Vidya Pratishthan, Ujjain may be given the status of Board of Examinations with the name “Maharshi Sandipani Rashtriya Veda Sanskrita Vidya Parishat with headquarters in Ujjain which will continue all programs and activities which were being conducted hitherto in addition to being a Board of Examinations.

The promotion of Vedic education is for a comprehensive study of India’s glorious knowledge tradition and encompasses multi-layered oral tradition of Vedic Studies (Veda Samhita, Padapatha to Ghanapatha, Vedanga, Veda Bhashya etc), recitation and intonation, and Sanskrit knowledge system content. In view of the policy of mainstreaming of traditional students and on the basis of national consensus among the policy making bodies focusing on Vedic education, the scheme of study of Veda stretching up to seven years in Pratishthan also entails study of various other modern subjects such as Sanskrit, English, Mathematics, Social Science, Science, Computer Science, Philosophy, Yoga, Vedic Agriculture, etc. as per the syllabus and availability of time. In view of NEP 2020, this scheme of study is with appropriate inputs of Vedic knowledge and drawing the parallels of modern knowledge in curriculum content focusing on Indian Knowledge System.

In Veda Pathashala-s, GSP Units and Gurukula-s of MSRVP, affiliated to the Board transact the curriculum primarily based on oral tradition of a particular complete Veda Shakha with perfect intonation and memorization, with additional subsidiary modern subjects such as English, Sanskrit, Mathematics, Science, Social Science and SUPW. Gradually, the Veda Pathashala-s will also introduce other skill and vocational subjects as per their resources.

It is a well-known fact that there were 1131 shakha-s or recensions of Vedas; namely 21 in Rigveda, 101 in Yajurveda, 1000 in Samaveda and 9 in Atharva Veda. In course of time, a large number of these shakhas became extinct and presently only 10 Shakhas, namely, one in Rigveda, 4

in Yajurveda, 3 in Samaveda and 2 in Atharvaveda are existing in recitation form on which Indian Knowledge System is founded now. Even in regard to these 10 Shakhas, there are very few representative Vedapathis who are continuing the oral Vedic tradition/ Veda recitation/Veda knowledge tradition in its pristine and complete form. Unless there is a full focus for Vedic learning as per oral tradition, the system will vanish in near future. These aspects of Oral Vedic studies are neither taught nor included in the syllabus of any modern system of school education, nor do the schools/Boards have the systemic expertise to incorporate and conduct them in the conventional modern schools.

The Vedic students who learn oral tradition/ recitation of Veda are there in their homes in remote villages, in serene and idyllic locations, in Veda Gurukulas, (GSP Units), in Veda Pathashala-s, in Vedic Ashrams etc. and their effort for Veda study stretches to around 1900 – 2100 hours per year; which is double the time of other conventional school Board's learning system. Vedic students have to have complete Veda by-heart and recite verbatim with intonation (*udatta, anudatta, swaritaetc*), on the strength of memory and guru parampara, without looking at any book/pothi. Because of unique ways of chanting the Veda mantras, unbroken oral transmission of Vedas and its practices, this has received the recognition in the UNESCO-World Oral Heritage in the list of Intangible Cultural Heritage of Humanity. Therefore, due emphasis is required to be given to maintain the pristine and complete integrity of the centuries old Vedic Education (oral tradition/ recitation/ Veda knowledge Tradition). Keeping this aspect in view the MSRVVP and the Board have adopted unique type of Veda curriculum with modern subjects like Sanskrit, English, Vernacular language, Mathematics, Social Science, Science, Computer Science, Philosophy, Yoga, Vedic Agriculture etc. as well as skill and vocational subjects as prescribed by NEP 2020.

As per Vedic philosophy, any person can become happy if he or she learns both *Para-Vidya and Aparā-Vidya*. The materialistic knowledge from the Vedas, their auxiliary branches and subjects of material interest were called *Aparā-Vidya*. The knowledge of supreme reality, the ultimate quest from Vedas, Upanishads is called *Para-Vidya*. In all the total

number of subjects to be studied as part of Veda and its auxiliaries are fourteen. There are fourteen branches of learning or *Vidyas* - four Vedas, Six Vedangas, Mimamsa (Purva Mimamsa and Uttara Mimamsa), Nyaya, Puranas and Dharma shastra. These fourteen along with Ayurveda, Dhanurveda, Gandharvaveda and Arthashastra become eighteen subjects for learning. All curriculum transaction was in Sanskrit language, as Sanskrit was the spoken language for a long time in this sub-continent.

Eighteen Shilpa-s or industrial and technical arts and crafts were mentioned with regard to the Shala at Takshashila. The following 18 skills/Vocational subjects are reported to be subjects of the study– (1) Vocal music (2) Instrumental music (3) Dancing (4) Painting (5) Mathematics (6) Accountancy (7) Engineering (8) Sculpture (9) Cattle breeding (10) Commerce (11) Medicine (12) Agriculture (13) Conveyancing and law (14) Administrative training (15) Archery and Military art (16) Magic (17) Snake charming (18) Art of finding hidden treasures.

For technical education in the above mentioned arts and crafts an apprenticeship system was developed in ancient India. As per the Upanishadic vision, the vidya and avidya make a person perfect to lead contented life here and liberation here-after.

Indian civilization has a strong tradition of learning of shastra-s, science and technology. Ancient India was a land of sages and seers as well as of scholars and scientists. Research has shown that India had been a Vishwa Guru, contributing to the field of learning (vidya-spiritual knowledge and avidya- materialistic knowledge) and learning centers like modern universities were set up. Many science and technology based advancements of that time, learning methodologies, theories and techniques discovered by the ancient sages have created and strengthened the fundamentals of our knowledge on many aspects, may it be on astronomy, physics, chemistry, mathematics, medicine, technology, phonetics, grammar etc. This needs to be essentially understood by every Indian to be proud citizen of this great country!

The idea of India like “Vasudhaiva Kutumbakam” quoted at the

entrance of the Parliament of India and many Veda Mantra-s quoted by constitutional authorities on various occasions are understood only on study of the Vedas and true inspiration can be drawn only by pondering over them. The inherent equality of all beings as embodiment of “sat, chit, ananda” has been emphasized in the Vedas and throughout the Vedic literature.

Many scholars have emphasized that Veda-s are also a source of scientific knowledge and we have to look into Vedas and other scriptural sources of India for the solution of modern problems, which the whole world is facing now. Unless students are taught the recitation of Vedas, knowledge content of Vedas and Vedic philosophy as an embodiment of spiritual and scientific knowledge, it is not possible to spread the message of Vedas to fulfill the aspiration of modern India.

The teaching of Veda (Vedic oral tradition/ Veda recitation/ Veda knowledge Tradition) is neither only religious education nor only religious instruction. It will be unreasonable to say that Vedic study is only a religious instruction. Veda-s are not religious texts only and they do not contain only religious tenets; they are the corpus of pure knowledge which are most useful to humanity as whole. Hence, instruction or education in Veda-s cannot be construed as only “religious education/religious instruction.”

Terming “teaching of Veda as a religious education” is not in consonance with the judgment of the Hon’ble Supreme Court (AIR 2013: 15 SCC 677), in Civil Appeal no. 6736 of 2004 (Date of judgment-3rd July 2013). The Vedas are not only religious texts, but they also contain the knowledge in the disciplines of mathematics, astronomy, meteorology, chemistry, hydraulics, physics, science and technology, agriculture, philosophy, yoga, education, poetics, grammar, linguistics etc. which has been brought out in the judgment by the Hon’ble Supreme Court of India.

Vedic education through establishment of Board in compliance with NEP-2020

The National Education Policy-2020 firmly recognizes the Indian Knowledge Systems (also known as 'Sanskrit Knowledge Systems'), their

importance and their inclusion in the curriculum, and the flexible approach in combining various subjects. Arts' and Humanities' students will also learn science; try to acquire vocational subjects and soft skills. India's special heritage in the arts, sciences and other fields will be helpful in moving towards multi-disciplinary education. The policy has been formulated to combine and draw inspiration from India's rich, ancient and modern culture and knowledge systems and traditions. The importance, relevance and beauty of India's classical languages and literature is also very important for a meaningful understanding the national aspiration. Sanskrit, being an important modern language mentioned in the Eighth Schedule of Indian Constitution, its classical literature that is greater in volume than that of Latin and Greek put together, contains vast treasures of mathematics, philosophy, grammar, music, politics, medicine, architecture, metallurgy, drama, poetry, storytelling, and more (known as 'Sanskrit Knowledge Systems'). These rich Sanskrit Knowledge System legacies for world heritage should not only be nurtured and preserved for posterity but also enhanced through research and put in to use in our education system, curriculum and put to new uses. All of these literatures have been composed over thousands of years by people from all walks of life, with a wide range of socio-economic background and vibrant philosophy. Sanskrit will be taught in engaging and experiential as well as contemporary relevant methods. The use of Sanskrit knowledge system is exclusively through listening to sound and pronunciation. Sanskrit textbooks at the Foundation and Middle School level will be available in Simple Standard Sanskrit (SSS) to teach Sanskrit through Sanskrit (STS) and make its study enjoyable. Phonetics and pronunciation prescriptions in NEP 2020 apply to the Vedas, the oral tradition of the Vedas and Vedic education, as they are founded upon phonetics and pronunciation.

There is no clear distinction made between arts and science, between curricular and extra-curricular activities, between vocational and academic streams, etc. The emphasis in NEP 2020 is on the development of a multi-disciplinary and holistic education among the sciences, social sciences, arts, humanities and sports for a multi-disciplinary world to

ensure the unity and integrity of all knowledge. Moral, human and constitutional values like empathy, respect for others, cleanliness, courtesy, democratic spirit, spirit of service, respect for public property, scientific temper, freedom, responsibility, pluralism, equality and justice are emphasized.

The NEP-2020 at point no. 4.23 contains instructions on the pedagogic integration of essential subjects, skills and abilities. Students will be given a large amount of flexible options in choosing their individual curriculum; but in today's fast-changing world, all students must learn certain fundamental core subjects, skills and abilities to be a well-grounded, successful, innovative, adaptable and productive individual in modern society. Students must develop scientific temper and evidence based thinking, creativity and innovation, aesthetics and sense of art, oral and written expression and communication, health and nutrition, physical education, fitness, health and sport, collaboration and teamwork, problem solving and logical thinking, vocational exposure and skills, digital literacy, coding and computational thinking, ethics and moral reasoning, knowledge and practice of human and constitutional values, gender sensitivity, fundamental duties, citizenship skills and values, knowledge of India, environmental awareness etc. Knowledge of these skills include conservation, sanitation and hygiene, current affairs and important issues facing local communities, the states, the country and the world, as well as proficiency in multiple languages. In order to enhance the linguistic skills of children and to preserve these rich languages and their artistic treasures, all students in all schools, public or private, shall have the option of learning at least two years in one classical language of India and its related literature.

The NEP-2020 at point no. 4.27 states that -“Knowledge of India” includes knowledge from ancient India and its contributions to modern India and its successes and challenges, and a clear sense of India’s future aspirations with regard to education, health, environment, etc. These elements will be incorporated in an accurate and scientific manner throughout the school curriculum wherever relevant; in particular, Indian Knowledge Systems, including tribal knowledge and indigenous and

traditional ways of learning, will be covered and included in mathematics, astronomy, philosophy, yoga, architecture, medicine, agriculture, engineering, linguistics, literature, sports, games, as well as in governance, polity, conservation. It will have informative topics on inspirational personalities of ancient and modern India in the fields of medicinal practices, forest management, traditional (organic) crop cultivation, natural farming, indigenous sports, science and other fields.

The NEP-2020 at point no. 11.1 gives directions to move towards holistic and multidisciplinary education. India emphasizes an ancient tradition of learning in a holistic and multidisciplinary manner, including the knowledge of 64 arts such as singing and painting, scientific fields such as chemistry and mathematics, vocational fields such as carpentry, tailoring; professional work such as medicine and engineering, as well as the soft skills of communication, discussion and negotiation etc. which were also taught at ancient universities such as Takshashila and Nalanda. The idea that all branches of creative human endeavour, including mathematics, science, vocational subjects and soft skills, should be considered 'arts', has a predominantly Indian origin. This concept of 'knowledge of the many arts' or what is often called 'liberal arts' in modern times (i.e., a liberal conception of the arts) will be our part of education system.

At point No. 11.3 the NEP-2020 further reiterates that such an education system “would aim to develop all capacities of human beings - intellectual, aesthetic, social, physical, emotional, and moral in an integrated manner. Such an education will help develop well-rounded individuals that possess critical 21st century capacities in fields across the arts, humanities, languages, sciences, social sciences, and professional, technical, and vocational fields; an ethic of social engagement; soft skills, such as communication, discussion and debate; and rigorous specialization in a chosen field or fields. Such a holistic education shall be, in the long term, the approach of all undergraduate programmes, including those in professional, technical, and vocational disciplines.”

The NEP-2020 at point no. 22.1 contains instructions for the promotion of Indian languages, art and culture. India is a rich storehouse of culture – which has evolved over thousands of years, and is reflected in its art, literary works, customs, traditions, linguistic expressions, artifacts, historical and cultural heritage sites, etc. Traveling in India, experiencing Indian hospitality, buying beautiful handicrafts and handmade clothes of India, reading ancient literature of India, practicing yoga and meditation, getting inspired by Indian philosophy, participating in festivals, appreciating India's diverse music and art and watching Indian films are some of the ways through which millions of people around the world participate in, enjoy and benefit from this cultural heritage of India every day.

In NEP-2020 at point no. 22.2 there are instructions about Indian arts. Promotion of Indian art and culture is important for India and to all of us. To inculcate in children a sense of our own identity, belonging and an appreciation of other culture and identity, it is necessary to develop in children key abilities such as cultural awareness and expression. unity, positive cultural identity and self-esteem can be built in children only by developing a sense and knowledge of their cultural history, art, language and tradition. Therefore, the contribution of cultural awareness and expression is important for personal and social well-being.

The core Vedic Education (Vedic Oral Tradition / Veda Path / Veda Knowledge Tradition) of Pratishthan along with other essential modern subjects- Sanskrit, English, Mother tongue, Mathematics, Social Science, Science, Computer Science, Philosophy, Yoga, Vedic Agriculture, Indian Art, Socially useful productive work etc., based on the IKS inputs are the foundations/sources of texts books of Pratishthan and Maharshi Sandipani Rashtriya Veda Sanskrit Shiksha Board. These inputs are in tune with the NEP 2020. The draft books are made available in pdf form keeping in view the NEP 2020 stipulations, requirements of MSRVP students and the advice of educational thinkers, authorities and policy of Maharshi Sandipani Rashtriya Veda Vidya Pratishthan, Ujjain. These books will be updated in line with NCFSE in future and finally will be made available in print form.

The Teachers of Veda, Sanskrit and Modern subjects in Rashtriya Adarsh Veda Vidyalaya, Ujjain and many teachers of Sanskrit and modern subjects in aided Veda Pathshalas of Pratishthan have worked for last two years tirelessly to prepare and present Sanskrit and modern subject text books in this form. I thank all of them from the bottom of my heart. Many eminent experts of the national level Institutes have helped in bringing quality in the textbooks by going through the texts from time to time. I thank all those experts and teachers of the schools. I extend my heartfelt gratitude to all my co-workers who have worked for DTP, drawing the sketches, art work and page setting.

All suggestions including constructive criticism are welcome for the improvement of the quality of the text books.

आपरितोषाद् विदुषां न साधु मन्ये प्रयोगविज्ञानम्।
बलवदपि शिक्षितानाम् आत्मन्यप्रत्ययं चेतः ॥

(Abhijnanashakuntalam 1.02)

Until the scholars are fully satisfied about the content, presentation, attainment of objective, I do not consider this effort to be successful, because even the scholars are not fully confident in the presentation without feedback from the stakeholders.

Prof. ViroopakshaV Jaddipal
Secretary

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Maharshi Sandipani Rashtriya Veda Sanskrit Shiksha Board, Ujjain

FOREWORD

The presented textbook of Science for Class 9th in Class Vedbhushan IV/Purvmadhyama-I/School Education has been published in compliance with the guidelines of the National Education Policy 2020. This course includes knowledge of Vedic Vangmay and ancient India and its contribution towards modern India and its successes and challenges and a clear sense of India's future aspirations in relation to education, health, environment etc. In particular, indigenous methods of learning based on Indian knowledge system and specific curriculum on forest management, traditional (organic) crop cultivation, natural farming etc. have been included. While developing the curriculum, care has been taken to ensure that various points and subjects can be easily understood through games. Video documentaries on inspirational personalities of ancient and modern India in science and other fields will be shown throughout the school curriculum. Students will be encouraged to visit different states as participants in cultural exchange programs.

To check the students' understanding of the subject, practice questions have been included at the end of each lesson, which include multiple choice questions and descriptive questions. Model question papers have been included at the end of the book so that students can self-evaluate themselves.

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Chapter - 1

Matter in our Surroundings

We depend on many things and substances in our daily life. For example – water for cooking and drinking, air for breathing, books for study etc.

Matter-

Objects that occupy space and have mass are called Matter. For example - water, sugar, milk, wood, air etc.

Properties of Matter -

1. Particles of matter are constantly moving.
2. Particles of matter are very small in size.
3. There is an attraction between the particles of matter, that is, its particles attract each other.
4. Some empty space (empty space) is found in between the particles of matter.

Types of Matter -

On the basis of the components or particles present in the substance, they are divided into two parts –

1. Pure substance - Such substances which have only one type of particles or components are called pure substances. For example - silver, copper, aluminium, gold, hydrogen, oxygen etc.
2. Impure substances - Substances which contain more than one type of particles or components are called impure substances. For example - air, water, carbon dioxide gas, soil etc.

States of matter -

Matter can be classified into three physical states on the basis of physical properties –

- a) Solid b) Liquid d) Gas

a) **Solid** - The following are the characteristic properties of the solid state -

- 1) The shape and volume of a solid are fixed, for example, the shape and volume of a chair, brick, gold, etc. are fixed.
- 2) Strong intermolecular forces are present between the particles of a solid.
- 3) Particles of solid are very close to each other, due to which their density is high and compressibility is negligible.
- 4) Diffusion is very less in the particles of solid.

The following are examples of solid substances – salt, wood, gold, silver, copper, pencil etc.

b) **Liquid** - The following are the characteristic properties of the liquid state -

- 1) A liquid do not have a definite shape but has fixed volume. It takes its shape according to the size of the vessel.
- 2) Weaker intermolecular forces of attraction exist between the particles of a liquid than those of a solid.
- 3) The particles of a liquid are slightly farther apart than those of a solid. For this reason their density is less than that of solid but more than that of gas and compressibility is more than that of solid but less than that of gas.
- 4) The diffusion of particles in a liquid is less than that of a gas but more than that of a solid.

The following are examples of liquid substances – milk, water etc.

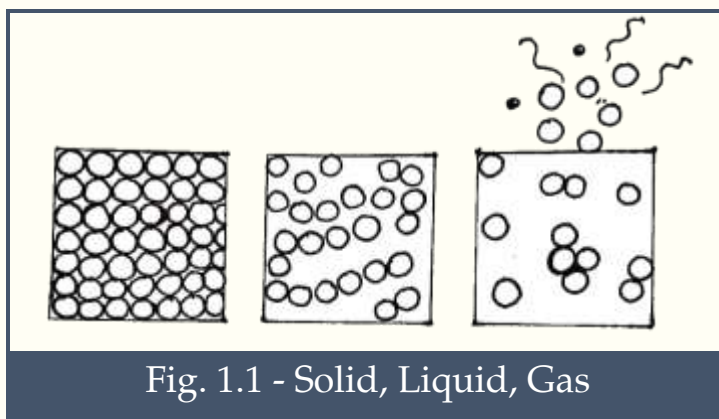
c) **Gas** – The following are the characteristic properties of the gas state

- 1) The volume and shape of a gas is indefinite, it determines its shape and volume according to the shape of the container.
- 2) The intermolecular force of attraction between the particles of a gas is negligible as compared to the particles of solid and gas.

- 3) The particles of a gas are free to move in any direction since the particles are farther than the particles of solids and liquids. For this reason its density is less than that of solid and liquid.
- 4) Gas has high compressibility.

Following are the examples of gaseous substances –

LPG (Liquefied Petroleum Gas), CNG (Compressed Natural Gas)



Maharishi Kanad has mentioned about the states of matter in Vaisesik philosophy.

तत्र द्रण्याणि पृथिव्यप्तेजोवाय्वाकाशकालदिगात्मनांसि नवैव ।

(वैशेषिक ग्रंथ 1.1.5)

Has mentioned matter as earth, water, light, air, sky, time, direction, mind and soul.

Earth means solid form of matter, water means liquid form of matter, air means gaseous form of matter. Maharishi Kanad has also considered energy, space and time as substances. This classification of states of matter is similar to that of modern science.

