بِسۡمِ اللّٰہِ الرَّحۡمٰنِ الرَّحِیۡمِ

IN THE NAME OF ALLAH, THE ALL-MERCIFUL, THE ALL-COMPASSIONATE

General Science (Tech)

CLASS 9

PUNJAB CURRICULUM AND TEXTBOOK BOARD, LAHORE

Approved by the Federal Ministry of Education,
(Curriculum Wing) Islamabad
vide letter No. F.6-5/2003 dated 22 Dec, 2003.

Government of Pakistan, Islamabad.

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Publisher: Punjab Curriculam & Textbook Board, Lahore.
Printer:Nadeem Younis Printers, Lahore.

DATE OF PRINTING	PMIU	PEF	TOTAL QUANTITY
March 2025	28,219	40	28,259

1 INTRODUCTION AND ROLE OF SCIENCE

In this chapter you will learn:

- Introduction of Science
- History of Science
- Concept of Science in Islam
- Contribution of Muslim and Pakistani Scientists
- Branches of Science
- Role of Science and Technology

The word "Science" is derived from the latin word "Scientia", which means to study and analyse facts in original form. The basic principle of science is observation and hypothesis. To establish scientific law in the light of experiments is called scientific method.

1.1 History of Science

The history of science is as old as the man himself. With the passage of time man learnt from his interaction with the surroundings which later added to his knowledge of science e.g., when he burnt first time the wood for fire, he basically discovered the process of combustion and he also came to know that wood burns but a stone does not.

Greek philosophers took interest in science even before 500 B.C. Greeks were not interested in proving their ideas through experiments. They had a firm belief that life is based on air, water, earth and fire and these four elements make different things when combined in different proportions.

600 A.D. to 1400 A.D. is the era of Islamic chemistry. In this period many intelligent and research minded scholars observed the properties of matter. They carried on new experiments and discovered elements like "Arsenic". Besides this, a number of compounds were made. Experimental tools like retort were made for distillation. The period of Alchemy was no doubt the period of muslim scientists. They presented chemistry as experimental science for the first time. Many experiments were performed in this period and many new chemical reactions were discovered.

In 13th century muslims brought a complete change in the field of chemistry and they dominated for about seven centuries until Changez Khan and Halaku Khan destroyed the Islamic world. Gradually the western scientists who got knowledge from muslim universities took over the task of developing science from the muslims. They introduced these scientific approaches in Europe, which are still practised.

1.2 Concept of Science in Islam

Islam is a complete code of life. It gives us a clear and real picture of the facts and invites us to utilize natural resources for the benefit of mankind.

Islam is a practical religion and it is based on logic, observations, experiments and results. Many verses of the Holy Quran point out these factors clearly. The Holy Quran says:

- Don't they see?
- Don't they think over it?
- Don't they ponder upon it?

Teachings of the Holy Quran make us more inquisitive about our surroundings even the first ever words of the Holy Quran are very clear about this:

- Read! In the name of thy Lord and Cherisher, Who created. Created man, out of a clot of congealed blood. Read! And thy Lord is most Bountiful. He Who taught (the use of) the Pen. Taught man that which he knew not (Surah: 96 verse 1-5).

Like Quranic verses there are many hadiths in which emphasis is given on the knowledge, its importance and obligation on muslims. For examples Hazrat Muhammad (رسول اللہ خاتم النبیین صلی اللہ علیہ وعلی آلہ واصحابہ وسلم) said:

- "To seek knowledge is the obligation of every man and woman."

Like this, another hadith is

- "Seek knowledge from lap (cradle) to grave."

Allah says:

- "And of every thing We have created pairs: that ye may receive instruction. (Surah:51,verse: 49)"

We are observing pairs in human beings and other living creatures, however, scientists tell that Allah has made everything in pairs including smallest insects to the biggest creature of the sea. Only males and females reproduce offsprings of animals and plants.

If the human being ponder on these things, they can understand God's power & oneness for further guidance.

Allah Says:

- If the ocean were ink (where with to write out) the words of my Lord, sooner would the ocean be exhausted than would the words of my Lord, even if we added another ocean like it, for its aid. (Surah: 18, Verse: 109)

  This tells us that human knowledge & wisdom is unable to the known facts of nature.

Allah Says:

- It is only a little knowledge that is communicated to you. (Surah: 17, Verse: 85)

Great scientists cannot claim to understand reality and their views keep on changing day by day. Quran invites us to think, which is the basis of science.

Activity

Read carefully the verse-164 of Surah Al-Baqarah alongwith its translation and make a list of natural phenomena. Do these phenomena introduce us the laws of nature?

1.3 Contribution of Muslim and Pakistani Scientists.

(a) Jabir Bin Hayyan (722-817 A.D.)

Jabir Bin Hayyan is said to be the founder of chemistry. He discovered methods to extract metals from ores, making steel, leather, dyeing cloths and protecting iron from rust. He prepared chemicals like nitric acid, sulphuric acid and hydrochloric acid. Jabir Bin Hayyan was the discoverer of many other chemical compounds.

Jabir Bin Rayyan wrote books about chemistry and related topics in arabic. Among these books Al-Kitab and Al-Khalis are very famous books.

(b) Muhammad Bin Zikrya Al-Razi (865-925 A.D.)

His full name was Abu Bakar Muhammad Bin Zikrya Al-Razi. He was not only a chemist but a great physician as well. He was an experienced surgeon and administrator of a hospital in Baghdad. He was the first person to use opium to make his patients unconscious. He was the first person to explain in detail the causes, symptoms and treatment of chicken pox and small pox. His theories and ideas about these diseases are still practised. He was the first person to prepare alcohol from fermentation.

He classified chemical substances into four groups.

1. Minerals 2. Botanicals 3. Animals 4. Derived

This classification of chemical compounds done by Al-Razi is still accepted.

(c) Ibn-ul-Haitham (965-1039 A.D.)

His full name was Abu Ali Al-Hasan Ibn-ul-Hassan Al-Basri. He is known as Al-Hazen in the west. He identified inertia of matter, a theory which was later developed by Newton and called laws of motion. He discovered the pin hole-camera.

The name of his book, which is reputed all over the world, is "Kitab-ul-Manazir." It is a complete mathematical and practical book about the specialties of light. Ibn-ul-Haitham is considered to be the first expert on the laws of refraction, reflection besides lens and mirrors. The detail that Ibn-ul-Haitham had presented about eye is considered to be the right even now after going through many experiments.

(d) Al-Bairuni (973-1048 A.D.)

Al-Bairuni's full name was Burhan-ul-Haq Abu Rehan Muhammad Bin Ahmad. He was called as Al-Bairuni from the very beginning.
He got his early education from Abu-Naser Mansoor, a great philosopher and mathematician of his time.

Al-Bairuni was a physician, astronomer, mathematician, physicist, geographer and a historian all at the same time. He discovered that light travels faster than sound.

He discovered that radius of the earth was 6338 km. He discovered it near Pind Dadan Khan, District Jehlum about 100 km south east of Islamabad, the capital of Pakistan. The latest measure of the earth's radius is 6353 km with a difference of only 15 km. He made great contribution in the fields of astronomy, astrology, mathematics and geography.

He wrote about 150 books on Mathematics. The name of famous book of Al-Bairuni is "Tahreer-ul-Amakin".

(e) Bu Ali Sina (980-1037 A.D.)

His full name was Abu Ali Al-Hussain Ibn-Abdullah. He is very well known as Avecena in Europe. He is considered Aristotle of the muslim world. He wrote a research article on 760 herbs. It shows that he was not only a chemist but also an expert in medicine. He was the first person to reject the idea of converting common metal into gold. He wrote about 100 books on philosophy, science, fiqah, literature and biology. His famous book on philosophy is Kitab-al-Shifa. In this famous book along with the subjects of physics, chemistry, mathematics too much has been discussed about subjects like music and biology. His great work on medicine is his famous book Al-Qanoon-fil-Tib. It consists of 14 volumes. It explains the making and working of different parts of human body. This book was taught as a textbook in western universities until the late 17^{th} century.

Pakistani Scientists

(a) Dr. Abdus Salam

The only nobel prize winner scientist of Pakistan Dr. Abdus Salam was born at Santok Das District Sahiwal on January 29, 1926. After studying in Govt. College Jhang and Lahore he proceeded to England where he did his M.Sc. in mathematics and physics from Cambridge university in 1948-49 and won the Smith prize. He joined Government College Lahore in 1951 and became head of the mathematics department.

He served as member of Pakistan Atomic Energy Commission from 1958 to 1974. He worked as scientific advisor to the president of Pakistan from 1961 to 1974. SPARCO was established in 1961 and he was appointed as its chairman. He proposed the establishment of Islamic Science Foundation during the OIC meeting in Lahore in 1974. He also founded an International Institute for theoretical physics in Italy and remained its head for the rest of his life. Dr. Abdus Salam put forward theory of the unification of two natural forces i.e., the weak nuclear force and electromagnetic force. In 1979 along with Weinberg and Gloshow won the nobel prize for his work in theoretical physics Dr. Abdus Salam is the only Pakistani scientist who got nobel prize.