Elements -

Those substances in which only one type of atom is present are called elements. A molecule of an element is made up of one or more than one atom. For example, molecules of gold (Au), silver (Ag), helium (He), copper (Cu) are formed by only one atom of the same element. While the molecules of Nitrogen (N₂), Oxygen (O₂) are formed by two atoms of the same element.

Compound -

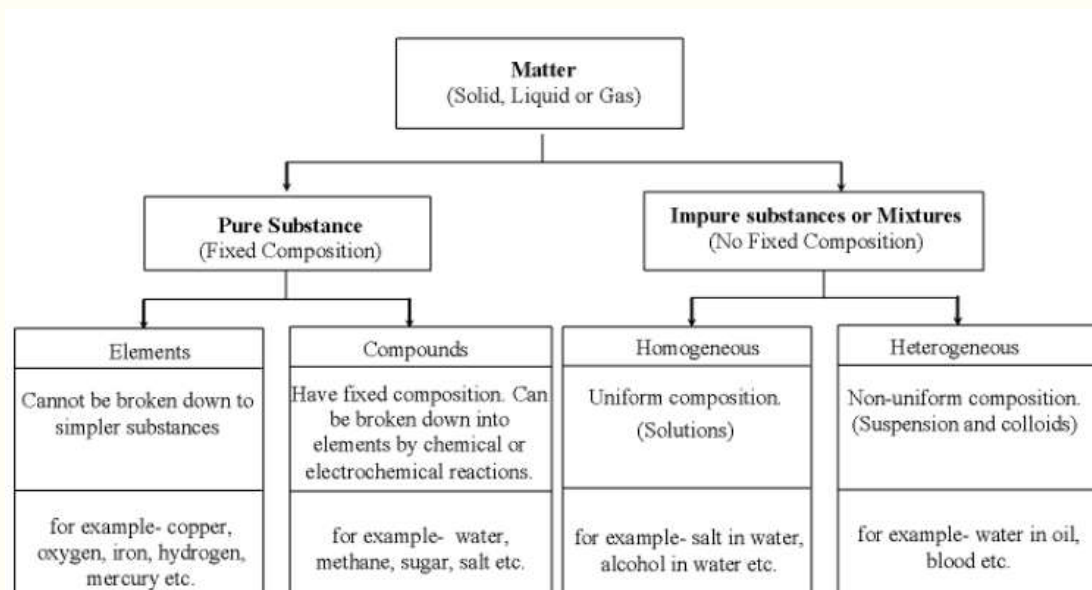
Those substances which are formed by the chemical combination of two or more types of elements in a definite ratio of atoms are called compounds. For example, salt (NaCl) is made up of one atom each of sodium and chlorine. Other examples of compounds are water (H₂O), ammonia (NH₃) etc.

Mixture -

The substance formed by mixing two or more elements or compounds which are not chemically combined in any proportion, is called a Mixture. For example- Gases in the Air, Gun Powder, Solutions

Mixtures can be classified into two parts –

- a) Homogeneous mixture b) Heterogeneous mixture
- a) **Homogeneous Mixture** - Such a mixture in which all the substances found are in the same state and are completely mixed together, is called homogeneous mixture, eg - Air is a homogeneous mixture of different gases, sugar solution, salt solution.
- b) **Heterogeneous Mixture** - A mixture in which all the substances are present in different states and remain separate is called heterogeneous mixture. like smoke, soap solution, starch solution, blood.



Solution – When there is a homogeneous mixture of two or more substances, it is called a solution. The particles of the substance of the solution are very small in size, so they cannot be seen by the naked eye, a microscope is required to see these particles.

Example – When we mix sugar in water, a homogeneous mixture is obtained. We call this homogeneous mixture a solution. A solution is made up of a solvent and a solute.

Solvent – The component of the solution in which a substance is dissolved is called solvent. For example, water acts as a solvent in a solution of sugar and water.

Solute – The component of a solution that is dissolved in a substance is called a solute.

For example, in a solution of sugar and water, sugar acts as a solute.

Suspension – A heterogeneous mixture of two or more substances is called a suspension. The particles of this mixture can be seen with the naked eye. When a ray of light passes through this mixture, the light gets scattered due to which the particles of the mixture get spread. In this mixture, the substances can be separated by filtration method.

Example – Mixture of chalk and water etc.

Colloidal Solution – Colloidal solution is a heterogeneous mixture. The size of the particles in this solution is very small as compared to the size of the particles in the suspension and bigger than that of a true solution. The particles in a colloidal solution can be separated by the method of centrifugation.

Example – milk, shaving cream, paint, fog, soap solution, blood etc.

Change of state of matter and its effects -

On changing the state of matter, the distance between the particles, the position of the particles and the energy of the particles change.

1. **Effect of temperature** - By heating substances, the intermolecular force between their particles becomes weak and the state of the particles

starts changing. The particles get energy through heat, due to which the particles start moving from their place and the kinetic energy of the particles increases. When a substance is heated, the solid melts and becomes a liquid. The temperature at which a solid substance melts into a liquid is called the 'melting point' of that substance.

The amount of heat energy required to convert 1 kg of solid substance into liquid at its melting point is called 'latent heat of fusion'.

Ice starts melting at 0°C . Hence, the melting point of ice is 0°C .

$$0^{\circ}\text{C} = 273\text{K}$$

When a liquid is heated, it turns into a gas. The temperature at which a liquid changes into a gas is called the 'Boiling point' of that substance.

Water starts boiling at 100°C . We can convert 0°C to Kelvin as follows.

Conversion of $^{\circ}\text{C}$ to Kelvin (K) unit -

$$\begin{aligned} \text{(I)} \quad 100^{\circ}\text{C} &= 273 + 100\text{K} \\ &= 373\text{K} \end{aligned}$$

$$\begin{aligned} \text{(II)} \quad 27^{\circ}\text{C} &= 273 + 27\text{K} \\ &= 300\text{K} \end{aligned}$$

Kelvin (K) unit to degree Celsius ($^{\circ}\text{C}$) -

$$\begin{aligned} \text{(I)} \quad 100\text{K} &= 100 - 273^{\circ}\text{C} \\ &= - 173^{\circ}\text{C} \end{aligned}$$

$$\begin{aligned} 373\text{K} &= 373 - 273^{\circ}\text{C} \\ &= 100^{\circ}\text{C} \end{aligned}$$

2. **Effect of pressure** - On applying pressure, the particles of the gas come very close to each other due to which the gas phase changes into liquid.

Purification of substances

Following are the methods of purifying the impure substances present in nature -

1. **Filtration** - When insoluble solid matter is present in a liquid as an impurity, the process of separating it with the help of filter paper is called filtration. The solid which remains behind on the filter paper is called as Residue and the liquid which passes through the filter paper is called Filtrate. eg. Separation of water from sandy water.

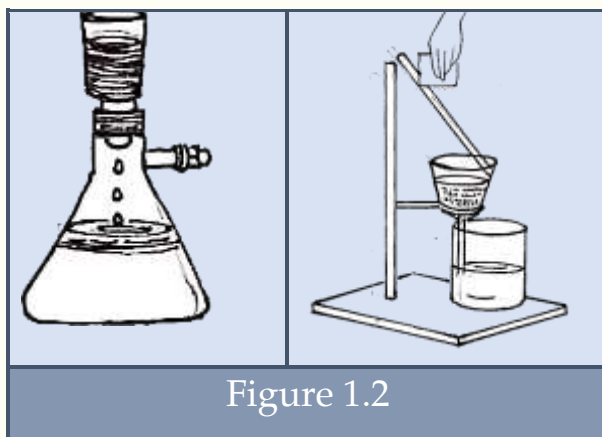


Figure 1.2

2. **Crystallization** - When a large amount of solid substance is dissolved in a liquid, a concentrated solution is formed. The process of separating Pure solids and liquids by cooling a hot concentrated solution is called crystallization. For example, to separate the sugar from the syrup, the syrup is boiled, due to which its liquid evaporates, then the syrup is cooled, thus we get sugar crystals.

3. **Sublimation** - The process of converting solid substances into gaseous state on heating and gaseous substances back into solid state on cooling is called sublimation. For example, on heating camphor, it directly vaporizes and converts into gaseous state.

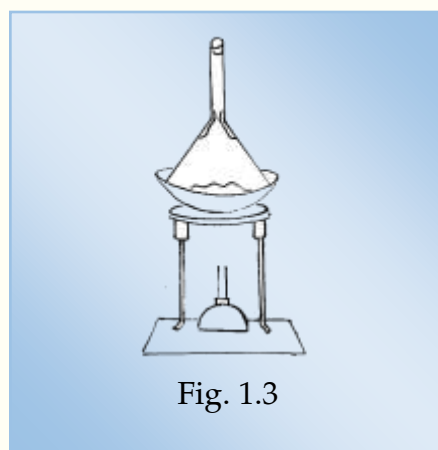


Fig. 1.3

sublimation

solid state \longleftrightarrow gaseous state

4. **Differential Extraction** - A mixture of liquids or substances which do not dissolve in each other can be separated by the method of differential extraction. For example, a mixture of water and oil.

5. **Distillation** - When a liquid contains soluble solid impurities, the mixture is evaporated and the liquid is condensed (cooled) by collecting this vapor in another vessel. In this way we can separate the liquid from the solid impurity.

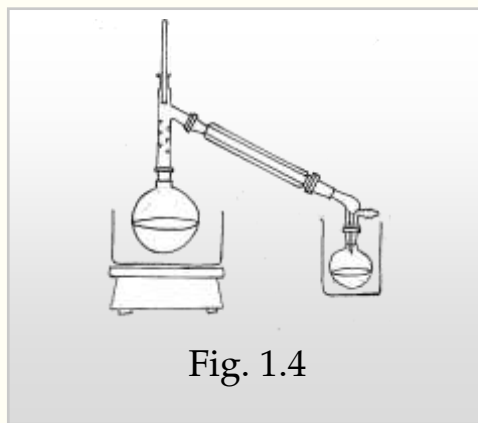


Fig. 1.4

impure liquid \longrightarrow steam \longrightarrow pure liquid

6. **Fractional distillation** - The process of separating substances present in a mixture on the basis of difference in their boiling points is called fractional distillation.

When a mixture is heated, the liquid with the lowest boiling point evaporates first and the liquid with the highest boiling point evaporates last. Different liquids are obtained by condensing their vapors by moving them with a fractionating column. eg. Different components of petroleum such as petrol, diesel, kerosene, vaseline etc. can be separated by fractional distillation method.

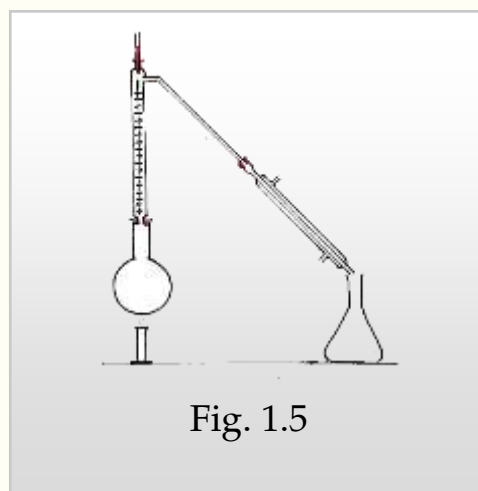


Fig. 1.5

Practice Work

Q. 1 Select the correct option.

- How many states of matter are there –
A) 2 B) 3 C) 9 D) 7
- In which state of matter there is minimum empty space between the particles -
a) Solid b) Gas c) Liquid d) Water
- The state of matter in which the volume of matter is fixed but the shape is not fixed –
a) Gas b) Liquid c) Solid d) None of these

Q. 2 Fill in the blanks.

- Air is a mixture of different gases.
- Those substances in which only one type of atom is present are called
- Diffusion between solid particles is very.....

Q. 3 Mark True (✓) or False (✗) against the following statements.

- The constituents of petroleum can be separated by fractional distillation method.
- Water can be separated from sandy water by filtration method.

Q. 4 Match the correct pair.

- | Column 'A' | Column 'B' |
|--------------------------|------------|
| 1. Element | A. Ammonia |
| 2. Compound | B. Gold |
| 3. Material Mixture | C. Smoke |
| 4. Heterogeneous mixture | D. Air |

Q. 5 Very short answer type questions

- Which of the following are pure substances -

- (a) Iron (b) Milk (c) Soil
(d) Gold (e) Oxygen (f) Brick

2. Classify the following into elements, compounds and mixtures -

- (a) Gold (b) Silver (c) Salt
(d) Water (e) Air (f) Ammonia

Q.6 Short Answer Type Questions

1. What method would you use to separate the following ?

- (a) Separation of sugar from syrup.
(b) By which method water is separated from sandy water?
(c) To remove oil from water

2. What is a mixture? Give an example.

3. Classify each of the following into homogeneous and heterogeneous mixtures?

Soda, Water, Wood, Ice, Air, Soil, Vinegar, Strained tea

4. Convert the following temperatures to Kelvin units.

- a) 30°C b) 140°C c) 170°C

5. Convert the following temperatures to Celsius units.

- a) 400K b) 673K c) 420K

Q.7 Long Answer Type Questions

1. Write four properties of liquid state.
2. Write the definition of compound and give an example.
3. Explain the sublimation method by making a labeled diagram?
4. What is a solution? Explain with examples.
5. Explain suspension and colloidal solution with examples.

Project work

Try to get pure water from sandy water by filtration method with the help of your Guruji. Write the experiment done in your notebook.

Chapter - 2

Atoms and Molecules

Kanad principle -

Maharishi Kanad had given his opinion about the indivisibility of matter before 500 BC which is called the Principle of Indivisibility of matter. Kanad told in his theory that any substance can be divided into small pieces and after a limit these small pieces cannot be divided further. Particles that cannot be divided further are called ATOMS.

Dalton's principle -

1808, Dalton propounded Dalton's theory based on the idea of Maharishi Kanad and other former philosophers, according to this theory, the smallest particle of a substance is an atom, the atom cannot be divided. In this theory, the law of conservation of mass and the law of definite proportions were explained.

ईशावास्यमिदं सर्वं यत्किञ्चजगत्याञ्जगत्।

(शु.य.का.सं. 40/1)

According to Yajurveda, energy is present in molecules and atoms.

Nuclear -

All substances like elements, compounds, mixtures are made up of microscopic particles, which are called atoms. The smallest particle of a substance is an atom which can participate in any chemical reaction but cannot remain in an independent state.

चरमः सद्विशेषाणामनेकोऽसंयुतः सदा ।

परमाणुः स विज्ञेयो नृणामैक्यभ्रमो यतः ॥

(श्रीमद्भागवत तृतीय स्कन्ध एकादशोऽध्याय 01)

In this shloka of Shrimad Bhagwat, the topic of nuclear creation has been mentioned. The smallest part of the earth etc. (which includes the body) which cannot be divided is called an atom.



Molecule -

Two or more atoms joined together by chemical bonds are called molecules. The smallest particle of an element or compound that can exist in an independent state is called a molecule.

अणुद्वौ परमाणू स्यात्त्रसरेणुस्त्रयः स्मृतः ।

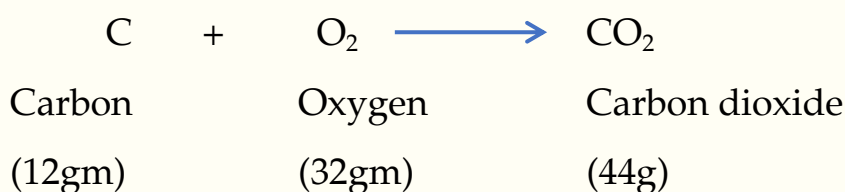
जालार्करश्म्यवगतः खमेवानुपतन्नगात् ॥

(श्रीमद्भागवत तृतीय स्कन्ध एकादशोऽध्याय 05)

Can be seen in the light of the sun's rays coming through the window. Trasrenu means green house gases like O₃ (Ozone), Carbon Dioxide (CO₂), Sulfur Dioxide (SO₂), Nitrogen Dioxide (NO₂). Green house gases increase the temperature of the earth.

law of chemical combination -

1. **Law of conservation of mass** - Mass can neither be created nor destroyed in a chemical reaction. The mass of substances participating in a chemical reaction remains the same before and after the reaction.



2. **Law of constant proportion** - Compounds are formed by combining two or more elements. The ratio of these elements in the compound remains constant. It means that whatever be the source from which it is obtained, a pure chemical compound is always made up of the same elements in the same mass percentage. For eg. The ratio of hydrogen and oxygen in water is always 1:8 by mass.

Table 2.1 - Symbols of some elements -

Sl.No.	Element Name	Symbol	Atomic Number	Atomic Mass
1.	Aluminum	Al	13	27
2.	Barium	Ba	56	137

3.	Copper	Cu	29	63.5
4.	Silver	Au	79	197
5.	Chandi (silver)	Ag	47	107.9
6.	Iron	Fe	26	55.9
7.	Sodium	Na	11	23
8.	Calcium	Ca	20	40
9.	Cobalt	Co	27	58.9
10.	Carbon	C	6	12
11.	Oxygen	O	8	16
12.	Nitrogen	N	7	14
13.	Hydrogen	H	1	1
14.	Chlorine	Cl	17	35.5
15.	Boron	B	5	10.8
16.	Argon	Ar	18	39.9
17.	Potassium	K	19	39.1
18.	Magnesium	Mg	12	24.3
19.	Helium	He	2	4
20.	Zinc	Zn	30	65.4

Ion – If there is an excess or deficiency of electrons in an atom, then that atom becomes electrically charged, the group of such electrically charged atom or group of atoms is called an ion.

Ions are of two types –

- 1) **Cation** – The atom which is deficient in electrons is called a cation.(positively charged)
- 2) **Anion** – The atom having excess of electrons is called anion. (negatively charged).

Example – Magnesium chloride ($MgCl_2$), is made up of positive magnesium ion (Mg^{2+}) and negative chloride ion (Cl^-).

Writing chemical formula -

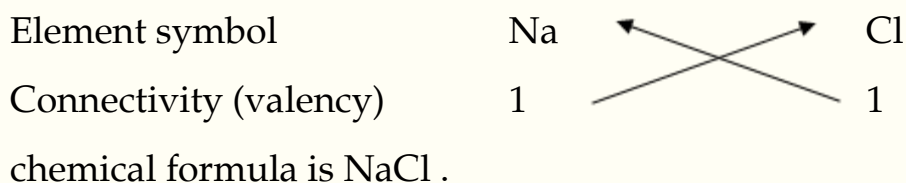
Atoms of one element combine with atoms of another element to form a chemical compound. It is necessary to know the valency of elements for the formation of chemical compounds. The valencies of some elements and polyatomic ions are given in the table given below –

Table 2.2

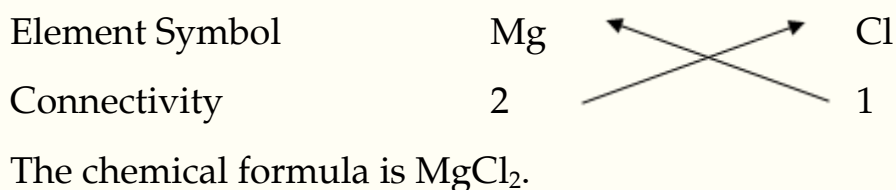
Ion name	valency	symbol	Ion name	valency	symbol
Potassium	1	K ⁺	Fluoride	-1	F ⁻
Sodium	1	Na ⁺	Chloride	-1	Cl ⁻
Magnesium	2	Mg ⁺²	Bromide	-1	Br ⁻
Calcium	2	Ca ⁺²	Iodide	-1	I ⁻
Iron	2, 3	Fe ⁺² Fe ⁺³	Oxide	-2	O ²⁻
Copper	1, 2	Cu ⁺ Cu ⁺²	Sulphide	-2	S ²⁻
Aluminum	3	Al ⁺³	Nitrite	-2	No ₂ ⁻
Carbon	4	_C_	Hydroxide	-1	OH ⁻
Hydrogen	1	H ⁺	carbonate	-2	Co ₃ ²⁻
Hydride	-1	H ⁻	Sulphate	-2	So ₄ ²⁻

Now let us write the chemical formulas of some compounds -

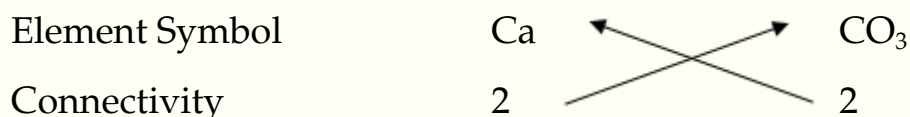
- 1) Chemical formula of sodium chloride –



- 2) Chemical formula of magnesium chloride –



3) Chemical formula of calcium carbonate –



The chemical formula is CaCO₃

4) Chemical formula of Iron Oxide (II) –



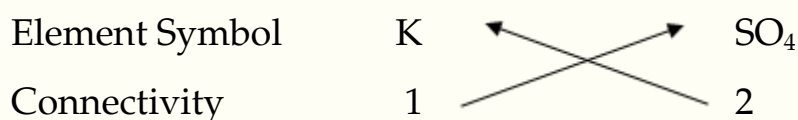
Chemical formula is FeO.

5) Chemical formula of carbon tetrachloride –



The chemical formula is CCl₄.

6) Chemical formula of potassium sulphate –



The chemical formula is K₂SO₄

Physical particles of atom and their discovery -

Electric discharge tube - is a glass tube, at both ends of which metal electrodes are attached, which are called cathode (negative electrode) and anode (positive electrode). A vacuum pump is connected to the glass tube, through which vacuum can be generated in the tube and the pressure in the tube can be increased or decreased.

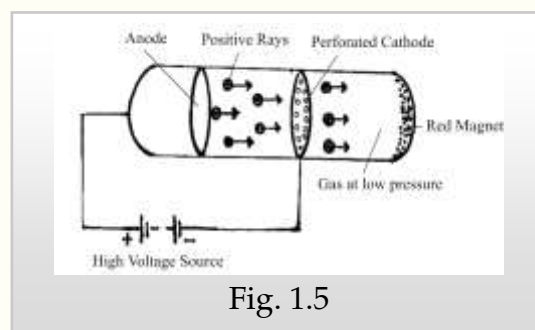
Discovery of electron

By connecting a high value voltage source on the metal electrode by creating a high vacuum in the electric discharge tube, the flow of electricity from the cathode of the tube to the anode starts in the form of rays called cathode rays. Cathode rays are considered to be composed of negatively charged particles. This experiment J.J. Done by Thomson. These negatively charged particles are called 'electrons'.



Discovery of the Proton

1886, 'Goldstein obtained new types of rays at low pressure and high potential in the electric discharge tube, which are called anode rays. Anode rays are positive.



Rutherford also explained the positively charged particle 'Proton' in the atomic model in 1911.

Rutherford's Atomic Model –

Rutherford did an experiment to study the structure of the atom. In this experiment, when a beam of fast moving alpha (α) particles are allowed to strike a very thin gold foil in vacuum, it is found that,

- 1) Most of the alpha (α) particles pass straight through the gold foil without being deflected by it. This leads to the conclusion that most of the atom is hollow (empty space) inside.
- 2) Some alpha (α) particles are deflected through small and large angles, since similar charges repel each other, so a positively charged body will repel another positively charged body. From this, it turns out that the positively charged part of the atom is very less which repels the positively charged alpha particles. This 'centre of positive charge' in the atom is known as 'Nucleus'.
- 3) Very few alpha (α) particles hit the gold foil and returns back. From this it can be concluded that the positive charge is concentrated in a very small (hard and dense part) inside the atom, this place is called nucleus.

Based on this experiment, it was also concluded that the size of the nucleus is very less as compared to the size of the atom and the electrons move in a circular motion around the nucleus.

Drawbacks of Rutherford's atomic model –

- 1) Rutherford's atomic model could not explain the stability of the atom.

2) Rutherford's atomic model could not explain the line spectrum.

Bohr's Atomic Model-

To overcome the shortcomings of Rutherford's atomic model, Niels Bohr presented the following concepts about the Structure of the Atom.

- 1) According to Bohr, electrons revolve around the nucleus only in 'Fixed orbits' (energy levels), each orbit having a different radius.
- 2) Electrons do not emit (lose) energy while revolving around the nucleus in their fixed orbits.

Arrangement of electrons in the atoms-

Electrons are arranged according to their increasing potential energy in different "Energy levels" or "Shells". The energy levels of the electrons are denoted by the numbers (1,2,3,4,5,...) whereas shells are represented by the letters (K,L,M,N....).

1st energy level is K-shell

2nd energy level is L-shell

3rd energy level is M-shell

4th energy level is N-shell, and so on.

The maximum number of electrons present in one orbit is $2n$. where $n =$ number of that energy level.

so:

K	=	1,	$2n^2$	=	$2(1)^2$	=	2
L	=	2,	$2n^2$	=	$2(2)^2$	=	8
M	=	3,	$2n^2$	=	$2(3)^2$	=	18
N	=	4,	$2n^2$	=	$2(4)^2$	=	32

Valency - The number of electrons present in the outermost shell of an atom is called 'Valency'.

Table 2.3 - Electronic distribution and valency of various elements

Element name	Symbol	Atomic number	Distribution of Electrons				Valency
			K	L	M	N	
Hydrogen	H	1	1	-	-	-	1
Helium	He	2	2	-	-	-	0
Lithium	Li	3	2	1	-	-	1
Beryllium	Be	4	2	2	-	-	2
Boron	B	5	2	3	-	-	3
Carbon	C	6	2	4	-	-	4
Nitrogen	N	7	2	5	-	-	3
Oxygen	O	8	2	6	-	-	2
Fluorine	F	9	2	7	-	-	1
Neon	Ne	10	2	8	-	-	0
Sodium	Na	11	2	8	1	-	1
Magnesium	Mg	12	2	8	2	-	2
Aluminum	Al	13	2	8	3	-	3
Silicon	Si	14	2	8	4	-	4
Phosphorus	P	15	2	8	5	-	3, 5
Sulfur	S	16	2	8	6	-	2
Chlorine	Cl	17	2	8	7	-	1
Argon	Ar	18	2	8	8	-	0

Discovery of Neutron

Neutron was discovered in 1932 by “James Chadwick”. It is a neutral particle (No charge), which is present in the nucleus of an atom.

Mass number

The total number of protons and neutrons present in the nucleus of an atom is called ‘mass number.’

Mass number = Number of protons + Number of neutrons

$$A = P + n$$

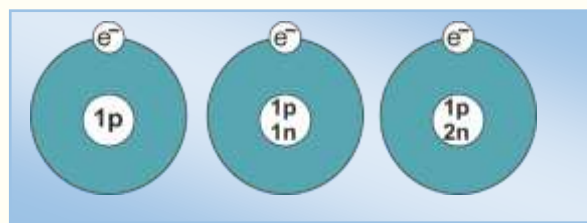
ex. - The mass number of carbon is 12, since the number of protons in it is 6 and the number of neutrons is 6.

Atomic Number -

The number of protons present in the nucleus of an atom is called its atomic number or "Atomic Number". eg. There are 8 protons and 8 neutrons in the nucleus of oxygen, so, the atomic number of oxygen will be 8.

Isotopes -

Atoms of the same element having the same atomic number but different mass numbers are called 'Isotopes'.



ex., ${}_1\text{H}^1$, ${}_1\text{H}^2$, ${}_1\text{H}^3$
Protium Deuterium Tritium

Hydrogen has three isotopes, Protium, Deuterium, Tritium, all three have the same atomic number but different mass numbers.

Uses of isotopes

1. An isotope of uranium is used as fuel in a nuclear reactor.
2. An isotope of iodine is used in the treatment of throat disease (gonorrhoea).
3. Cobalt – 60 isotope is used in the treatment of cancer.

Isobars-

Atoms of different elements having the same mass number but different atomic numbers are called 'Isobars'.

ex., ${}_{18}\text{Ar}^{40}$, ${}_{20}\text{Ca}^{40}$

Argon and calcium have the same mass number but different atomic numbers.

Practice Work-

Q. 1 Choose the correct option-

- The chemical symbol of sodium is -
a) C b) Cl c) Na d) P
- How many isotopes of hydrogen are there -
A) 2 B) 3 C) 4 D) 1
- The discoverer of electron is -
a) J.J. Thomson b) Rutherford c) Goldstein d) Chadwick

Q. 2 Fill in the blanks –

- The number of protons present in the nucleus of an atom is called the of that atom.
- The mass number of carbon is
- Cobalt – 60 isotope is used in the treatment of disease.

Q. 3 Mark True (✓) or False (✗) against the following statements.

- The chemical symbol of copper is CU.
- Neutron is a neutral particle.
- Isotopes of uranium are used as fuel in nuclear reactors.

Q. 4 Match the correct pair.

Column 'A'	Column 'B'
1. Calcium and argon	Isotopes
2. Protium and deuterium	Isobars
3. Cobalt	Goiter
4. Iodine	Cancer Treatment

Q. 5 Very short answer type questions

- In the treatment of which disease isotope of iodine is used ?
- Write the name of the discoverer of proton.



3. Write the names of the basic particles present in the atom.
4. What is the smallest particle of matter called ?
5. Who discovered neutron ?

Q.6 Short Answer Type Questions

1. Write the law of conservation of mass.
2. Define isotope with example.
3. Write the principle of Maharishi Kanad.
4. Write the chemical formula of the following –
 - a) Sodium chloride
 - b) Calcium chloride
 - c) Carbon tetrachloride
 - d) Potassium sulphate

Q.7 Long Answer Type Questions

1. Explain the electric discharge tube with a diagram.
2. Explain Rutherford's atomic model.
3. Explain Bohr's atomic model.

Project work

Complete the following table.

Atomic number	Mass number	Number of neutrons	Number of protons	Number of electrons	Atom species
6					
8	16				Oxygen
	40		20		

Chapter - 3

Diversity of organisms

Meaning of diversity in organisms

The living beings found around us are different from each other in one way or the other. On our earth there are living organisms ranging in size from very small micro-organisms to huge ones like the giant blue whale. This diversity found in living beings is called "BioDiversity".

Importance of Diversity in organisms-

Diversity in organisms maintains plant and ecological balance by providing stability to the ecosystem. Plants and animals are connected to each other through food chain or food web. If a species of organisms becomes extinct, it will directly affect the ecosystem. That's why diversity in living beings is of utmost importance.

एतद्देशप्रसूतस्य साकाशादग्रजन्मनः ।

स्वं स्वं चरित्रं शिक्षेरन् पृथिव्यां सर्वमानवाः । (मनुस्मृति)

There is mention in Manusmriti about the importance of diversity of living beings in nature.

वनस्पत्योषधिलता त्वक्सारा वीरुधो द्रुमाः ।

उत्स्रोतसस्तमःप्राया अन्तःस्पर्शा विशेषिणः ॥

(श्रीमद्भागवत तृतीय स्कन्ध दशमोऽध्याय 19)

In this verse of Shrimad Bhagwat, it has been told that the communication of plants, medicine, creeper, Twaksar, Virudh and Drum is from the bottom (root) to the top. They feel touch.

भूतैर्यदा पञ्चभिरात्मसृष्टैः, पुरं विराजं विरचय्य तस्मिन् ।

स्वांशेन विष्टः पुरूषाभिधानमवाप नारायण आदिदेवः ॥

(श्रीमद्भागवत एकादशः स्कन्धः अथ चतुर्थोऽध्यायः 03)

There is mention of the five great elements - earth, water, fire, air and sky.

मृगोष्ट्रखरमर्काखु सरीसृपखगमक्षिकाः ।

आत्मनः पुत्रवत् पश्येत्तैरैषामन्तरं कियत् ॥

(श्रीमद्भागवत सप्तम स्कन्ध अथ चतुर्दशोऽध्याय 9)

Deer, camel, donkey, monkey, rat, reptiles, birds, flies etc. are mentioned in this verse of Shrimad Bhagwat.

The Hierarchy of Classification –

Biologists such as Ernst Haeckel, Robert Whittaker and Carl Woese tried to classify all living organisms into broad category called as “Kingdoms”.

Major groups of Animals and Plants -

Robert Whittaker (1959) divided the organisms into 5 Kingdoms - Monera, Protista, Fungi, Plantae, Animalia.

1. **Monera** - These are prokaryotic organisms, that is, the genetic material in their cell remains in the cytoplasm. In these, nuclear membrane, nucleus and cell - organelles are absent. In these, reproduction is by conjugation method. They are both Autotrophic or heterotrophic. eg. - Bacteria, Archaeobacteria, Cyanobacteria (blue –green algae).



Fig. 3.1 – Nostoc

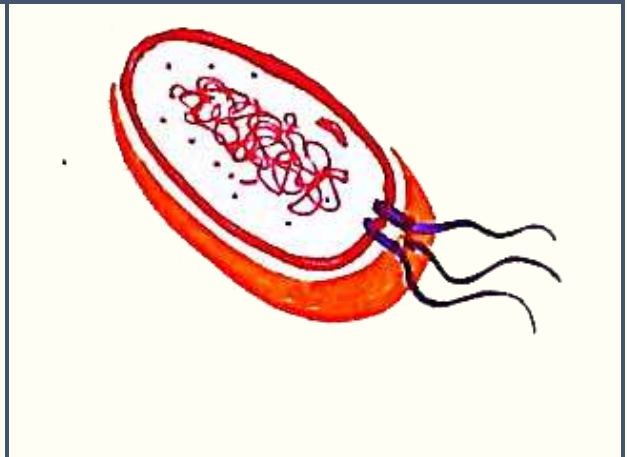
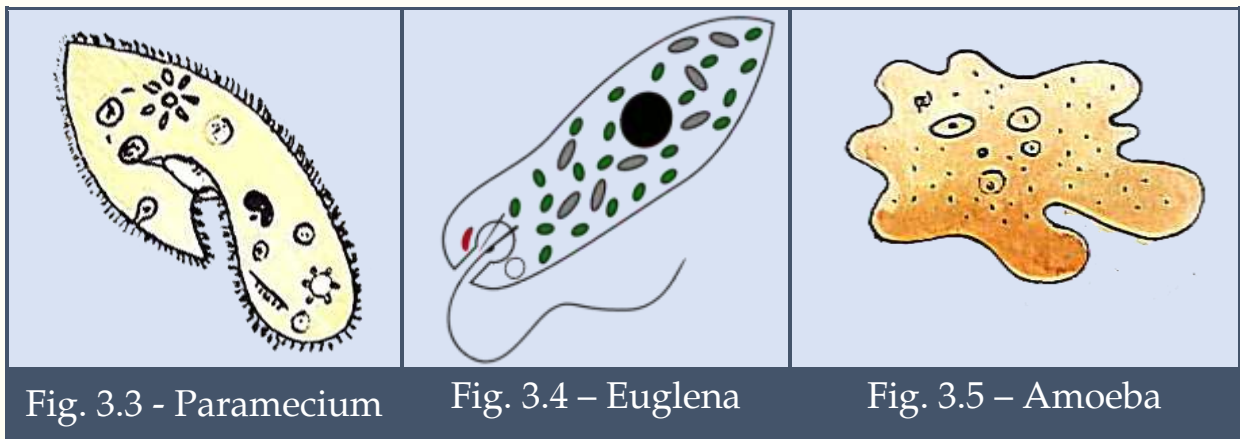


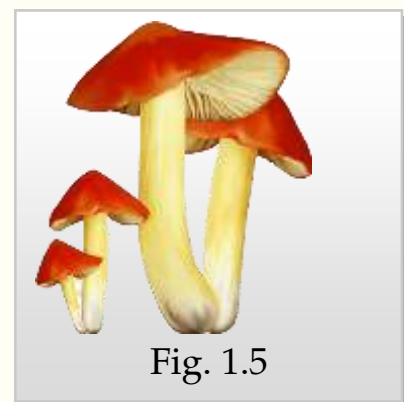
Fig. 3.2 – Bacteria

2. **Protista** - Unicellular, eukaryotic organisms come in this class. In these, nuclear membrane, nucleus and organelles are present. They reproduce by both asexual and sexual methods. Mode of nutrition can be autotrophic or heterotrophic.

Ex-Algae, Diatoms and Protozoans. (Paramecium, Euglena, Amoeba)



3. **Fungi** - Eukaryotic, heterotrophic organisms come in this class. Most of the fungi depend on decaying organic matter for nutrition and are called 'Saprophytes'. Some fungi form symbiotic relationships with blue-green algae (called 'Lichens'). Some fungi get their food from algae and provide habitat for algae to live. Such fungi are called 'Parasites'.



4. **Planti (Plant)** – They are multicellular eukaryots with cell wall. They manufacture their own food by the method of photosynthesis using chlorophyll and hence are called as 'Autotrophs'. On the basis of seed holding capacity, Planti can be divided into the following divisions

- a) Thallophyta b) Bryophyta c) Pteridophyta
- d) Gymnosperm e) Angiosperm

5. **Animalia** - Multicellular, eukaryotic organisms without cell wall come in this class. These organisms are mostly mobile. They are heterotrophs. Animalia can be divided into two groups on the basis of the presence of notochord – a) Invertebrates b) Vertebrates

A) **Invertebrates** - The vertebral column is not present in the animals of this group. Invertebrate animals can be divided into the following categories.

- 1. Porifera - Sycon, Euspanzia, Spongilla
- 2. Coelenterata - Hydra, Sea Anemone, Jellyfish

3. Platyhelminthes – Liver flukes, Tapeworms
4. Nematoda - Ascaris, Wuchereria
5. Annelida - Nereis, Leech, Earthworm
6. Arthropoda - House fly, grasshopper, crab, scorpion etc.
7. Mollusca - Snail, Octopus, Oyster
8. Echinodermata - starfish, sea urchins, sea cucumbers

B) Vertebrates - Spinal cord and endoskeleton are found in the animals of this group. They are also called Vertebrate Animals. Vertebrate animals can be divided into the following categories –

1. Fish - dog fish, electric fish, rohu fish
2. Amphibians – Salamander, Frog
3. Reptiles - snakes, turtles, crocodiles
4. Birds (Aves) - Ostrich, Peacock, Parrot
5. Mammals - bats, kangaroos, humans

Classification of living beings in Shrimad Bhagwat –

1. Classification on the basis of mobility –

The living beings that do not move are called immovable and the moving living beings are called Sachara.

2. Classification on the basis of flow of diet –

Vertical – In such animals, the flow of food is parallel to the earth.

Adho – In such animals, the flow of food is from top to bottom. Such creatures are vertical walkers and the alimentary canal is vertical.

सृष्टं स्वशक्त्येदमनुप्रविष्टचतुर्विधं पुरमात्मांशकेन ।

(श्रीमद्भागवत चतुर्थ स्कन्ध अथ चतुर्विंशोऽध्याय 64)

अण्डेषु पेशिषु तरुष्वविनिश्चितेषु प्राणो हि जीवमुपधावति तत्र तत्र ।

(श्रीमद्भागवत एकादशः स्कन्धः अथ तृतीयोऽध्यायः 39)

There is mention of four types of animals namely Jarayuj, Andaj, Svedaj and Udbhijja.

3. On the basis of nature of birth –

The creatures are divided into four types.

Swadej like bedbugs etc., Andaj born from egg, Udbhij born from the earth like tree-plants and Jarayuj which are attached to the placenta.

4. Classification on the basis of flying power –

तिरश्चामष्टमः सर्गः सोऽष्टाविंशद्विधो मतः ।

अविदो भूरितमसो घ्राणज्ञा हृद्यवेदिनः ॥

(श्रीमद्भागवत तृतीय स्कन्ध दशमोऽध्याय 20)

कङ्कगृध्रबकश्येनभासभल्लूकबर्हिणः ।

हंससारसचक्राहकाकोलूकादयः खगाः ॥

(श्रीमद्भागवत तृतीय स्कन्ध दशमोऽध्याय 24)

In this verse of Shrimad Bhagwat, birds have been classified on the basis of their ability to fly. The flying creatures like heron, vulture, quail, hawk, bhas, bhalluk, peacock, swan, stork, chakwa, crow and owl etc. are called birds.

5. Classification on the basis of type of hooves -

खरोऽश्वोऽश्वतरो गौरः शरभश्चमरी तथा ।

गौरजो महिषः कृष्णः सूकरो गवयो रुरुः ।

द्विशफाः पशवश्चेमे अविरुष्टृश्च सत्तम ॥

(श्रीमद्भागवत तृतीय स्कन्ध दशमोऽध्याय 21)

In this verse of Shrimad Bhagwat, animals have been classified on the basis of their hoofs. Animals with two hooves are called animals. For example, cow, buffalo, goat, blackbuck, pig, blue cow, sheep and camel etc. are called animals with two hoofs.

एते चैकशफाः क्षत्तः शृणु पञ्चनखान् पशून् ॥

(श्रीमद्भागवत तृतीय स्कन्ध दशमोऽध्याय 22)

In this verse of Shrimad Bhagwat, it has been mentioned about a hoofed animal like – donkey, horse, mule, gormiga, sharf etc. are hoofed animals.

6. Classification on the basis of nails –

श्वः सृगालो वृको व्याघ्रो मार्जारः शशशल्लकौ ।

सिंहः कर्पिर्गजः कूर्मो गोधा च मकरादयः ॥

(श्रीमद्भागवत तृतीय स्कन्ध दशमोऽध्याय 23)

In this verse of Shrimad Bhagwat, animals with five nails have been mentioned. For example, dog, jackal, wolf, tiger, rabbit, lion, monkey, elephant, tortoise etc. are animals with five nails.

7. Classification on the basis of number of legs

तेषां बहुपदाः श्रेष्ठाश्चतुष्पादस्ततो द्विपात् ॥

(श्रीमद्भागवत तृतीय स्कन्ध अथैकोनत्रिंशोऽध्याय 30)

It has been mentioned about non-legged, two-legged, four-legged creatures.