(b) Dr. Abdul Qadeer Khan

The world known scientist of Pakistan, Dr. Abdul Qadeer Khan was born on April 1st 1936 in Bhopal (India). He received his early education in Bhopal and in 1952 his family migrated to Karachi. He joined government service but very soon left it and went to Europe in 1961, where he studied at Shorlton Berg University in Germany for two years. Then he did his M.Sc from Technology University Hague (Holland). Later he did his Ph.D. from Leaven university, Belgium. He was appointed as research assistant in the same university. He came back to Pakistan in 1975 permanently due to his patriotic spirit, and was appointed as director of Kahuta Research Laboratories, which was later re-named as Dr. A.Q. Khan Research laboratory as a tribute to the great scientist. Along with other Pakistani scientists he successfully tested the nuclear devices at Chaghi in Balochistan on May 28, 1998. As a result of that Pakistan became Atomic Power. Pakistani nation cannot forget the services rendered by Dr. Abdul Qadeer Khan and will salute Dr. Abdul Qadeer Khan with the core of its heart.

(c) Dr. Munir Ahmad Khan

Dr. Munir Ahmad Khan was born in Kasur in 1926. He got his early education in Central Model school Lahore and then graduated from Govt. college Lahore. He did his B.Sc. in Electric Power from University of Engineering and Technology Lahore in 1949. He also got M.Sc. degree from an American college in 1951. Dr. Munir Ahmad Khan joined service in international Atomic Agency in Vienna in 1957 and stayed there till 1971. He was appointed as chairman of Pakistan Atomic Energy Commission in 1972 and retired from the services of

commission in 1990. Under his guidance, lot of progress was made in the fields of agriculture research, atomic energy and medicine.

(d) Dr. Atta-ur-Rehman

Dr. Atta-ur-Rehman was born in Dehli in 1942, migrated to Lahore in 1947. He got his early education from Karachi Grammar School. He did his B.Sc. (honours) from Karachi University in 1963. He got Ph.D. degree from Cambridge University in 1968. In 1977 he was appointed as co-director in Hussain Jamal institute of chemistry and then promoted as director in 1990. His services are highly appreciated in the field of medicine. He has published more than 200 research papers and lot of people have benefitted from him. He has received lot of national and international awards.

(e) Dr. Samar Mubarak Mand

Dr. Samar was born in Rawalpindi on september 17, 1941. He passed his matriculation from Saint Anthony High School Lahore in 1956. He did his M.Sc. in Physics from government college Lahore in 1962. He did his M. Phil in Nuclear Physics from Oxford University England in 1966.

Dr. Samar Mubarak Mand started his career as a scientific officer in Pakistan Atomic Energy in 1962. He was ranked as a director general in 1994, and in 1996 he was made technical member.

His special achievement was the responsibilities given by the Prime Minister of Pakistan to lead the team of Nuclear Scientist at Chaghi to conduct six nuclear tests for Pakistan. These nuclear tests were successfully conducted on 28th and 30th May 1998. As Director General of National Development Complex, he designed and developed "Shaheen" medium range missiles, which were successfully tested on April 15, 1999.

(f) Dr. Ashfaq Ahmad

Dr. Ashfaq Ahmad passed his M.Sc. in physics from government college Lahore in 1951. He taught in government college Lahore from 1952 to 1960. He went to Canada where he did his Ph.D. from Montreal university. He went to Neils Bohr Institute, Coupan Hagen and Sorborn for higher studies. He joined Pakistan Atomic Energy Commission in 1960. He was made Chairman of Pakistan Atomic Energy Commission in 1991, where he did his best to improve the working of the commission. He is attached with our National Nuclear Programme from the last 25 years. He is one of the pioneers of our nuclear compatibility.

1.4 Branches of Science

Science is a vast subject. For our own convenience we divide it into various branches like other subjects.

(1) Physics

Physics is that branch of science, which deals specially with matter and energy. It is also called the science of measurement because it deals mostly with measurement. Mechanics, heat, light, sound, electricity etc. are its main branches.

(2) Chemistry

Chemistry is that branch of science, which deals with nature, composition, and chemical properties of various things.

A number of chemical reactions are being produced at any time in the world. In our body a large number of chemical reactions are occurring e.g., digestion of food, formation of blood, purification of blood etc. Physical, inorganic and organic chemistry are its main branches.