Variety of plants in Shrimad Bhagwat –

Most of the plants are vegetative which grow due to solar energy of light in which when water and salts move up from the earth and prepared food is distributed from top to bottom in root and lateral.

सर्वतोऽलकृङ्गं दिव्यैर्नित्यपुष्पफलद्रुमैः ।

मन्दारैः पारिजातैश्च पाटलाशोकचम्पकैः ॥

(श्रीमद्भागवत अष्टम स्कन्ध अथ द्वितीयोऽध्याय 10)

चूतैः प्रियालैः पनसैराश्रैराश्रतकैरपि ।

क्रमुकैर्नारिकेलैश्च खजूरैर्बीजपूरकैः ॥

(श्रीमद्भागवत अष्टम स्कन्ध अथ द्वितीयोऽध्याय 11)

मधुकैः शालतालैश्च तमालैरसनार्जुनैः ।

अरिष्टोदुम्बरप्लक्षैर्वटैः किंशुकचन्दनैः ॥

(श्रीमद्भागवत अष्टम स्कन्ध अथ द्वितीयोऽध्याय 12)

पिचुमन्दैः कोविदारैः सरलैः सुरदारूभिः ।

द्राक्षेक्षुरम्भ जम्बुभिर्बदर्यक्षाभयामलैः ॥



(श्रीमद्भागवत अष्टम स्कन्ध अथ द्वितीयोऽध्याय 13)

बिल्वैः कपित्थैर्जन्बीरैर्वृतो भल्लातकादिभिः ॥

तस्मिन्सरः सुविपुलं लसत्काञ्चनपंकजम् ॥

(श्रीमद्भागवत अष्टम स्कन्ध अथ द्वितीयोऽध्याय 14)

Various types of plants have been mentioned in Srimadbhagvat. Some plants are always laden with fruits and flowers. Mandar, Parijat, Gulab, Ashoka, Champa, different types of mangoes, priyal, jackfruit, amda, betel nut, coconut, dates, reetha, sycamore, pakar, banyan, palas, sandalwood, neem, kachnar, sal, cedar, grapes, reed Trees like banana, jamun, ber, rudraksh, hare, amla, bael, kaith, lemon, etc. are mentioned.

Biodiversity in Vedic Vangmay -

सत्यं बृहदृतमुग्रं दीक्षा तपो ब्रह्म यज्ञः पृथिवीं धारयन्ति ।

सा नो भूतस्य भव्यस्य पत्न्युरुं लोकं पृथिवी नः कृणोतु ॥

(अथर्व. 12.1.1)

Brahma, Tapa, Yajnadiksha and vastly spread water are the ones who support the earth, this earth had taken care of the living beings of the past and will take care of the living beings of the future, this type of earth should give us a place to live.

असबाधं बध्यतो मानवानां यस्या उद्वतः प्रवतः समं बहु ।

नानावीर्या ओषधीर्या बिभर्ति पृथिवी नः प्रथतां राध्यतां नः ॥

(अथर्व. 12.1.2)

Holds herbs on high, low and flat places, may we get all kinds and complete and fulfill all our wishes.

गिरयस्ते पर्वता हिमवन्तोऽरण्यं ते पृथिवि स्योनमस्तु ।

(अथर्व. 12.1.11)

Oh earth May your snow-capped mountains and dense forests give us happiness. Forests of snowy regions have been mentioned.

शिला भूमिरश्मा पांसुः सा भूमिः संघृता धृता ।

(अथर्व. 12.1.26)

Takes the form of rock, earth, stone and dust.

ये त आरण्याः पशवो मृगा वने हिताः सिंहा व्याघ्राः पुरुषादश्चरन्ति ।

उलं वृकं पृथिवि दुच्छुनामित ऋक्षीकां रक्षो अप बाधयास्मत् ॥

(अथर्व. 12.1.49)

Wolves, bears etc. are mentioned in Aranya (Jungle).

यां द्विपादः पक्षिणः सम्पतन्ति हंसाः सुपर्णाः शकुना वयांसि ।

(अथर्व. 12.1.51)

Two legged birds swans, crows, vultures etc. are mentioned.



Practice Work -

Q. 1 Choose the correct option

- The animal of Arthropoda class is -
 - Leech
 - Snail
 - Housefly
 - Starfish
- The animal of reptilia class is -
 - Frog
 - Snake
 - Bat
 - Kangaroo
- Animalia is divided into how many groups on the basis of presence of notochord -
 - 2
 - 4
 - 3
 - 5

Q. 2 Fill in the blanks –

- The five kingdom classification was introduced by
- Monera has nutrition.
- Single celled eukaryotic organisms come in thegroup.

Q. 3 Mark True (✓) or False (✗) against the following statements.

- Bat is a mammal.
- Snail is an animal of Mollusca class.
- Euglena is an animal of the Protista group.

Q. 4 Match the correct pair.

- | Column 'A' | Column 'B' |
|-------------|------------|
| 1. Monera | Amoeba |
| 2. Protesta | Bacteria |
| 3. Bird | Leech |
| 4. Annelida | Peacock |

Q. 5 Very short answer type questions

- Frog is an animal of which class ?

-
2. Write the names of the animals of the class Amphibians.
 3. Into how many classes has Robert Whittaker divided the organisms ?

Q. 6 Short Answer Type Questions

1. What is biodiversity ?
2. What is the importance of diversity in living beings ?
3. Tell about the animals of Protista class.

Q.7 Long Answer Type Questions

1. Throw light on biodiversity in Vedic literature.

Chapter - 4

Motion

When we look at the objects located around us, some objects like house, temple, school, hostel, trees and plants etc. are seen by us in rest or stationary state and some objects like moving train, running student, flying Birds etc. are visible to us in a state of motion. If an object changes position with respect to other objects with respect to time, then this state of the object is called "Motion".

अहस्ता यदपदी वर्धत क्षाः शचीभिर्वेद्यानाम्।

शुष्णं परि प्रदक्षिणिद् विश्वायवे नि शिश्रथः ॥ (ऋग्वेद 10.22.14)

There is a reference to the walking (motion) of people on the earth. The state of a particle, body or object that does not change with time is called the 'state of rest' of the object. The change in position of a particle, body or object with time is called the 'state of motion' of the object.

Types of motion - Some of the major motions are as follows -

1. **Straight line motion** - If an object moves along a straight line, then this type of motion of the object is called Straight line motion. eg. - Bus speed on straight road.
2. **Circular motion** - When an object moves on a circular path, then this type of motion of the object is called Circular motion. eg. The motion of a stone tied to a light string and rotated.
3. **Oscillatory motion** - When an object on a fixed path repeats its previous motion again and again after a fixed time interval, then this type of motion of the object is called Oscillatory motion. eg. - Motion of the pendulum of the clock.

गतऊर्ध्वं गमनम् आगतम् अधोगमनं यत्र पक्षिगतिविशेषः ।

The word Gatagatam is used in Sanskrit language. This Pind has been explained by Jatadhar. The up and down motion of a body in the vertical direction is called oscillatory motion.

गतं च आगतं च द्वयोः समाहारं यातायातम्।

Oscillatory motion has been explained in a book named Rasamanjari.

Vector and scalar quantities -

There are two types of quantities on the basis of direction and magnitude.

1. **Vector quantities** - Such quantities which have both direction and magnitude are called vector quantities. eg. - displacement, velocity, acceleration etc.
2. **Scalar quantities** - Such quantities which have only magnitude and no direction are called scalar quantities. eg. Distance, speed etc.

Distance and Displacement

Distance - The length of the path covered by an object is called distance. It is a scalar quantity. It is always positive. The SI unit of distance is 'meter'.

$$1 \text{ meter} = 100 \text{ centimeters}$$

$$1 \text{ kilometer} = 1000 \text{ meters}$$

Displacement - The shortest length between two points in a given direction is called displacement. It is a vector quantity and its SI unit is meter.

Speed - The distance traveled by an object in unit time is called the speed of the object.

$$\text{Speed} = \frac{\text{Distance covered by the object}}{\text{Time taken to cover the distance}}$$

Speed is a scalar quantity. Speed is measured in 'meters per second' or 'kilometers per hour'.

Velocity - The distance traveled by an object in a certain direction in unit time is called the velocity of the object.

$$\text{Velocity} = \frac{\text{Displacement}}{\text{Time}}$$

Velocity is a vector quantity. Velocity is measured in 'meters per second'.

Uniform motion - If an object covers equal distances in equal intervals of time, then this type of motion of the object is called 'uniform motion'. eg. - If an object covers a distance of 10 meters in the first second and again 10 meters in the next second and again 10 meters in the third second, this type of motion of the object is called uniform motion.

Ex-.Motion of Earth around Sun.

Non-uniform motion - If an object covers different distances in equal intervals of time, then this type of motion of the object is called non-uniform motion. eg. - If an object covers a distance of 10 meters in the first second and 7 meters in the next second and 12 meters in the third second, then this type of motion of the object is called non-uniform motion.

Ex-Bouncing ball, moving train.

Acceleration - The rate of change of velocity of an object is called 'acceleration'.

$$\text{Acceleration} = \frac{\text{change in velocity}}{\text{time}}$$

Acceleration is a vector quantity. It is measured in meter per second². Acceleration can be positive or negative. Negative acceleration is called deceleration.

Practice Work

Q. 1 Select the correct option.

- The SI unit of velocity is -
 - $\frac{\text{Meter}}{\text{Second}}$
 - Meter \times Second
 - $\frac{\text{Meter}}{\text{Second}^2}$
 - Meter² \times Second²
- The distance traveled per unit time is called –
 - Speed
 - Velocity
 - Acceleration
 - Displacement
- If an object changes its position with respect to time, then in which state will that object be?
 - Stationary phase
 - Dynamic phase
 - Displaced state
 - None of these

Q. 2 Fill in the blanks

- The quantity which has both direction and magnitude is called
- The shortest distance between two points is called.....
- The distance traveled by a moving object in unit time is called.....

Q. 3 Mark True (✓) or False (✗) against the following statements.

- The change in velocity per unit time is called acceleration.
- The motion of a swing is an example of straight line motion.
- The motion of a train is an example of circular motion.

Q. 4 Match the correct pairs

- | Column 'A' | Column 'B' |
|-------------------------|--------------------------------------|
| 1. Straight line motion | - Motion of the bus |
| 2. Circular motion | - Motion of the pendulum of a clock |
| 3. Oscillatory motion | - Motion of a stone tied to a string |

Q. 5 Very short answer type questions

1. What is the rate of change of velocity of an object called?
2. What is the length of the path covered by an object called?
3. Such quantities which have both direction and magnitude are called.

Q. 6 Short Answer Type Questions

1. What is uniform motion? Explain by giving examples.
2. A student covers a distance of 200 km in 4 hours in his vehicle. Find the speed of the student's vehicle.
3. A bus is moving in the west direction. It travels 100 km in 2 hours. Find the velocity of the bus.

Q.7 Long Answer Type Questions

1. What is speed? What are the types of speed?

Project work

Try to classify the motion of various objects and animals around you as straight line motion, circular motion, oscillatory motion.

Chapter - 5

Force and laws of motion

We know that if an object is at rest or rest, then we have to make some efforts to bring it into motion and if the object is in motion, then we have to make some effort to bring it back to rest. For example, a pitch roller kept in the playground has to be pushed to bring it from a stationary state, to a state of motion and brakes have to be applied by the driver to stop a moving train. Therefore, the physical quantity which tries to bring the objects from the state of rest to the state of motion or from the state of motion to the state of rest is called 'Force'. Force is that external factor which brings or tries to bring about a change in an object in a state of rest or in a state of motion or in size or shape or direction.

$$\text{Force} = \text{Mass} \times \text{Acceleration}$$

$$F = M \times a$$

Force is a vector quantity. Its SI unit is 'Newton'.

बलमसि बलं मे दाः स्वाहा ।

(अथर्व 2.17.3)

In this mantra of Atharvveda, Agnidev has been requested to provide strength. It is clear from this mantra that there was a concept of force in Vedic literature.

Types of Force -

There are two types of forces - 1. Balanced force 2. Unbalanced force

1. **Balanced Force** - If equal force is applied on an object or body from opposite directions, the resultant force becomes zero, such a force is called balanced force.
2. **Unbalanced force** - If the resultant force of all the forces acting on an object or body does not become zero, then such force is called unbalanced force.

Newton's laws of motion -

Newton propounded three laws based on force and motion, which are known as Newton's laws of motion -

Newton's first law of motion -

According to this law, if an object is at rest, it will remain at rest or if it is in motion, it will remain in motion unless an external force is applied to it. Newton's first law of motion is also called the “law of Inertia”.

Activity - 1

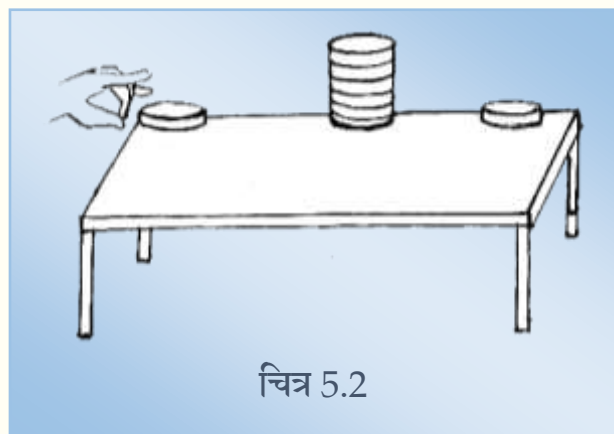
Take a glass tumbler, a thick smooth piece of cardboard, a coin. Now, keep the cardboard on the glass tumbler as shown in the picture and place the coin on the cardboard. Now give a quick push to the piece of cardboard with your fingers. You will see that the cardboard moves forward but the coin falls into the glass because the coin remains at rest so it falls into the glass and due to the force on the cardboard it slides further.



Figure 5.1

Activity - 2

Take 5-6 pieces used for playing carrom and a striker. Now place the pieces one above the other as shown in the picture. Now hit the striker with the bottom piece of the stack of pieces. Now we will see that the lower piece has moved ahead and the pile of other pieces remains the same, this happens because the striker exerts a force on the lower



चित्र 5.2

piece due to which it moves forward. While the other pieces remain at the same place due to being at rest.

Examples of Newton's first law of motion -

1. When a train standing on a railway platform starts suddenly, the passenger sitting in it gets pushed backwards because the passenger remains at rest and when the train stops suddenly, the passenger sitting in it leans forward because the upper part of the passenger's body remains in dynamic state.
2. When the branch of a tree bearing guava fruit is shaken, the fruit falls down due to being in resting state.

Impulse/Momentum -

The momentum of an object in motion is equal to the product of its mass and velocity. Let the mass of the object be 'm' and velocity be 'v'.

$$\text{Momentum (P)} = \text{Mass} \times \text{Velocity}$$

$$P = m \times v$$

Momentum is a vector quantity. Its SI unit will be 'kilogram x meter/second'.

Newton's second law of motion -

The rate of change of momentum of an object is proportional to the force applied on it and the change of momentum is in the direction in which the force is applied. Let the initial velocity of the object of mass (m) be 'u'. When a force 'F' is applied on the object, after time 't' the velocity of the object becomes 'v'. Therefore

$$\text{Initial momentum of the object, } P_1 = mu$$

$$\text{Final momentum of the object after time } t, P_2 = mv$$

Change in momentum = final momentum – initial momentum

$$= P_2 - P_1$$

$$= mv - mu$$

$$= m(v - u)$$

$$\text{Rate of change of momentum} = \frac{m(v-u)}{t}$$

As per rule,

$$F \propto \frac{m(v-u)}{t}$$

$$\frac{v-u}{t} = a$$

The rate of change of velocity is called 'Acceleration'.

$$F \propto ma$$

$$\text{Putting } F = K m.a$$

$$K = 1(\text{Proportionality constant})$$

$$F = ma$$

Newton's second law of motion gives us the definition of 'force'.

Examples of Newton's second law of motion -

1. During a cricket match, the fielder pulls his hands backwards while catching the ball, so that the momentum of the ball is reduced and the hands are not hurt.

Newton's third law of motion -

For every action there is an equal but opposite reaction.

Examples of Newton's third law of motion -

1. When a passenger sitting in a boat jumps forward from the boat towards the shore, the boat moves backward.



Fig. 5.3

2. To steer the boat, the boatman pushes the water backward with the help of oars, due to which the water exerts a reaction force on the boat and the boat moves forward.

3. While swimming in the water, the swimmer pushes the water backward with the help of his hands and feet to move forward in the water and the water applies a reaction force on the swimmer due to which he moves forward.

Maharishi Kanad revealed important facts related to the movement of objects in Vaisesik Darshan –

नोदनविशेषाभावान्नोर्ध्वं न तिर्यग्गमनम् ।

प्रयत्नविशेषान्नोदनविशेषः ।

नोदनविशेषादुदसनविशेषः ।

(वैशेषिक दर्शन 5.1.8-9)

According to this sutra of Vaisesik Darshana, due to the absence of any special motivation (force), the object can neither be deviated upwards nor here and there.

A particular inspiration (force) is produced by effort only and through this inspiration (force) movement is generated in the object.

कार्यविरोधी कर्मः ।

(वैशेषिक दर्शन 1.1.14)

According to this formula of Vaisheshika philosophy, every action has its opposite action.

This formula of Maharishi Kanad is equivalent to Newton's three laws of motion. It is clear from the above reference that Maharishi Kanad was the first seer of the laws of motion.

Law of conservation of momentum -

According to Newton's second law of motion, if the force applied on a body or system is zero, that is, the value of the resultant force is zero, then the value of momentum of that object remains constant. This is the law of conservation of momentum.

Example of the law of conservation of momentum -

1. The principle of rocket propulsion is based on the law of conservation of momentum.

-
2. When two balls of equal momentum collide with each other, the balls come to a sudden stop, here the total momentum of the system is equal before and after the collision, that is, the total momentum of the system remains conserved.



Practice Work

Q. 1 Choose the correct option

- If an object with mass moves with a velocity, then its momentum will be -
 - ma
 - mv
 - (v - u)
 - None of these
- The definition comes from Newton's second law of motion.
 - Force
 - Energy
 - Momentum
 - Acceleration
- Newton's first law of motion is called.
 - law of inertia
 - law of conservation of momentum
 - law of conservation of energy
 - none of these

Q. 2 Fill in the blanks

- For every action there is an equal but reaction.
- Force is a quantity.
- The unit of momentum is

Q. 3 Mark True (✓) or False (✗) against the following statements.

- The resistance of an object to change in its state of motion is called inertia.
- The unit of force is watt.
- An object of mass M whose velocity is V. Its momentum will be MV.

Q. 4 Match the correct pair.

- | Column 'A' | Column 'B' |
|---------------------------------|-----------------------------|
| 1. Force | Mass × velocity |
| 2. Momentum | Mass × acceleration |
| 3. Newton's first law of motion | Theory of rocket propulsion |

4. law of conservation of momentum Law of inertia

Q. 5 Very short answer type questions

1. In which direction will a passenger sitting in a moving train lean when the train stops suddenly ?
2. On which principle is the principle of rocket propulsion based?
3. What type of physical quantity is momentum ?

Q. 6 Short Answer Type Questions

1. Why does a swimmer push water backwards with the help of his hands and feet while swimming in water ?
2. Why does the passenger sitting on the platform bend backwards when the train starts moving suddenly ?
3. What is the law of conservation of momentum ?

Q.7 Long Answer Type Questions

1. What is force ? Write the types of force.
2. Explain Newton's second law of motion with an example.

Chapter - 6

Gravity

When we throw an object upwards by some force, it comes back to the earth after some time and when an object is dropped from some height, it automatically falls on the surface of the earth, why this happens because the earth attracts every object or body towards itself by a force which is called the “force of gravity”.

आकृष्टिशक्तिश्च मही तथा यत् खस्थं, गुरुस्वाभिमुखं स्वशक्त्या ।

आकृष्यते तत् पततीव भाति, समेसमन्तात् क्व पतत्वियं खे ॥

(सिद्धान्त भुवन. 16)

Bhaskaracharya says that the earth has the power of attraction due to which it pulls the heavy objects above towards itself.

The basis of gravity theory is obtained from Vedic literature and ancient Indian literature.

आधारशक्त्यावधृतः कालग्निरयम् ऊर्ध्वगः ।

तथैव निम्नगः सोम ॥

(बृहत् जाबाल उपनिषद् 2.8)

In this mantra of the Upanishad, the principle of gravity has been described as the base force.

लोष्टः क्षिप्तो बाहुवेगं गत्वा नैव तिर्यक् गच्छति नोर्ध्वमारोहति,

पृथिवीविकारः पृथिवीमेव गच्छति आन्तर्यतः ॥

(पतंजलि व्याकरण महाभाष्य, स्थानेन्तरतमः 1.1.49)

According to Mahabhashya, if a stone is thrown upwards, it neither bends nor climbs up after attaining maximum velocity, it returns back to the earth.

यदा ते हर्यता हरी वावृधाते दिवेदिवे ।

आदित् ते विश्वा भुवनानि येमिरे ॥

(ऋग्वेद 8.12.28)

In this Rigvedic mantra, it has been told that all the lokas (celestial bodies) have an attraction with the Sun, therefore all the lokas (celestial bodies) rotate in their orbits.



नोत स्ववृष्टिं मदे अस्य युध्यत एको अन्यच्चकृषे विश्वमानुषक् ।

(ऋग्वेद 1.52.14)

It is mentioned in this mantra of Rigveda that every atom has the power of attraction and the atom attracts other atoms towards itself.

सविता यन्त्रैः पृथिवीमरम्णादस्कम्भने सविता द्यामदंहत् ।

अश्वमिवाधुक्षद्भुनिमन्तरिक्षमतूर्ते बद्धं सविता समुद्रम् ॥

(ऋग्वेद 10.149.1)

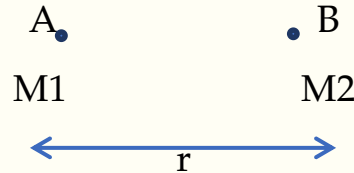
Sun, Earth and other planets are bound by the force of attraction and all the planets revolve around their axis.

Newton also studied the objects falling on the earth's surface automatically from above and rendered the theory of gravity.

Newton's universal law of gravitation -

The force of attraction between two bodies is called the force of gravity.

Every particle of the universe is attracting every other particle towards itself due to the force of gravity.



Let two bodies A and B whose masses are M1 and M2 respectively. A and B are located at a distance r from each other, then according to this rule -

1. The force of attraction acting between two bodies is proportional to the product of the masses of the bodies.

$$F \propto M1 \times M2 \quad \dots\dots\dots (1)$$

2. The force of attraction acting between two objects is inversely proportional to the square of the distance between the objects.

$$F \propto \frac{1}{r^2} \quad \dots\dots\dots (2)$$

On combining both the equations

$$F \propto \frac{M_1 \times M_2}{r^2}$$

$$F = G \cdot \frac{M_1 \times M_2}{r^2}$$

where 'G' is a constant called the 'constant of universal gravitation'. Whose value is $6.67 \times 10^{-11} \frac{Nm^2}{Kg^2}$.

Events based on the law of gravity

1. The Sun and the planets are pulled towards each other by the force of gravity. This is the reason why all the planets are revolving around the Sun in a certain orbit.
2. Due to the force of gravity, all the satellites are orbiting their planet. For example, the motion of the moon around the earth.
3. Tides in the sea.
4. Earth keeps us bound to itself only by the force of gravity.

Gravitational Acceleration -

An attractive force acts between two bodies, which is called the force of gravity. If one of these bodies is the earth, then this force of attraction is called gravity of earth, that is, gravity is the force of attraction by which the earth pulls an object towards itself. The acceleration produced due to this force is called acceleration due to gravity, whose value is 9.8 m/s^2 .

Activity - 1

Take some paper, pen, coins, stones. Now drop all the objects simultaneously from some height. Do all the objects reach the earth at the same time?

You see that the stone and the coin fall together, after a while the pen and finally the paper. Objects fall down in different times because there is a force of friction on the objects, this force of friction is more for paper and less for stone.

Weight of an object

The weight of an object is the force with which the object is attracted towards the earth. Hence, the weight of the object $w = mg$

Weight of an object on the moon - The force with which the moon attracts an object is called the weight of that object. The weight of an object on the Moon is less as compared to the Earth because the mass of the Moon and the force of attraction are less than that of the Earth.

The weight of an object on the Moon is 1/6 times that of the Earth.

Weightlessness -

The condition of experiencing zero weight by a person is called 'weightlessness'. Due to the absence of reaction force, the condition of weightlessness arises.

eg. 1. A passenger sitting in a swing experiences a reduction in weight while coming down the swing.

2. When the rope of the swing suddenly breaks, the passenger sitting in the swing feels weightless.
3. A passenger standing in the lift experiences a reduction in weight when the lift goes down.

Buoyancy and Pressure

Propulsion - The force acting perpendicular to the surface of an object is called Propulsion. Its SI unit is newton. eg. To fill air with a pump in a bicycle or football, force is exerted on the entire area of the piston by the feet.

Pressure - The force acting on a unit area of an object is called Pressure.

$$\text{Pressure} = \frac{\text{Force}}{\text{Area}}$$

The SI unit is the newton per square meter or Pascal.

Buoyancy -

When an object is dropped in a liquid, the liquid exerts an upward force on the object, which is called buoyancy. If the weight of the object is greater than the buoyant force, then the object will sink in water. If the weight of the object is less than the buoyant force, then the object starts floating partially or completely.

Archimedes' principle -

When an object is partially or completely immersed in a liquid, the liquid exerts an upward force equal to the weight of the liquid displaced by the object, which is called the buoyant force. This is called "Archimedes' principle".

Use of Archimedes' principle -

1. This principle is used in the design of ships and submarines.
2. To measure the purity of milk.

Practice Work

Q. 1 Select the correct option -

1. Which of the following is the unit of pressure?
 - a) Pascal
 - b) Newton
 - c) Joule
 - d) Erg
2. Which force acts between two bodies due to gravity –
 - a) Attraction
 - b) Repulsion
 - c) Both attraction and repulsion
 - d) None of these
3. The force acting on the unit area of the object is called -
 - a) Pressure
 - b) Thrust
 - c) Buoyancy
 - d) None of these

Q. 2 Fill in the blanks –

1. When objects are immersed in a liquid, they experienceforce.
2. The of an object is equal to the product of mass and acceleration due to gravity.
3. When the rope of the swing suddenly breaks, the passenger sitting in the swing feels

Q. 3 Mark True (✓) or False (✗) against the following statements.

1. The SI unit of mass is kilogram × meter.

2. The mass of an object is 12 kg on the earth, its mass on the moon will be 2 kg.
3. Due to the force of gravity, all the satellites are revolving around their planet.

Q. 4 Match the correct pair.

Column 'A'	Column 'B'
1. Pranod	a. Pascal
2. Pressure	b. Newton
3. Gravitational constant	c. 9.8 m/s^2
4. Acceleration due to gravity	d. $6.67 \times 10^{-11} \text{ Nm}^2 / \text{Kg}^2$

Q. 5 Very short answer type questions

1. The occurrence of tides in the sea is the result of which force?
2. On the basis of which principle the ship is constructed?
3. What is the unit of thrust?

Q. 6 Short Answer Type Questions

1. What is weightlessness?
2. Write the principle of Archimedes.
3. What is acceleration due to gravity?

Q.7 Long Answer Type Questions

1. Write Newton's universal law of gravitation.

Chapter - 7

Work and Energy

Generally, we call the activities of cooking food, cleaning the house, carrying things from one place to another, reciting Veda mantras, exercising etc. as work, but the scientific concept of work is different.

Work - The product of the force applied on an object and the displacement of the object in the direction of the force is called work.

$$\text{Work} = \text{Force} \times \text{Displacement}$$

$$W = F \times S$$

Work is a scalar quantity and its unit is Joule.

ex. 1. During a cricket match, a bowler throws the ball towards the batsman with a force i.e. the ball has traveled a distance (displacement) in a certain direction. When a force is applied on an object and it moves from its place to another place, then such work is called positive work.

2. On pushing the wall of the house with your hands, the wall remains stable at its place, due to which the displacement in the wall is zero. The work done on the wall will also be zero.

Energy - The ability to do work in objects is called energy. The unit of energy is joule. For example, there is energy in petrol, diesel, electricity, water, air etc. Many things can be done with this energy by vehicles or equipment. Energy is found in different forms.

Mechanical energy

The energy obtained by doing work is called Mechanical energy. Mechanical energy is the sum of kinetic energy and Potential energy.

1. **Kinetic energy** - The ability to do work in an object due to its motion is called kinetic energy of that object. Suppose the mass of an object is m and it is moving with a velocity v , then the kinetic energy of the object -

$$\text{Kinetic energy} = \frac{1}{2} \times \text{mass} \times \text{velocity}^2$$

$$\text{KE} = \frac{1}{2} \times m \times v^2$$

ex. Wind mill is driven by the kinetic energy of the wind.

2. **Potential energy** - The ability to do work due to position in an object is called the potential energy of that object, against the force of gravity

$$\text{Potential energy} = mgh$$

where m = mass, g = acceleration due to gravity, h = height

ex. Energy of water collected by building a dam, energy stored in a pulled slingshot or arrow bow, etc.

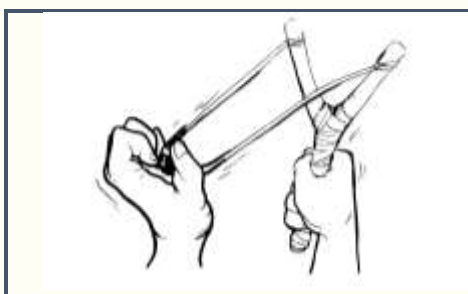


Fig. 7.1 – Catapult

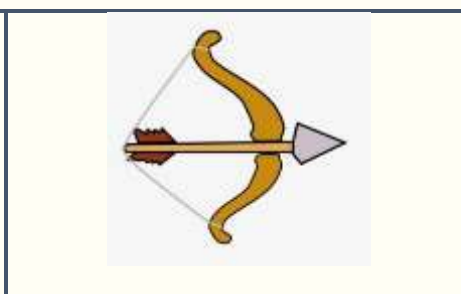


Fig. 7.2 - Arrow – Bow

Different forms of energy

1. **Electrical energy** - The energy generated by the flow of electric charges is called electrical energy. Electric bulbs, fans etc. run in homes only through electrical energy.
2. **Sound energy** - The energy generated by the vibration of various musical instruments is called sound energy. The energy produced by a loudspeaker is an example of sound energy.
3. **Nuclear energy** - The energy generated by the reaction of fusion or fission of nuclei in the nuclear furnace is called nuclear energy. Nuclear energy is used in the generation of electricity.
4. **Magnetic energy** - The energy generated in the magnetic field is called magnetic energy.
5. **Chemical Energy** - The stored energy created by the combination of chemicals in the cell and battery is called chemical energy. Chemical energy can be converted into electrical energy using cells and batteries.
6. **Heat energy** - The energy generated by the combustion of fuel is called heat energy. Heat energy is obtained from the combustion of coal, petrol and diesel.

7. **Light energy** - The energy generated from natural and artificial sources of light is called light energy. eg. Energy received from the sun is an example of light energy.

दिवस्परि प्रथमं जज्ञे ऽ अग्निरस्मद्वितीयं परिजातवेदाः ।

तृतीयमप्सु नृमणा ऽ अजस्रमिन्धान ऽ एनं जरते स्वाधी? ॥ (यजुर्वेद 12.18)

समुद्रे त्वा नृमणाऽअप्स्वन्तर्नृचक्षा ऽ ईधे दिवो ऽ अग्ने ऽ ऊधन्

तृतीये च्वा रजसि तिस्तिथ्वा ॐ समपामुपस्थे महिषा ऽ अवर्द्धन् ॥ (यजुर्वेद.12.20)

अक्कन्ददग्निस्तनयन्निव द्यौ? क्षामा रेरिहृद्वीरुधः समञ्जन् ।

सद्यो जज्ञानो वि हीमिद्धो ऽ अक्व्यदा रोदसी भानुना भात्यन्त? ॥ (यजुर्वेद.12.21)

In Yajurveda, there is mention of sea fire, water energy, solar energy, terrestrial energy, celestial energy, geological energy, energy generated from trees etc.

Conversion of energy

Energy can be converted from one form to another.

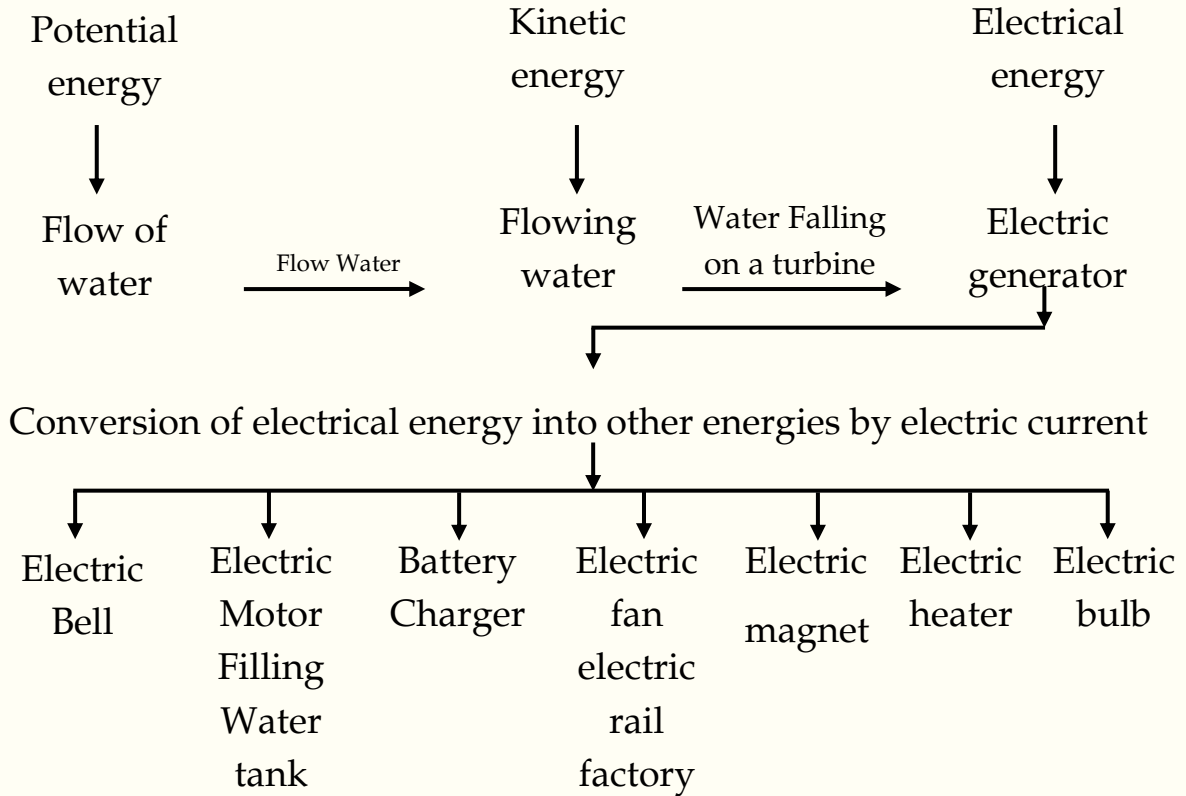


Fig. 7.3 - Transformation of energy

Energy can be converted from one form to another with the help of devices.

Table 7.1

Sl.No.	Name of the device	Energy used	Energy converted
1.	Electric bulb	Electrical energy	Light energy
2.	Cell/battery	Chemical energy	Electrical energy
3.	Loud speaker	Electrical energy	Sound energy
4.	Electric heater	Electrical energy	Heat energy
5.	Wind mill power	Wind energy	Electrical energy

Energy Conservation Laws -

According to this law, energy can neither be created nor destroyed, energy can be converted from one form to another. The total energy of the system always remains constant.

अग्निरमृतो ऽ अभवद्वयोभिर्ष्व देनन्द्यौरजनयत्सुरेताः ।

(यजु. 12.25)

Yajurveda says that Agni (energy) is immortal and renewable. It has no age so it is immortal.

Power - The rate of doing work is called power.

$$\text{Power} = \frac{\text{work}}{\text{time}}$$

$$P = \frac{W}{T}$$

The unit of power is watt.

Practice Work

Q. 1 Select the correct option -

1. Rate of doing work is called -
 - a) Power
 - b) Energy
 - c) Momentum
 - d) Force
2. The unit of energy is -
 - a) Newton
 - b) Kilogram
 - c) Watt
 - d) Joule
3. In which device electrical energy is converted into light energy.
 - a) Electric bell
 - b) Loud speaker
 - c) Electric bulb
 - d) Microphone

Q. 2 Fill in the blanks -

1. Energy due to position in objects is called energy.
2. When the bow and arrow is pulled, _____ energy is stored in it.
3. The unit of work is

Q. 3 Mark True (✓) or False (✗) against the following statements.

1. The unit of work is water.
2. The rate of doing work is called power.
3. The energy possessed by an object due to its motion is called kinetic energy.

Q. 4 Match the correctly

- | Column 'A' | Column 'B' |
|------------------|-----------------------------------|
| 1. Electric bulb | Wind energy to electrical energy |
| 2. Chemical cell | Electrical energy to sound energy |

3. Loudspeaker Electrical energy to light energy
4. Windmill Chemical energy to electrical energy

Q. 5 Very short answer type questions -

1. What is the capacity to do work?
2. What energy does an electric heater convert electrical energy into?
3. What is the unit of power?

Q. 6 Short Answer Type Questions

1. Write the law of conservation of energy.
2. Explain potential energy with an example.
3. What is work? Explain with examples.

Q.7 Long Answer Type Questions

1. Write the different forms of energy.

Chapter - 8

Sound

We hear different types of sounds every day like - sound of vehicles, chirping of birds, sound of loud speaker, sound of musical instruments etc. Sound gives sense of hearing in our ears.

Origin of sound

Sound is produced when an object vibrates. The energy required to produce vibrations in an object is supplied from an external source.

Sound can be produced in the following ways -

1. Sound is produced by the friction of objects.
2. Sound is produced when objects are rubbed.
3. By the vibration of the string (wire) of musical instruments like sitar, guitar etc.
4. Sound is produced due to the vibrations of an object up and down on either side of its mean position.

व्याप्तिसत्त्वात् तु शब्दस्य

(Nirukta 1/1)

The word refers to sound.

Activity - 1

Take a wire and tie one end of it with the help of a nail and stretch it. Now with your other hand pull the middle end of the wire upwards and release it. By doing this we hear sound.

Speech System in Humans-

In humans, sound is produced by the vocal cords or throat. The vocal cords are at the upper end of the trachea. There are two ligaments in the larynx of the throat, which are called vocal cords, while speaking, the

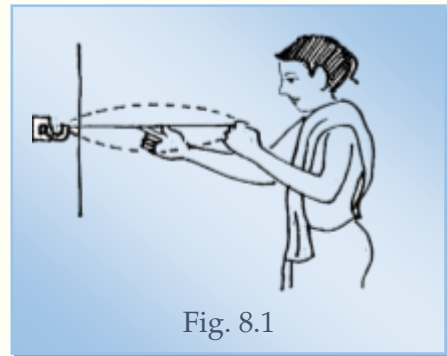


Fig. 8.1

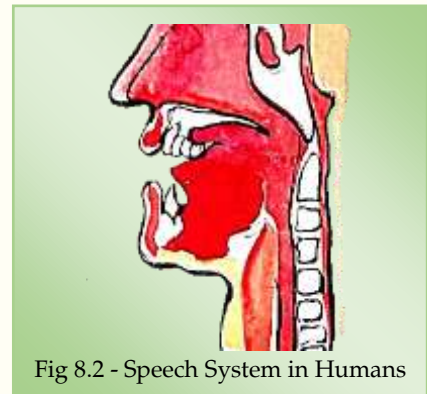


Fig 8.2 - Speech System in Humans



vocal cords are pulled, due to which a narrow wrinkle is formed between them. When the air in the lungs comes out of the slit, the vocal cords vibrate and sound is produced.

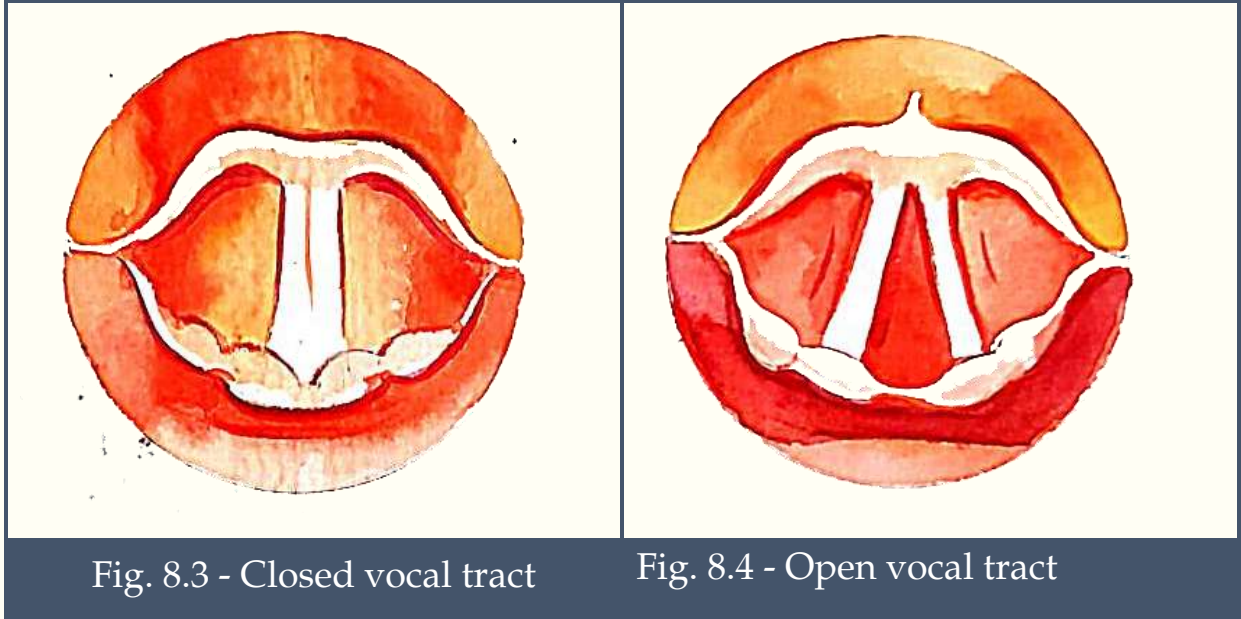


Fig. 8.3 - Closed vocal tract

Fig. 8.4 - Open vocal tract

Transmission of sound

When sound is produced by an object, vibrations start in the particles of the medium surrounding that object. First of all, the particles near the object vibrate. After that each vibrating particle transfers these vibrations to other particles coming in contact with it. In this way sound travels from one particle to another.