(3) Biology

It is a study of living things. The word biology is derived from two Greek words i.e., "bios and logos". Bios means life and logos means arguments. Living things include man, animals and plants. In this we study the growth, working and re-production of living things. It has two main branches:

i. **Botany:** It deals with the study of plants. It includes their structure, growth, and interaction with their environment.

ii. **Zoology:** It deals with the study of animals. It includes their structure, growth and interaction with their environment. Most of the characteristics in plants and animals are common.

When plants and animals are studied together, the branch is called biology.

(4) Astronomy

It is the study of the universe e.g., Sun, Earth, stars etc. Mathematics and physics play an important role in astronomy.

(5) Mathematics

Mathematics is the knowledge about numbers and measurements, which includes calculations, algebra and geometry, etc. Mathematics is helpful in many other sciences. It helps us to explain long theories and ideas briefly, and results can be deduced easily. Newton and Einstein were great mathematicians.

(6) Agriculture

It deals with land cultivation and livestock. It tells us how to grow crops and how to control their losses. Cultivation devices, machinery, fertilizers and pesticides are also included in this science.

(7) Medicine

It is that branch of science, which deals with knowledge of human anatomy, diagnosis of diseases and their cure. It also includes pharmacy, instruments and machines used in diagnosis and treatment.

(8) Geography

Geo means earth and graphy means graph marking. In geography, the different parts of the earth are marked graphically like the dry regions and wet regions. There is a discussion about human relationship, vegetation, air, water, soil and the structure of the terrestrial globe in the subject of geography.

Relationship of Different Branches of Science

Different branches of science have a deep relationship with one another. For instance physics and chemistry are connected with each other. The concept that matter is made up with the mingling of different atoms has always been a subject of physics. Also the structure of atom is included in physics. But the formation of molecules by atoms and its causes have been a subject of chemistry. Physics describes the physical properties of matter and explain the laws according to which atoms combine to make molecules. But the formation of molecules shows the chemical characteristic. There is a great relationship between chemistry and biology. In biology the functioning of different organs and their structures are described. But different living bodies and the chemical reactions taking place in them are related to chemistry, which is called biochemistry.

Mathematical assistance is applied for the mathematical solution of different quantities of physics and chemistry. Many laws of physics and chemistry are derived by mathematics. Some of the branches of science studied collectively are mentioned below:

1. Biophysics:

Biology is studied with the help of the principles of physics.

2. Biochemistry:

Biology is studied with the help of chemistry.

3. Geophysics:

Different aspects and characteristics of land are analysed with the help of physics.

4. Astrophysics:

When the whole universe (astronomical phenomena) is studied in context with the laws of the physics it is called Astrophysics.

1.5 Role of Science and Technology in our Life

Various articles of daily use e.g., the wheel of clay-man, the forge of blacksmith, the spindle of weaver, the rahat and plough of farmer and the oarage boats etc. are the result of ancient knowledge and technology.

Generation and supply of electricity, in mid 19th century resulted in various domestic and industrial inventions. Electricity not only provides light but also runs various industrial and home appliances. As a result, increase in industrial production occurred.

Various discoveries and inventions in the present century have brought a revolution in communication sector. Wireless, telephone, radio, television, computer and satellites have interlinked the whole world. The man has made the travel in space possible.

Today computer rule the world. This invention of modern world, have brought a revolution in every field of life. E-mail has become quick means of communication. Computers and mobile phones have also provided a convenient means of photography. Through internet, one can easily get information from all around the globe. The data can easily be saved and retrieved.

We use science and technology to live a comfortable life. Today, there is hardly any field not affected by science and technology. In agriculture sector, it is the production of high yielding varieties, pesticides, fertilizers and farm machinery. In industrial sector, the use of automatic electrical and mechanical machines, in communication introduction of supersonic planes, electrical trains and in medical, use of life saving drugs and diagnostic instruments are the result of advancement in the field of science and technology.

Questions

Q:1 Fill in the blanks:

i. Jabir Bin Hayyan was an expert in _____.

ii. The study of animals is called _____.

iii. Bu Ali Sina is called _____of the muslim world.

iv. _____ divided chemical compounds into four categories namely, minerals, botanicals, animals and derived compounds.

v. "Kitab-ul-Manazir" is the first book on _____.