The transmission of sound always takes place through some or the other medium like – solid, liquid, gas. Sound does not propagate in vacuum. The speed of sound is maximum in solid state, less in liquid state and least in gaseous state. The speed of sound in air at 00C is 331 meters per second.

श्रुधि श्रुत्कर्ण वह्निभिर्देवैरग्ने सयावभिः । (ऋग्वेद 1.44.13)

अग्ने तव श्रवो व्वयो महि ब्राजन्तेऽ अर्चयोव्विभावसो ।

(यजुर्वेद 12.106)

धूमो वा अग्नेः श्रवो वयः स ह्य एनम अमुष्मिन् लोके श्रावयति ।

(शत.ब्रा. 7.3.1.29)

Sound waves are also transmitted through electricity. Due to which remote people can talk to each other. The process of telephone works on this basis.

Amplitude, frequency and time period -

Amplitude – The maximum displacement of a vibrating body from its mean position is called amplitude.

Frequency - The total number of vibrations made in one second of a vibrating body is called frequency. Frequency is measured in Hertz. eg. If a fan installed in the house completes 20 rounds in 1 second, then its frequency will be 20 Hz.

Time period - The time taken to complete one vibration or one oscillation is called time period. The unit of time period is second.

$$\text{Time period (T)} = 1 / \text{frequency}$$

$$T = \frac{1}{f}$$

Strength and sharpness-

Loudness of sound - The loudness of sound depends on the amplitude of vibration of the object. The loudness of sound increases with the increase in the size of the object. The unit of loudness of sound is 'Decibel'. eg. - When the drum is hit hard. Then a loud or loud sound is produced because the amplitude of vibration is high but when the drum is struck lightly, the amplitude is low so that a low sound is heard.

Tartva - The quality of sound being thin (tishna) or heavy (thick) is called Tartva. The pitch of a sound depends on the frequency of the sound. The sound whose pitch or frequency is high is heavy (thick) and the sound whose pitch or frequency is low is thin. Due to high pitch or frequency, the voice of women and children is thinner than that of men.

Audible, Inaudible and Ultrasonic sound

Audible sound - The sound having frequency between 20 HZ (Hz) to 20000 HZ (Hz) is called audible sound. Our ear can hear this type of sound.

Inaudible sound - Sound having frequency below 20 HZ (Hz) is called inaudible sound. Our ear cannot hear this type of sound.

Ultrasonic sound - Sound having frequency above 20000 HZ (Hz) is called ultrasonic sound. Our ear cannot hear this type of sound. But some animals like bats, cats, dogs etc. can hear this type of sound.

Uses of ultrasonic sound -

1. To measure the depth of the sea with the help of sonar device and to find the position and speed of the submarine.
2. In the treatment of arthritis and in the detection of brain tumors.
3. To destroy harmful bacteria present in milk etc.

Human ear

The outer part of the human ear is funnel shaped. It collects sound from the environment, this sound passes through a tube called the auditory cavity. At the end of the auditory cavity is a thin membrane called the eardrum.

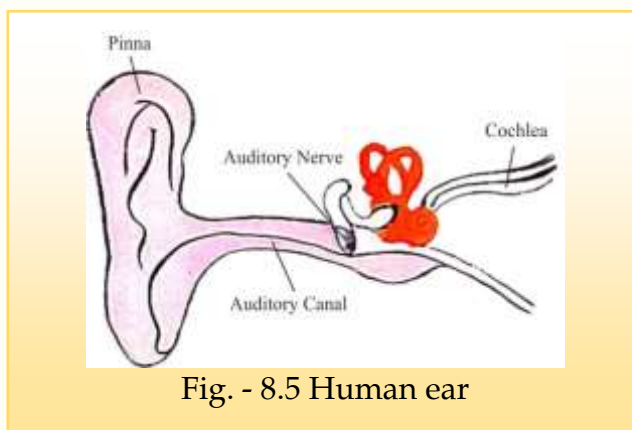


Fig. - 8.5 Human ear

The eardrum vibrates with the vibrations of the sound and sends the vibrations to the inner ear. From here signals are sent to the brain by the auditory nerve. This is how we hear sound.

Noise pollution

When the intensity of sound is more than 80 decibels, then such sound seems unpleasant to the ears, it is called noise. Noise pollution is caused by the sound of motor vehicles, the sound of train engines, factories, loud speakers.

Side effects of noise pollution

Noise pollution causes health problems like deafness, high blood pressure, insomnia etc.

Measures to limit noise pollution -

1. By using noise reducing device (silencer) in vehicles.
2. By establishing industries away from residential areas.
3. By reducing the limit of sound intensity of sound amplifiers.
4. By planting trees around the industries and along the roads.

Sonar -

Made up of SONAR (Sound Navigation and Ranging). With this technique, we can determine the depth of the sea, the distance between two submarines, the distance between the ice shell (stone) coming in the way of the ship, the wreckage of the sunken ship, the direction and speed of the ship

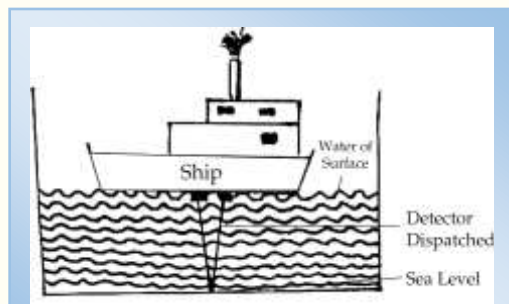


Fig. 8.6 – Sonar

coming from the front through ultrasonic waves. etc. information can be obtained.

Sonar consists of a transmitter and a detector. The transmitter generates and transmits ultrasonic waves, these waves come back after colliding with an object located in the sea which is received by the detector. The detector converts the ultrasonic waves into electrical waves which tell the distance of the object in front.

Practice Work

Q. 1 Choose the correct option

- The total number of vibrations made by the object in one second is called -
 - Time period
 - Amplitude
 - Frequency
 - None of these
- In which of the following the transmission of sound is maximum -
 - Water
 - Air
 - Vacuum
 - Iron object
- The unit of time period is -
 - Hertz
 - Second
 - Kilogram
 - Decibel

Q. 2 Fill in the blanks -

- The unit of loudness of sound is.....
- Sound is produced by in objects.
- Sound waves of frequency less than 3.20 Hz are called _____.

Q. 3 Mark True (✓) or False (✗) against the following statements.

- The loudness of sound depends on the amplitude.
- The pitch of a sound depends on the frequency.
- The speed of sound is maximum in solid medium.

Q. 4 Match the correct pair.

- | Column 'A' | Column 'B' |
|-------------------------|-----------------------|
| 1. Audio | Frequency below 20 Hz |
| 2. Inaudible sound from | 20 Hz to 20000 Hz |
| 3. Frequency | Second |
| 4. Periodic | Hertz |

Q. 5 Very short answer type questions

1. What are the sound waves of frequency more than 1.20000 Hz called?
2. On what does the pitch of sound depend ?
3. What is the time taken in one vibration called ?

Q. 6 Short Answer Type Questions

1. What is audio sound ?
2. Write the uses of ultrasonic sound.
3. What are the measures to limit noise pollution ?

Q.7 Long Answer Type Questions

1. Explain the SONAR method.
2. Explain with a diagram the structure of the human ear.

Chapter - 9

Why Do We Fall Ill ?

Health-

It is a state of being well enough to function well physically, mentally and socially.

Our body does digestion of food, respiration, excretion etc. regularly. When there is an irregularity or disturbance in these functions, we become sick.

रोगस्तु दोषवैषम्यं दोषसाम्यमरोगता ।

Asymmetry of defects is disease.

याभिः क्रियाभिः जायन्ते शरीरे धातवः समाः ।
सा चिकित्सा विकाराणां कर्म तद्भिषजां मतम् ॥

(चरकसूत्र 16.34)

Those activities by which the equanimity of the doshas in the body is created, that is the therapy and this is also the duty of the doctors.

अरुस्त्राणमिदं महत् पृथिव्या अद्युद्धृतम् ।
तदास्त्रावस्य भेषणं तदु रोगमनीनशत् ॥

(अथर्ववेद 2.3.5)

The treatment of diarrhea has been mentioned in this mantra of Atharvaveda.

शं नो भवन्त्वप ओषधयः शिवाः ।

(अथर्ववेद 2.3.6)

May water and medicines cure our diseases.

Sun rays therapy

अनु सूर्यमुदयतां हृद्योतो हरिमा च ते ।
गो रोहितस्य वर्णेन तेन त्वा परि दध्मसि ॥

(अथर्ववेद – 1/22/1)

O diseased person! Burning of your heart due to heart disease and jaundice and anaemia, the yellowness of your body should be removed from the body by sunlight. We make you strong in every way by the blood-coloured rays of the Sun. The sunrise covers you with orange rays.

In this mantra from the seer of Atharvveda, information has been given about the health of the body through the rays of the sun in the morning. Today's scientists have invented Vitamin-D in the rising rays of the Sun. Today's doctors also recommend walking in the sun in the context of many diseases.



Fig.9.1 – Savoring the morning rays for body

Bathing in sunlight has wonderful benefits in problems like TB and cancer, heat or energy is required in the body to control blood circulation. Due to getting heat, there is no contraction in the pulses. Digestion is also fine by this. The work of digestion is done by Jathragni. By taking sufficient amount of sun's heat, the gastric fire becomes more active and the food is digested well. In this mantra, there is mention of a disease named "Harima", which is called Anaemia. In this disease there is deficiency of blood in the body.

Germ killer

अन्वाञ्च्यं शीर्षण्यमथो पार्ष्ट्यं क्रिमीन्।

(अथर्व. 2.31.4)

It has been mentioned to destroy the germs produced in the intestines, produced in the head, produced in the ribs.

By Veterinarian Surya Prakash -

उद्यन्नादित्यः क्रिमीन् हन्तु निम्नोचन् हन्तु रश्मिभिः।

ये अन्तः क्रिमयो गवि॥

(अथर्व. 2.32.1)



In this Atharvavedic mantra, it is mentioned about the destruction of germs caused by disease in the cow's body by the rising and setting sun rays.

Disinfectant -

विश्वरूपं चतुरक्षं क्रिमिं सारङ्गमर्जुनम्।
शृणाम्यस्य पृष्ठीरपि वृश्चामि यच्छिरः ॥

(अथर्व. 2.32.2)

In this mantra of Atharvaveda, it is mentioned that insects of different sizes, four-eyed, colored and white are destroyed by the rays of the sun.

Tuberculosis (fever)

अक्षीभ्यां ते नासिकाभ्यां कर्णाभ्यां छुबुकादधि।
यक्ष्मं शीर्षण्यं मस्तिष्काज्जिह्वाया वि वृहामि ते ॥

(अथर्व. 2.33.1)

it is mentioned to protect various parts of the body like eyes, ears, navel, head, tongue and brain from tuberculosis (fever).

मुञ्च शीर्षकत्या उत कास एनं परुष्परुराविवेशा यो अस्य।
यो अभ्रजा वातजा यश्च शुष्मो वनस्पतीन्त्सचतां पर्वतांश्च ॥

(अथर्व. 1.12.3)

Cough, diseases arising from rain water has been mentioned by sunlight.

शं मे परस्मै गात्राय शमस्त्ववराय मे।
शं मे चतुर्भ्यो अङ्गेभ्यः शमस्तु तन्वे मम ॥

(अथर्व. 1.12.4)

In this mantra of Atharvaveda, prayer has been made to keep different parts of the body, head, middle part, both hands, both feet disease free.

इमाऽ आपः शमु मे सन्तु देवीरोषधे
त्रायस्व स्वधिते मैनः हिः सीः ।

(यजु. 4.1)

Water and medicines with divine properties save us from diseases.
सुमित्रिया न ऽ आप ऽ ओषधयः सन्तु दुर्मित्रियास्तस्मै सन्तु ।

(यजु. 36.23)

May water and medicines be friendly to us.

ओषधयः शान्तिः । वनस्पतयः शान्तिः... ।

(यजु. 36.17)

Medicines and herbs are pacifiers for us.

अश्रवावती ऽ सोमावतीमूर्जयन्तीमुदोजसम् ।

(यजु. 12.81)

Ashwavati and Somvati provide energy.

अश्वत्थे वो निषदनं पर्णे वो व्वसतिष्कृता ।

(यजु. 12.79)

Medicines reside in Peepal leaves.

भेषजमसि भेषजं गवेश्रवाय पुरुषाय भेषजम् ।

सुखं मेषाय मेष्यै ॥

(यजु. 3.59)

Men, cows, horses, sheep are mentioned to cure diseases of all.

अग्ने त्व न्नोऽअन्तमऽउत त्राता शिवो भवाव्वरूत्थ्यः ।

(यजु. 25.47)

There is mention of fire having medicinal properties.

अप्स्वन्तरमृतमप्सु भेषजम्.. ।

(यजु. 9.6)

There is mention of water having medicinal properties.

आपोऽअसम्मात्रमातरः ।

(यजु. 4.2)

Water is our mother.

वात आ वातु भेषजं शंभु मयोभु नो हृदे ।

प्र ण आयूषि तारिषत् ॥

(सामवेद पूर्वार्चिक 184, ऋग्वेद 10.186.1)

There is mention of Bsheshaj (medicine) element in the air. Air has been described as a curative.

उद्यन्नादित्यः क्रिमीन् हन्तु निम्नोचन् हन्तु रश्मिभिः ।

(अथर्व. 2.32.1)

The rising sun destroys many types of worms.

शमिता नो व्वनस्पतिः सविता प्रसुवन्नभगम् ।

(यजु. 21.21)

Medicines are mentioned as curatives.

सहस्व मे ऽअरातीः सहस्व पृतनायतः ।

सहस्व सर्व्व पाप्मानं सहमानास्योषधे ॥

(यजु. 12.99)

The medicine has been described as the one that cures diseases and gives strength to the body.

इष्कृतिर्नाम वो माताथो यूयं स्थ निष्कृतीः ।

सीराः पतत्रिणी स्थन षदामयति निष्कृथ ॥

(यजु. 12.83)

Medicine has been compared to dormant rivers. There is a mention of taking out diseases from the body of a sick person by means of medicines.

अति विश्रवाः परिष्ठा स्तेनऽ इव व्वजमक्कमुः ।

ओषधीः प्राचुञ्च्यवुर्ष्वित्किञ्च तन्नो रपः ॥

(यजु. 12.84)

षस्यौषधीः प्रसर्पथाङ्गमङ्गं परुष्परुः ।

ततोषक्षं वि बाधद्धऽउग्रो मध्यमशीरिव ॥

(यजु. 12.86)

Medicines destroy the diseases of the body.

ओषधीरिति मातरस्तद्धो देवीरुप ब्रुवे ।
सनेयमश्श्वं गां व्वास ऽ आत्कमानं तव पूरुष ॥

(यजु. 12.78)

Medicines protect from diseases like mother.

अश्श्वत्थे वो निषदनं पण्णे वो व्वसतिष्कृता ।
गोभाज ऽ इत्तिकलासथ यत्सनवथ पुरुषम् ॥

(यजु. 12.79)

Ashwath (Peepal) and Palash are mentioned as medicines.

अन्या वो ऽ अन्यामवत्त्वन्यान्यस्याऽउपावत ।
ताः सर्वाः संविदानाऽइदमे प्रावता व्वचः ॥

(यजु. 12.88)

A new drug made from a combination of drugs has been mentioned.

त्वां गन्धर्वा अखनँस्त्वामिन्द्रस्त्वां बृहस्पतिः ।
त्वामोषधे सोमो राजा व्विद्वान्न यक्ष्मादमुच्यत ॥

(यजु. 12.98)

Medicine is prescribed for the treatment of tuberculosis (TB).

दीर्घायुस्त ऽ ओषधे खनिता यस्मै च त्वा खनाम्यहम् ।
अथो त्वं दीर्घायुर्भूत्वा शतवल्शा व्विरोहतात् ॥

(यजु. 12.100)

There is mention of underground medicine.

शीतहृदा हि नो भुवोऽग्निष्कृणोतु भेषजम् ।

(अथर्व. 6.106.3)

अग्निर्हिमस्य भेषजम्... ।

(यजु. 23.10)

There is mention of Bheshaj (medicine) element in Agni.

Leprosy -

यो गिरिष्वजायथा वीरुधां बलवत्तमः ।

कुष्ठेहि तक्मनाशन तक्मानं नाशयन्नितः ॥

(अथर्व. 5.4.1)

In this mantra of Atharvaveda, the leprosy plant that grows in the mountains has been mentioned. The plant is mentioned to have been used to treat a skin disease (leprosy).

Anthelmintic -

यो अक्ष्यौ परिसर्पति यो नासे परिसर्पति ।
दतां यो मध्यं गच्छति तं क्रिर्मि जम्भयामसि ॥

(अथर्व. 5.23.3)

In this mantra of Atharvaveda, it has been mentioned to destroy the worm found in the eyes, in the nails, between the teeth.

उत् पुरस्तात् सूर्य एति विश्वदृष्टो अदृष्टहा ।
दृष्टांश्च घ्नन्नदृष्टांश्च सर्वांश्च प्रमृणन् क्रिमीन् ॥

(अथर्व. 5.23.6)

It has been told in this Atharvavedic mantra that the light of the rising sun destroys the invisible worms.

Genetic diseases

स क्षेत्रियं विषाणया विषूचीनमनीनशत् ।

(अथर्व. 3.7.1)

Hereditary diseases like tuberculosis, leprosy, epilepsy etc. have been mentioned in this mantra of Atharvaveda.

Water as medicine

आप इद् वा उ भेषजीरापो अमीवचातनीः ।
आपो विश्वस्य भेषजीस्तास्त्वा मुञ्चन्तु क्षेत्रियात् ॥

(अथर्व. 3.7.5)

In this Atharvedic mantra, water has been described as the medicine for all diseases and treatment of regional diseases (hereditary diseases) by water has been mentioned.

अदो यदवधावत्यवत्कमधि पर्वतात् ।
तत् ते कृणोमि भेषजं सुभेषजं यथाससि ॥

(अथर्व. 2.3.1)

Moonj medicine has been mentioned in this mantra of Atharvaveda. There is mention of making medicine from the fore head of Moonj.

अनु सूर्यमुदयतां हृद्योतो हरिमा च ते। (अथर्व. 1.22.1)

It is mentioned to remove the yellowness of the body caused by heart disease and kamala disease with the help of sunlight.

There are two types of diseases -

1. **Infectious diseases** - Such diseases which spread by coming in contact with each other. are called infectious diseases. These diseases spread through water, air, insects, food and contact. eg. Cholera, common cold, corona, AIDS, typhoid etc.
2. **Non-infectious diseases** - Such diseases which do not spread by coming in contact with each other. are called non-communicable diseases. eg. Cancer, joint pain etc.

Diseases caused by Parasites

1. **Malaria** -

Parasite - female Anopheles mosquito (Plasmodium)

Symptoms - high fever with chills

Affected Organs - Spleen and RBC

Preventive measures - Using mosquito net while sleeping, water should not be allowed to collect around the house.

Treatment - After getting the blood tested, taking medicines on the advice of the doctor.

2. **Pyorrhoea** -

Parasite - Anti amoeba gingivalis

Symptoms: Bleeding gums.

Affected Organs - Gums

Preventive measures - Regular cleaning of teeth, taking digestible substances in food.

Diseases caused by Bacteria

1. Tuberculosis -

Bacteria - Mycobacterium tuberculosis

Symptoms - continuous cough and phlegm, blood coming with phlegm, low temperature fever.

Affected Organ - Lung

Preventive measures - Vaccination at the right time, keeping the tuberculosis patient separate.

X-ray of chest, examination of sputum, taking medicines as per doctor's advice.

2. Cholera -

Bacteria - Vibrio cholerae

Symptoms - Persistent diarrhea and vomiting

Affected organ- small intestine.

Preventive measures - Drinking clean boiled water, eating cooked fresh food.

Treatment - ORS solution and taking medicine as per doctor's advice.

यद्यर्चिर्यदि वासि शोचिः शकल्येषि यदि वा ते जनित्रम्।

हृदुर्नामासि हरितस्य देव स नः संविद्वान् परि वृड्ङ्घ तक्मन्॥

(अथर्व. 1.25.2)

In this Atharvavedic mantra, there is mention of yellowing of the body due to fever, which is a sign of typhoid disease and prayer has been made in the mantra to make the body free from fever.

नमः शीताय तक्मने नमो रूराय शोचिषे कृणोमि।

यो अन्येद्युरुभयद्युरभ्येति तृतीयकाय नमो अस्तु तक्मने॥

(अथर्व. 1.25.4)



In this mantra of Atharvaveda, the fever that rises after getting cold has been mentioned and it has been told that this type of fever comes on the second and third day of getting sick.

3. Typhoid -

Bacteria - Salmonella Typhi

Symptoms - high fever, headache

Affected organ- small intestine.

Preventive measures - Protecting food from flies, consuming pure water and food.

Treatment - taking medicines with the advice of a doctor.

Diseases caused by virus

1. AIDS - (Acquired Immuno Deficiency Syndrome)

Virus - HIV

Symptoms - destruction of immunity

Affected Organs - Immune System (WBC)

Preventive measures - use of new blade for shaving, use of new needle in injection, safe sex

2. Polio

Virus - poliomyelitis, muscle contraction, slow growth of affected limbs

Symptom – fever, fatigue, headache, stiffness of the neck, pain in the limbs.

Affected Organs - Throat, spinal cord, pulse

Preventive measures - By giving polio vaccine at a fixed time

Treatment - Physiotherapy, operation as per doctor

Causative worm

Harmful effects of worms on children's health -

Worm infestation in children causes fatigue, restlessness and irritability, weight loss, cold, cough, abdominal pain, vomiting, diarrhoea, anaemia, bleeding with diarrhoea, etc.

Ways to prevent worm infestation

1. Clean and boiled water should be drunk.
2. Keep the cleanliness of the body.
3. Wash your hands with soap before eating.
4. Wash fruits and vegetables with water before use.
5. After defecation, clean the toilet and wash your hands with soap.

Advantages of worm control -

By preventing worm infection in children, their development takes place at a rapid pace and the immunity of children increases.

Some specific diseases

1. Cancer

In any part of the human body, if the cell growth becomes uncontrollable and forms a bunch of cells. A cluster of these cells is called cancer. Cancer is treated by chemotherapy or surgery when cancer is detected in the early stages.

2. Food poisoning -

Food is made toxic (poisonous) by micro-organisms producing toxic substances in food. Food poisoning becomes a disease on eating such poisonous food. To avoid this, one should eat fresh food.

3. Paralysis

Due to high blood pressure in the body, an artery of the brain gets cut, due to which there is not enough supply of blood in the brain. Due to which the nerves of half of the body become inactive, which is called Paralysis.

4. Corona -

It is a group of many types of viruses that cause diseases in mammals and birds. In this RNA Viruses happen to cause disease. Due to these, the human respiratory system becomes inactive, which can also lead to death due to its intensity.

Symptoms - Headache, stuffy nose, sore throat, dry cough, difficulty in breathing, muscle pain, fever and fatigue.

Avoidance measures - Follow social distancing, use tissue paper (handkerchief) while sneezing or coughing and throw it in the dustbin after use. Use a cloth mask. Wash hands frequently with soap and use sanitizer.

Treatment - In case of high fever, cold, consult a doctor immediately. Vaccination has been done for the treatment of corona.

Vaccine

When the dead or inactive micro-organisms are introduced into the body, the cells of the body destroy the pathogenic micro-organisms by generating an immune system in the body to fight according to the disease and always protect the body from the disease. Diseases like polio, small pox, corona etc. can be prevented by vaccine.

अस्थिरसं परुसंसमास्थितं हृदयामयम्।
बलासं सर्वं नाशयाङ्गेषु यश्च पर्वसु ॥

(अथर्व. 6.14.1)

Cough and diseases related to breath have been mentioned in this mantra of Atharvaveda.

Diseases of the head

शीर्षक्तिं शीर्षामयं कर्णशूलं विलोहितम्।
सर्वं शीर्षण्यं ते रोगं बहिर्निर्मन्त्रयामहे ॥

(अथर्व. 9.8.1)

In this mantra of Atharvaveda, it is mentioned to remove diseases related to head and diseases related to ears.

Various diseases

हरिमाणं ते अङ्गभ्योऽध्वामन्तरोदरात्।
यक्ष्मोधामन्तरात्मनो बहिर्निर्मन्त्रयामहे ॥

(अथर्व. 9.8.9)

In this Atharvavedic mantra, it has been mentioned to remove anemia (harima) from the body, ascites (atva) from the stomach and fever (yakshma) from the body or to protect the body from these diseases.

पादाभ्यां ते जानुभ्यां श्रोणिभ्यां परि भंससः ।
अनूकादर्षणीरुष्णिहाभ्यः शीर्ष्णो रोगमनीनशम् ॥

(अथर्व. 9.8.21)

In this mantra of Atharvaveda, it has been mentioned to remove diseases from thighs, feet, knees and head.



Practice Work

Q. 1 Select the correct option -

1. Malaria disease is caused by -
 - a) by bacteria
 - b) by virus
 - c) Parasite
 - d) None of these
2. Example of non-communicable disease is -
 - a) Corona
 - b) AIDS
 - c) Cancer
 - d) Cholera
3. Cold and flu arise -
 - a) Parasite
 - b) Bacteria
 - c) Virus
 - d) None of these

Q. 2 Fill in the blanks -

1. Polio disease is transmitted through
2. In cholera..... solution is used.
3. In pyorrhoea are affected.

Q. 3 Mark True (✓) or False (✗) against the following statements.

1. AIDS is a disease caused by virus.
2. Typhoid is a disease caused by bacteria.
3. Malaria is a disease caused by protozoa.

Q. 4 Match the correct pair.

- | Column 'A' | Column 'B' |
|-----------------|---------------|
| 1. Tuberculosis | Spine |
| 2. Cholera | Lung |
| 3. Aids | Gut |
| 4. Polio | Immune system |

Q. 5 Very short answer type questions

1. Write the names of infectious diseases.

2. Name the diseases caused by bacteria.
3. Write the symptoms of typhoid disease.

Q.6 Short Answer Type Questions

1. What is food poisoning?
2. Write the preventive measures against worm infestation.
3. How does the vaccine work?

Q.7 Long Answer Type Questions

1. What are the symptoms of corona disease? What precautions are necessary to avoid corona infection.

Project work -

1. Make a list of infectious and specific diseases occurring in your area. Due to the spread of infectious and specific diseases, make a table chart of symptoms and prevention and put it in the class room.

Chapter - 10

Natural Resources

Life on earth depends on resources like soil, water, air and energy from sun. All the living beings on the earth get energy from the sun. We fulfill our needs from air, water, soil, trees, animals etc. obtained from nature. Every substance obtained from nature, which is used by all living beings, is called Natural Wealth or Natural Resource eg -water, soil, air, plants, animals, fossil fuels etc.

त्रीणि च्छन्दांसि कवयो वि येतिरे पुरुरूपं दर्शतं विश्वचक्षणम्।
आपो वाता ओषधयः तान्येकस्मिन् भुवन आर्पितानि ॥

(अथर्व. 18.1.17)

The three constituent elements of the environment, water, air, medicines are mentioned. They surround the land and give happiness to man, hence they are called Chhandas.

विश्वमन्यामभीवार तदन्यस्मामधिश्रितम्।

(अथर्व. 1.32.4)

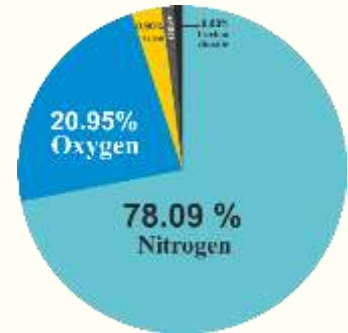
In this mantra of Atharvaveda, it has been told that the whole world is surrounded by the sky.

The air that covers the whole of the earth like blanket is called the 'Atmosphere'.

Importance of air, water and soil

Importance of Air-

78.09%, oxygen 20.95%, carbon dioxide 0.03%, hydrogen 0.00006% are found in the Earth's atmosphere. Apart from these gases, other gases are also found in some quantity in the atmosphere.



The gases present in the atmosphere are very important for animals and plants. All living beings use the oxygen in the atmosphere

for respiration. All green plants make their own food by the process of photosynthesis using carbon dioxide from the atmosphere. Plants grow by using nitrogen from the atmosphere. The atmosphere of the earth also works to control the temperature.

Importance of water

Water covers 75% of the earth's surface. All the life activities of all the living beings present on the earth depend on water. Water is needed for the growth of plants and for making food. Water is an important component in controlling all human activities.

Importance of soil

The top layer of land is called soil. Various nutrients and minerals are present in the soil which are used by the plants for their growth and development.

Wind Speed

Due to the difference of air pressure on the earth, motion arises in the air, which is called wind. Winds affect all the living beings on the earth. High speed winds affect the plants and take away the top fertile layer of the soil. Wind speed can be measured with the help of device called anemometer.

भूरसि भूमिरस्यदितिरसि विश्वघाया विश्वस्य भुवनस्य धर्त्री ।
पृथिवीं यच्छ पृथिवीं दृ ९ ह पृथिवीं मा हि ९ सीः ॥

(यजु. 13.18)

the earth, sky and space and strengthen them.

Air pollution and water pollution -

मा ऽ पो मौषधीर्हि ९ सीर्धाम्नो
राजँस्ततो वरुण नो मुञ्च ।
यदाहुरध्न्याऽइति वरूणेति शपामहे ततो वरुण नो मुञ्च ।
सुमित्रिया न ऽ आप ऽ ओषधयः सन्तु दुर्मित्रियास्तस्मै सन्तु यो ऽ स्मान् द्वेष्टि
यं च वयं द्विष्मः ।

(यजु. 6.22)



Do not pollute the water and do not cut the tree and keep the water pure and tree plantation has been mentioned.

Air pollution

The accumulation of harmful pollutants like carbon dioxide, carbon monoxide, sulfur dioxide, dust, smoke etc. in the air is called air pollution.

Causes of air pollution

1. Harmful gases released from fuel combustion in vehicles pollute the air.
2. Smoke coming out of industries increases air pollution.
3. Chemicals used to protect crops from pests pollute the air.
4. The smoke emanating from the use of wood as a domestic fuel pollutes the air.
5. Due to deforestation, the balance of gases in the atmosphere is deteriorating due to which the air is getting polluted.
6. The atmosphere is getting polluted due to the rapid growth of population.

Effects of air pollutants -

1. Carbon monoxide gas present in the smoke coming out of motor vehicles is a toxic gas. It reduces the oxygen carrying capacity of the blood.
2. The smoke coming out of the factories causes burning sensation in the eyes and diseases of the throat because sulfur dioxide, nitrous oxide etc. are present in this type of smoke.
3. Combustion of fuel used in power plants produces sulfur dioxide gas which causes lung related diseases.
4. Chlorofluoro carbon used in refrigerators, air conditioners, perfumes harms the ozone layer of the atmosphere. The ozone layer protects us from harmful ultraviolet rays coming from the sun.

5. The layer made of smoke and fog coming out of motor vehicles in winter causes diseases like cough, asthma etc.

Acid rain

Sulfur and carbon present in the smoke coming out of various industries, factories, power plants, motor vehicles react with rain water to form nitrous acid, nitric acid, sulfuric acid and organic acid and by making the rain acidic, it enters the earth along with the rain. But it rains which is called Acid Rain. Acid rain is the reason for the yellowing of the Taj Mahal. Acid rain causes irritation to the eyes and skin.

Green house effect (plant house effect)

Some part of the sun rays coming from the sun is absorbed by the earth and some part is reflected. Some part of the reflected rays gets stopped in the atmosphere itself, these stopped rays work to increase the temperature of the atmosphere. This effect is called Green house effect or Plant house effect. The continuous increase in the temperature of the atmosphere is called 'Global warming'. Carbon dioxide, methane, nitrous oxide and water vapor are responsible for this effect. These gases are called 'Green house gases'.

Air pollution control measures

1. Stopping deforestation and planting new trees.
2. Using CNG as fuel in vehicles.
3. Use of electric vehicles.
4. Use of ideal fuel LPG as domestic fuel.
5. Using alternative sources of energy.

Water Pollution

When water becomes unfit for drinking and other uses, then water is said to be polluted. Waste materials coming out of factories, excreta-urine, spraying chemicals in etc. in the water. This causes water pollution.

घृतवत् पयो मधुमन्नो अर्चत ।

(ऋग्वेद 10.64.9)



Rivers provide us sweet and nourishing water. That's why it is mentioned not to contaminate them.



Figure 10.3 - Water pollution

Causes of water pollution

1. Water is getting polluted due to discharge of excreta-urine, bathing of cattle, dumping of garbage, mixing of dirty water coming out of houses in water sources like river, pond, well etc.
2. Water is getting polluted due to the mixing of waste materials coming out of the factories in the water sources.
3. Water is getting polluted due to mixing of fertilizers and pesticides used in crops in the water sources.

Effects of water pollution -

1. Drinking polluted water causes cholera, dysentery, skin diseases etc.
2. The fertilizer capacity of the land is decreasing when polluted water is mixed in the soil.

Water pollution control measures -

1. Urine should not be discarded in water sources.

2. The dirty water coming out of the houses should be stopped from getting into the water sources like river, pond etc.
3. The waste materials and dirty water coming out of the factories should be prevented from mixing in the water sources.
4. Garbage should not be thrown in water sources.
5. Washing clothes, bathing animals etc should not be done in water sources.

Water purification by sunlight (Water Purification through Sun Light)

यच्छल्मलौ भवति यन्नदीषु यदोषधीभ्यः परिजायते विषम् । (अ.वे. - 7/50/3)

माऽपो हिंसीः मा ओषधीः हिंसीः । (य.वे. - 6/22)

अपः पिन्व ओषधीर्जिन्व । (य.वे. - 14/8)

The contamination of water has been indicated in the above mantra of Atharvaveda. And in other mantras it has been told not to contaminate water and vegetation. About 30% of people in developing countries need safe drinking water. Due to contaminated water hundreds of people die due to incurable diseases like Vidbhang. Many modern treatments are done to make the water of rivers, wells and ponds potable. Like Heat Pasteurization, Filtration etc. Dehydration of water by sunlight is the gift of our ancient sages. It is said in the Atharva Veda –

भीमा इन्द्रस्य हेतयः शतमृष्टीरयस्मयीः । ताभिर्हविरदान् गन्धर्वानवकादान् व्यूषतु ॥

(अ.वे. - 4/37/9)

याः सूर्यो रश्मिभिराततान... ।

(ऋ.वे. - 7/47/4)

The sun's rays are fierce like thousands of iron/golden weapons. Destroy the worms that feed on them. The waters expand and grow by the rays of the sun. Water has a deep connection with the Sun.

अमूया उप सूर्ये याभिर्वा सूर्यः सह । ता नो हिन्वन्त्वध्वरम् ॥

(अथर्ववेद 1.4.2)

This water which is contained in the sun (sun rays). Or the (waters) with which the sun is present, such holy water should be available for our 'Yagya'.



In these mantras of Vedas, a deep relation between sun and water has been shown. Collecting water from rivers, Pushkarini, wells etc. and using sunlight to make it drinkable was a special achievement of modern sages. In this tradition, at the age of 18, a month old scientist from Australia named Masonly Buston has invented a new method of water purification with sunlight. Which we call Solar Disinfection of Water (SODIS). There are three levels in this –



Figure 10.4 – Modern process of water purification by sunlight

- (1) Water storage (Collection of Water)
- (2) Treatment
- (3) Distribution

Biochemical Cycles -

1. Water cycle -

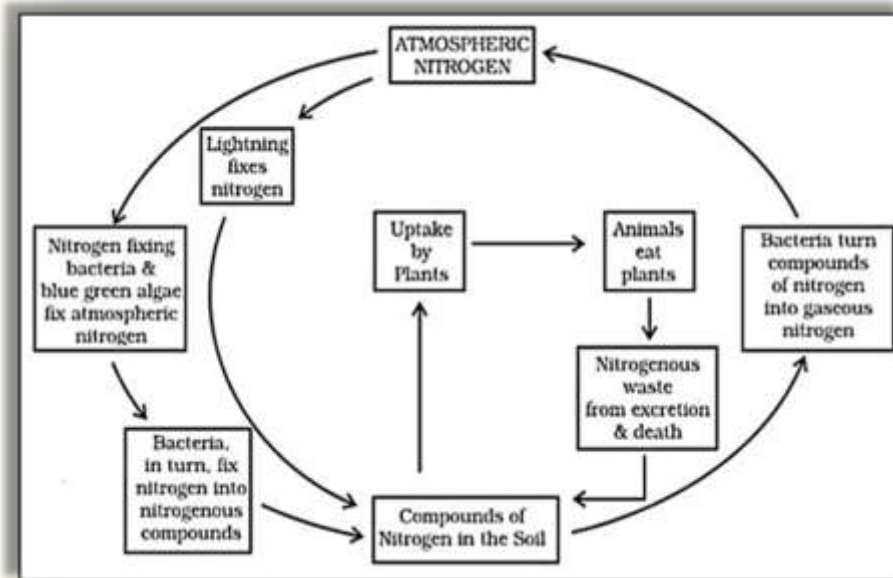
The water cycle refers to the cyclic flow of water between the different circles of the earth. In this process, due to the effect of heat by the process of evaporation, the surface or sea water rises up in the form of vapor and by the process of condensation, it gets converted into clouds, then by the process of precipitation, the water collected in the form of clouds in the form of drops of rain. falls on the earth. In this way the process of water cycle is completed.

2. Nitrogen cycle -

The process of conversion of atmospheric nitrogen into various compounds necessary for plants and organisms and the conversion of these nitrogenous compounds back into nitrogen gas after decomposition of dead organisms and plants is called the nitrogen cycle.



Nitric acid is produced by a natural process from atmospheric nitrogen which reaches the soil through rainwater where it reacts with limestone and alkali to convert into nitrate which is used by plants for their growth.

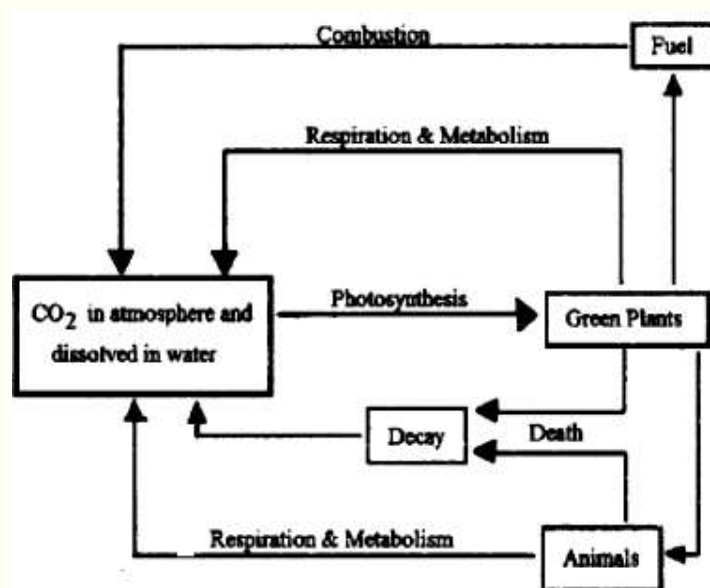


Special types of bacteria present in the soil decompose dead plants and animals into ammonia and ammonia salts, which other types of bacteria convert into nitrates. This combined nitrate present in the soil is converted into nitrogen gas by the denitrifying bacteria and it gets released and returns back to the atmosphere.

3. Carbon Cycle -

Composed of four major processes (photosynthesis, decomposition, respiration and combustion), the carbon cycle is essential for the existence of all living things.

Green plants make organic compounds by taking carbon dioxide from



Basic Carbon Cycle Flow Diagram

the atmosphere and release oxygen gas, which is used by humans and all living beings in respiration and releases carbon dioxide gas into the atmosphere.

After the decomposition of dead plants, carbon dioxide gas is again released into the atmosphere. Carbon dioxide gas is produced by the combustion of fossil fuels, coal, petroleum, gas etc., which again gets released into the atmosphere. In this way the carbon cycle goes on continuously.

Oxygen cycle -

Oxygen from the atmosphere is used for respiratory combustion and formation of oxides of nitrogen. The oxygen taken from the atmosphere returns to the atmosphere through the process of photosynthesis

Ozone layer -

A layer is found in the Earth's atmosphere which acts to prevent harmful ultraviolet rays coming from the Sun, it is called the ozone layer. The ozone layer is getting depleted due to the increasing use of Chloro-fluoro carbon (CFC) by refrigerators, perfumes etc. As a result of this there has been a decrease in the ozone layer and recently a hole was observed in the ozone layer. Harmful ultraviolet rays coming from the sun cause serious diseases like cancer, so it is very important to stop the depletion of ozone layer.