Q:2 Put the sign (✔) against the correct statement and the sign (✘) against the wrong statement.

i. Bu Ali Sina was considered to be one of the founders of medicine.

ii. Jabir Bin Hayyan was the first who discussed in detail the causes, symptoms, cure and prevention of smallpox and measles.

iii. Jabir Bin Hayyan was an expert in physics.

iv. "Kitab-ul-Manazir" is a publication of Al-Bairuni.

v. The knowledge about animals is called botany.

Q:3 Identify the correct answer and encircle it from the following statements.

(i) Ibn-ul-Haitham is related to branch of science.

a. Sound b. Heat
c. Light d. Chemistry

(ii) The name of famous book written by Al-Bairuni is:

a. Kitab-ul-Manazir b. Al-Havi
c. Al-Shafa d. Tahreer-ul-Amakin

(iii) The branch of science related to mechanics, heat, light and sound is?

a. Geology b. Astronomy
c. Chemistry d. Physics

(iv) Giving tribute to which Pakistani Scientist, the name of Kahuta Research Laboratories was changed.

a. Dr. Atta-ur-Rehman b. Dr. Abdul Qadeer Khan
c. Dr. Ashfaq Ahmad d. Dr. Samar Mubarik Mand

(v) Which Pakistani Scientist was awarded nobel prize?

a. Dr. Abdul Qadeer Khan b. Dr. Samar Mubarik Mand
c. Dr. Abdus Slam d. Dr. Munir Ahmad

Q: 4 What is meant by science?

Q: 5 Write down the five branches of science. What do you know about each branch of science?

Q: 6 Write down the names of two muslim scientists and give their important contributions to the service of science.

Q: 7 Write the names and contributions of few famous Pakistani Scientists.

Q: 8 The importance of science and knowledge have been discussed in the Holy Quran. Explain in the light of verses of the Holy Quran.

2 OUR LIFE AND CHEMISTRY

In this chapter you will learn:

- The building elements for life.
- The role of different gases in air.
- Essential elements for life.
- Water and its properties.
- An introduction to organic chemistry.

2.1 The Basic Building Elements Life

In the body of living organisms, many elements are found in different quantities. In them carbon, hydrogen and oxygen have great importance. The human body also constitute these three elements. These elements combine to form organic compounds such as proteins, carbohydrates and lipids. All these compounds work as building material for the bodies of living organisms e.g. meat, pulses, fats, cooking oil, sugar, wheat etc.

Carbon

Carbon is one of the essential part of all living things on this planet. Small quantities of carbon are found in the earth's crust as the free element. Carbon is an important element of natural compounds such as natural gas, petroleum and wood etc. Carbon is also present in the food you eat. The food containing carbon, hydrogen and oxygen are either carbohydrates (starch, sugar, cellulose) or fats (butter, oils) while the food containing carbon, hydrogen oxygen, and sulphur or nitrogen are proteins (meat, fish). All the plant life is also made up of compounds containing carbon, hydrogen and oxygen. Other carbon containing compounds are silk, soap, alcohol, plastic etc.

Hydrogen

Hydrogen is an essential part of water (H_2O) and therefore important for all living things. Other than this it is found in natural gas. It is most common element in the universe, for example the sun is a huge white-hot ball consisting almost entirely of hydrogen.

Oxygen

Oxygen is a colourless, odourless gas which is slightly soluble in water. Fish and all form of aquatic life rely on this property. It is the major constituent of air. The various organic compounds containing oxygen are glucose, sugar, cellulose, fats, proteins etc.

Importance of Carbon, Hydrogen and Oxygen

You have already studied that carbon, hydrogen and oxygen play important role in the living organisms. Respiration is a process which provides energy to the body while photosynthesis is a direct or indirect source of food for living beings. These three elements have basic role in these two processes.

Respiration

Oxygen is essential for life. It plays an important role in respiration. Respiration is the process by which living things use oxygen from the air to oxidize food substances (mainly glucose) in their body cell.

$$\text{Glucose} + \text{Oxygen} \longrightarrow \text{Carbon dioxide} + \text{Water} + \text{Energy}$$

When we breathe in, we take air into our lungs. The oxygen from the air then dissolves in the blood in our lungs. This dissolved oxygen is taken by hemoglobin to all parts of our body to react with glucose to produce energy. At the same time, carbon dioxide produced as a waste product is taken back to the lungs and breathed out.

Photosynthesis

Photosynthesis is a process by which green plants manufacture carbohydrates (glucose) from atmospheric carbon dioxide and water from the soil, in the presence of energy of sunlight.

$$\text{Water} + \text{Carbon dioxide} \xrightarrow[\text{Chlorophyll}]{\text{Sunlight}} \text{Glucose} + \text{Oxygen}$$

This process only occurs in chlorophyllous cells of the leaves and stems. Oxygen is produced in this process as a by-product and released into the atmosphere. Photosynthesis is effectively the reverse of respiration.