महत् तदुल्बं स्थविरं तदासीद्येनाविष्टितः प्रविवेशिथापः ॥

(ऋग. 10.51.1)

आपो वत्सं जनयन्तीर्गर्भमग्रे समैरयन्।

तस्योत जायमानस्योल्ब आसीद्धिरण्ययः कस्मै देवाय हविषा विधेम ॥

(अथर्व. 4.2.8)

In the Rigveda, the word mahat ulb has come for the ozone layer and it is said to be sthavir i.e. thick layer. Its color has been described as golden in Atharvaveda. Ulb is the word for the membrane made to protect the fetus. This ozone layer is there to protect the child like earth.

-
- | | | |
|----|---|---------------------|
| 2. | The gas necessary in the production of food by plants | Oxygen |
| 3. | A gas necessary for the respiration of living beings | Carbon dioxide |
| 4. | Polluted Water | Chlorofluorocarbons |

Q. 5 Very short answer type questions

1. What is the continuous increase in the temperature of the earth called ?

Q. 6 Short Answer Type Questions -

1. What are natural resources ?
2. What is water pollution ?
3. What is ozone layer ?

Q. 7 Long answer type questions -

1. Explain the water cycle with a diagram.
2. Explain the nitrogen cycle with a diagram.

आदर्श प्रश्नपत्र/ Model Que. Paper : IV/23-24/ विज्ञान /
वेदभूषण चतुर्थ-वर्ष / Vedabhusan Fourth Year/
कक्षा 9वीं / पूर्व मध्यमा - I/ Class 9th / Purv Madhyama - I
वर्ष / Year 2023-24
विषय – विज्ञान/Science

पूर्णांक/M.M. – 100

समय/Time – 3 घण्टे

<ul style="list-style-type: none">• सभी प्रश्न हल करना अनिवार्य हैं।• सभी प्रश्न के उत्तर पेपर में यथास्थान पर ही लिखें।• इस प्रश्न पत्र में कुल 38 प्रश्न हैं, प्रत्येक प्रश्न के सामने निर्धारित अंक दिये गये हैं।• उत्तीर्णता हेतु न्यूनतम 40% अंक निर्धारित हैं।• आदर्श प्रश्न पत्र का छात्रों को लिखित परीक्षा हेतु अभ्यास कराएँ।	<ul style="list-style-type: none">• It is mandatory to attempt all the questions compulsorily.• Write down the answers at the appropriate places provided.• This question paper contains 38 questions. Marks for each question are shown on the side.• The minimum pass marks are 40%.• The model question paper should be used by the students for written examination practice.
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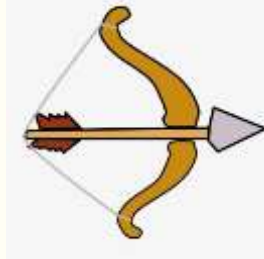
सही विकल्प का चयन कीजिए / Choose the correct option - $10 \times 2 = 20$

नोट – दिए गए प्रश्नों में आंतरिक विकल्पों (अ, ब, स, द) में से किसी एक का चयन करें –

Note – Select any one of the internal options (A, B, C, D) in the given questions -

1. तीर – कमान को खींचने में कौन-सी ऊर्जा संचित होती है -

Which energy is stored in pulling the arrow-bow?



- | | |
|---|--|
| (i) यांत्रिक ऊर्जा
Mechanical energy | (ii) स्थितिज ऊर्जा
Potential energy |
| (iii) गतिज ऊर्जा
Kinetic energy | (iv) ध्वनि ऊर्जा
Sound energy |

- (अ) केवल (i) (ब) (i) और (ii)
 Only (i) (i) and (ii)
- (स) केवल (ii) (द) (i), (ii), (iii) तीनों
 Only (ii) (i), (ii), (iii) all the three

2. निम्न में से पदार्थ का/के गुणधर्म है -

Which of the following is/are the property of the substance -

- (i) पदार्थ के कण आकार में अत्यन्त छोटे होते हैं
 The particles of matter are very small in size
- (ii) पदार्थ के कणों के मध्य प्रतिकर्षण होता है
 There is repulsion between the particles of matter
- (iii) पदार्थ के कण लगातार गतिशील रहते हैं
 The particles of matter are in constant motion
- (iv) पदार्थ के कणों के मध्य कुछ रिक्त स्थान पाया जाता है
 Some empty space is found between the particles of matter
- (अ) केवल (ii) (ब) (i), (iii) और (iv)
 Only (ii) (i), (iii) and (iv)
- (स) (i) और (iii) (द) केवल (iv)
 (i) and (iii) Only (iv)

3. समस्थानिकों का उपयोग किया जाता है - Isotopes are used for -

- (i) नाभिकीय रिपक्टर के रूप में As a nuclear reactor
- (ii) कैंसर रोग के उपचार में In the treatment of cancer disease
- (iii) गले के रोग के उपचार में In the treatment of throat diseases
- (iv) भारी वाहनों के ईंधन के रूप में As a fuel for heavy vehicles
- (अ) केवल (iii) (ब) केवल (ii)
 Only (iii) Only (ii)
- (स) (i), (ii) और (iii) (द) (i), (ii) और (iv)
 (i), (ii) and (iii) (i), (ii) and (iv)

4. यां द्विपादः पक्षिणः सम्पतन्ति हंसाः सुपर्णाः शकुना वयांसि। (अथर्व. 12.1.51)

उपर्युक्त वेद मन्त्र में जीवों का उल्लेख है –

The living beings mentioned in the above Veda Mantra are –

(i) हंस (ii) कौआ (iii) बन्दर (iv) भालू
Swan Crow Monkey Bear

(अ) केवल (ii) (ब) केवल (iv)
Only (ii) Only (iv)

(स) केवल (iii) (द) (i) और (ii)
Only (iii) (i) and (ii)

5. निम्न में से सदिश राशि है -

Which of the following is a vector quantity?

(i) विस्थापन (ii) त्वरण
Displacement Acceleration

(iii) दूरी (iv) चाल
Distance Speed

(अ) (i) और (ii) (ब) केवल (iii)
(i) and (ii) Only (iii)

(स) केवल (ii) (द) (ii) और (iii)
Only (ii) (ii) and (iii)

6. निम्न में से सरल रेखीय गति का उदाहरण है –

Which of the following is an example of straight line motion?

(i) घड़ी के पेण्डुलम की गति / The motion of the pendulum of the clock

(ii) झूले की गति / The motion of the swing

(iii) बस की गति / Motion of bus

(iv) ट्रेन की गति / Motion of train

(अ) केवल (iii) (ब) केवल (iv)
Only (iii) Only (iv)

- (स) (i), (ii), (iii) तीनों (द) (iii) और (iv)
 (i), (ii), (iii) all the three (iii) and (iv)

7. m द्रव्यमान वाली वस्तु v वेग से गतिशील हो तो उसका संवेग होगा -

If an object of mass m is moving with a velocity v, then its momentum will be –

- (i) ma (ii) mv (iii) (v – u) (iv) mu
 (अ) केवल (i) (ब) केवल (ii)
 Only (i) Only (ii)
 (स) (i) और (ii) (द) केवल (iii)
 (i) and (ii) Only (iii)

8. भेषजमसि भेषजं गवेश्वाय पुरुषाय भेषजम्। सुखं मेषाय मेष्यै ॥ (यजु. 3.59)

उपर्युक्त वेद मन्त्र में किन जीवों के रोग दूर करने के लिए औषधी का उल्लेख है –

In the above Veda mantra, medicine is mentioned to cure the diseases of which living beings –

- (i) गाय (ii) भालू (iii) भेड़ (iv) घोड़ा
 Cow Bear Sheep Horse
 (अ) केवल (i) (ब) (i) (iii) और (iv)
 Only (i) (i) (iii) and (iv)
 (स) केवल (iv) (द) केवल (iii)
 Only (iv) Only (iii)

9. कथन (A) – किसी वस्तु को ऊपर की ओर फेंकने पर वह वस्तु पुनः पृथिवी पर पुनः लौट आती है ।

Assertion (A) – When an object is thrown upwards, that object again returns to the earth.

कथन (R) – गुरुत्वाकर्षण बल के कारण पृथिवी सभी वस्तुओं को अपनी ओर खिचती है ।

Reason (R) - Due to the force of gravity, the earth pulls all the objects towards itself.

(अ) A एवं R दोनों सही हैं । R, A की सही व्याख्या करता है ।



Both A and R are correct. R is the correct explanation of A.

(ब) A एवं R दोनों सही है । R, A की सही व्याख्या नहीं करता है ।

Both A and R are correct. R does not explain A correctly.

(स) A सही है परन्तु R गलत है ।

A is correct but R is incorrect.

(द) A गलत है परन्तु R सही है ।

A is wrong but R is correct.

10. कथन (A) वाहनों में ईंधन के रूप में CNG का उपयोग किया जाता है ।

Assertion (A) CNG is used as fuel in vehicles.

कथन (R) घरों में ईंधन के रूप में LPG का उपयोग किया जाता है ।

Reason (R) LPG is used as a fuel in homes.

(अ) A एवं R दोनों सही है । R, A की सही व्याख्या करता है ।

Both A and R are correct. R is the correct explanation of A.

(ब) A एवं R दोनों सही है । R, A की सही व्याख्या नहीं करता है ।

Both A and R are correct. R does not explain A correctly.

(स) A सही है परन्तु R गलत है ।

A is correct but R is incorrect.

(द) A गलत है परन्तु R सही है ।

A is wrong but R is correct.

रिक्त स्थानों की पूर्ति कीजिए / Fill in the blanks –

5 × 1 = 5

11. क्षय रोग से प्रभावित अङ्ग है ।

The organ affected by tuberculosis is

12. पृथिवी के वायुमण्डल में नाइट्रोजन% मात्रा में पायी जाती है ।

Nitrogen is found in the earth's atmosphere in% quantity.

13. वायु की गति मापने वाला यंत्र है ।

The instrument used to measure the speed of wind is

14. न्यूट्रॉन पर आवेश होता है ।



Neutron has charge.

15. आयरन ऑक्साइड का रासायनिक सूत्र है।

The chemical formula of iron oxide is

16. निम्नलिखित युग्मों पर विचार कीजिए –

5 x 0.5 = 2.5

Consider the following pairs –

स्तम्भ क Column A	स्तम्भ ख Column B
(i) बल Force	(अ) $6.67 \times 10^{-11} \text{ Nm}^2/\text{kg}^2$ $6.67 \times 10^{-11} \text{ Nm}^2/\text{kg}^2$
(ii) न्यूटन की गति का प्रथम नियम Newton's first law of motion	(ब) राकेट नोदन का सिद्धांत Principle of rocket propulsion
(iii) संवेग संरक्षण का नियम Law of conservation of momentum	(स) जडत्व का नियम Law of inertia
(iv) गुरुत्वाकर्षण नियंताक Gravitational constant	(द) द्रव्यमान × त्वरण Mass × acceleration
(v) कार्य Work	(य) बल × वेग Force × Velocity (र) बल × विस्थापन Force × Displacement

उपर्युक्त युग्मों के आधार पर सही विकल्प का चयन कीजिए –

Select the correct option based on the above pairs –

अ. (i) (स), (ii) (अ), (iii) (र), (iv) (य), (v) (द)

ब. (i) (ब), (ii) (र), (iii) (य), (iv) (अ), (v) (स)

स. (i) (ब), (ii) (स), (iii) (द), (iv) (य), (v) (र)

द. (i) (द), (ii) (स), (iii) (ब), (iv) (अ), (v) (र)



17. निम्नलिखित युग्मों पर विचार कीजिए – 5 x 0.5 = 2.5
Consider the following pairs –

स्तम्भ क Column A	स्तम्भ ख Column B
(i) कैल्शियम एवं आर्गन Calcium and Argon	(अ) समस्थानिक Isotopes
(ii) प्रोटीन एवं ड्यूटीरियम Protein and Deuterium	(ब) समभारिक Isobar
(iii) कोबाल्ट Cobalt	(स) घेंघा रोग Goitre disease
(iv) आयोडीन Iodine	(द) कैंसर का उपचार Cancer treatment
(v) मोनेरा Monera	(य) शैवाल Algae
	(र) जीवाणु Bacteria

उपर्युक्त युग्मों के आधार पर सही विकल्प का चयन कीजिए –

Select the correct option based on the above pairs –

- अ. (i) (ब), (ii) (अ), (iii) (द), (iv) (स), (v) (र)
ब. (i) (ब), (ii) (र), (iii) (य), (iv) (अ), (v) (स)
स. (i) (स), (ii) (अ), (iii) (र), (iv) (य), (v) (द)
द. (i) (ब), (ii) (अ), (iii) (र), (iv) (स), (v) (य)
18. निम्नलिखित कथनों पर विचार कीजिए – 5 x 0.5 = 2.5
Consider the following statements –

- (i) कोलाइडी विलयन एक विषमांगी मिश्रण हैं।
Colloidal solution is a heterogeneous mixture.
- (ii) पदार्थों को ताप देने से उनके कणों के मध्य लगने वाला अन्तराणुक बल दुर्बल हो जाता हैं।

On heating substances, the intermolecular force between their particles becomes weak.

- (iii) पेट्रोल, डीजल आदि को आसवन विधि द्वारा पृथक किया जा सकता है।
Petrol, diesel etc. can be separated by distillation method.
- (iv) घोंघा, मोलस्का वर्ग का जंतु है।
Snail is an animal of class Mollusca.
- (v) ट्रेन की गति वृत्ताकार गति का उदाहरण है।
The motion of a train is an example of circular motion.
- उपर्युक्त (i से v तक) कथनों में से कौन – से सही है ?
Which of the statements given above (i to v) are correct?

- अ. i और iii ब. i, ii, iv
i and iii i, ii, iv
- स. i और v द. ii, iii, v
i and v ii, iii, v

19. निम्नलिखित कथनों पर विचार कीजिए – $5 \times 0.5 = 2.5$

Consider the following statements –

- (i) द्रव को ताप देने पर वह गैस में परिवर्तित हो जाते हैं।
On heating a liquid, it changes into a gas.
- (ii) कॉपर का रासायनिक प्रतीक Al है।
The chemical symbol of copper is Al.
- (iii) कार्य करने की दर को शक्ति कहते हैं।
The rate of doing work is called power.
- (iv) कम्पन करने वाली किसी वस्तु के अधिकतम विस्थापन को आयाम कहते हैं।
The maximum displacement of a vibrating body is called amplitude.
- (v) हैजा से प्रभावित अङ्ग फेफड़ा है।
The organ affected by cholera is the lungs.

उपर्युक्त (i से v तक) कथनों में से कौन – से सही है ?

Which of the statements given above (i to v) are correct?

- अ. i और iii ब. i, ii, v
i and iii i, ii, v
स. ii और iv द. i, iii, iv
ii and iv i, iii, iv

अति लघूत्तरीय प्रश्न (पूर्ण पक्ति में उत्तर लिखना है)

5 x 2 = 10

Very Short Answer Type Questions (Answer to be written in full line)

20. प्रणोद का मात्रक क्या है ?

What is the unit of thrust?

21. सरल रेखीय गति किसे कहते हैं ?

What is straight line motion?

22. न्यूटन की गति के प्रथम नियम को समझाइए।

Explain Newton's first law of motion.



23. गतिज ऊर्जा से आप क्या समझते हैं ?

What do you understand by kinetic energy?

24. आवर्तकाल को परिभाषित किजीए ।

Define time period.

लघूत्तरीय प्रश्न

5 x 3 = 15

Short Answer Type Questions

25. जीव विविधता का क्या महत्त्व है? जैव विविधता से सम्बद्ध वेद मन्त्र या श्लोक लिखिए ।

What is the importance of biodiversity? Write Veda Mantra or Shloka related to Biodiversity.

मन्त्र या श्लोक / Mantra or Shloka

26. गति किसे कहते हैं ? गति कितने प्रकार की होती है ? गति से सम्बद्ध वेद मन्त्र या श्लोक लिखिए।

What is motion? What are the types of motion? Write Veda Mantra or Shloka related to motion.

मन्त्र या श्लोक / Mantra or Shloka

27. बल क्या है ? बल कितने प्रकार के होते हैं ? बल से सम्बद्ध वेद मन्त्र या श्लोक लिखिए ।

What is force ? How many types of forces are there? Write Veda Mantra or Shloka related to force.

मन्त्र या श्लोक / Mantra or Shloka

28. तत्त्व किसे कहते हैं ? तत्त्व का एक उदाहरण लिखिए।

What is element? Write one example of element.



29. कृमि सङ्क्रमण से बचाव के उपाय लिखिए । कृमि से सम्बद्ध वेद मन्त्र या श्लोक लिखिए ।
Write the preventive measures against worm infestation. Write the Veda mantra or shloka related to worm.

मन्त्र या श्लोक / Mantra or Shloka

विवरणात्मक प्रश्न 5 x 4 = 20

Descriptive Questions

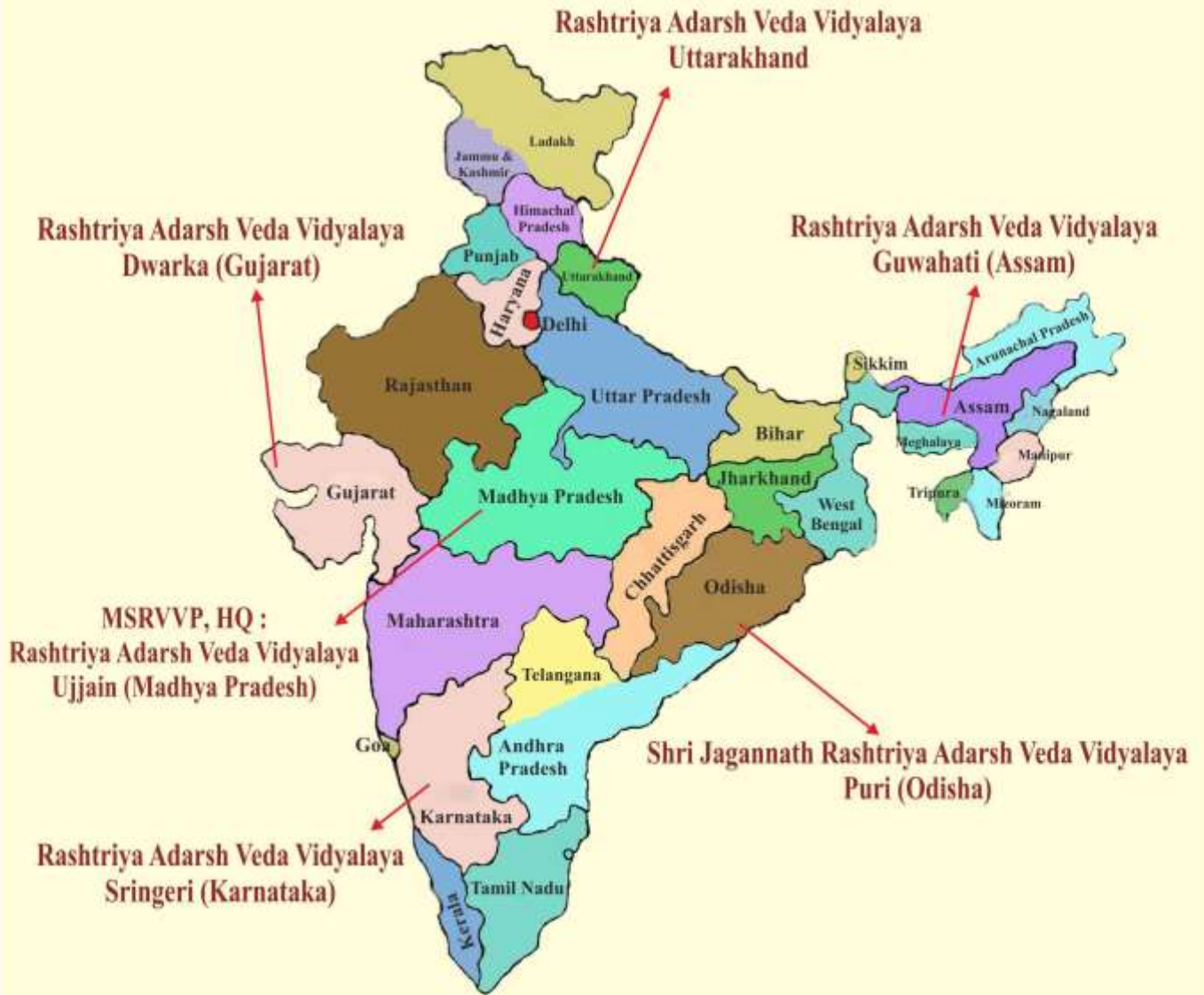
30. जल चक्र को सचित्र समझाइए ।
Explain the water cycle with diagram.

चित्र/Diagram



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