This is also called anabolic (building up) process while the respiration process is called catabolic (breaking down) process.

2.2 Organic Chemistry

Organic chemistry is the chemistry of compounds which contain the element carbon. Most of these compounds also contain hydrogen and many also contain oxygen or other element. There are a few compounds which contain carbon but are not classified as organic compounds. Carbon monoxide, carbon dioxide and the metal carbonates are examples.

Types of Carbon Compounds

Carbon occurs in large number of naturally occurring compounds. e.g. natural gas (methane) and many of our fuels are compounds of carbon and hydrogen. Coal is a mixture of compound containing carbon, hydrogen and oxygen. There are many inorganic carbon compounds such as carbonates of sodium, calcium, and magnesium.

Carbon is also present in our food and every part of our body. All plant life is made up of compounds containing carbon, hydrogen and oxygen. In the atmosphere, it is present in the form of carbon dioxide.

(a) Plastic

(b) Paints

(c) Medicines

(d) Carbohydrates containing food

Fig. 2.1 : Types of Carbon compounds

Hydrocarbons are the simplest organic compounds. The molecules of hydrocarbons are made up of only two elements hydrogen and carbon. They occur naturally in fossil fuels, petroleum, coal and peat. The important class of naturally occurring

organic compound is carbohydrates. The simplest form of carbohydrates is glucose. Other than carbohydrates, proteins, fats and oils are also very important organic compounds. The flesh of human beings, animals, birds and fishes are made of proteins.

Many of the organic compounds are made by man. They are artificial fibres, plastics, medicines , paints and many other things.

2.3 Water

Water is the common compound on earth. For instance, three fourth of the earth's surface is covered with sea. It is the only chemical compound found naturally as a liquid, as a solid (ice) and as a gas (water vapours). Water plays a vital role in industry, in home and in laboratory and is also essential for life. About two thirds of the human body is water and many foods consist predominantly of water (Table 2.1)

Interesting Information

Ethene gas can be used to help to ripen fruits specially bananas before they are sold. Crates of green bananas are left to ripen in special ripening rooms high in concentration of ethene gas.

Table 2.1: Water contents of some foods and living organs.

Food	% age of water by mass	Living organs	% age of water by mass
Tomatoes	95	Bones	22
Milk	87	Kidneys	82
Oranges	86	Blood	90
Apples	84	Egg	75
Potatoes	76		

Properties of Water

Water is a clear, colorless and odorless liquid. It has abnormal low freezing point ($0^{o}C$) and high boiling point ($100^{o}C$) at one atmospheric pressure.

Ice floats over water indicating that ice is lighter than water. In other words, the density of ice is less than the density of water. As the temperature of ice rises the ice melts and its density increases. The density

Interesting Information

The body of a young boys contains approximately 35 litres of water. This is over two thirds of the body weight. However, girls have very slightly less water per body weight. It is for this reason that certain medicines or drugs are faster acting on girls than on boys.

of water at 0°C is somewhere between 0.9990 g/cm^3 and 1.000 g/cm^3, while the density of ice at 0°C is of the order 0.918 g/cm^3. Therefore, there is considerable increase in volume when liquid changes to solid at 0°C. This is because that water molecules are less tightly packed (are at greater densities) in ice than in liquid water. The density of water is maximum at 4°C. The fact that water contracts on cooling from 0°C to 4°C is quite contrary of the behaviour of many of the other liquids. This property helps nature to preserve fish and other aquatic animals in winter in countries where freezing of water takes place during winter. When cooling of water starts, as winter approaches the density of water increases until it reaches its maximum (density 1.00 g/cm^3) at 4°C. Thus water is heavier at 4°C and sinks to its bottom. Further cooling cools down the surface layer below 4°C and since the density of water now is lower than the water at 4°C stays at the top and frozen to solid ice, while the liquid below remains at 4°C.

The soluble air present in the water below the ice, helps animals to breath and thus they spend a nice winter under a thick blanket of ice.

Water as Universal Solvent

One of the most interesting things about water is that it dissolves a variety of substances. It is therefore extensively used as a solvent in industrial chemical processes and also many chemical reactions are carried out in it. The solubilities of solids increase with increasing temperature. Different solutes have different solubilities at a particular temperature. For example at 50°C, 100g of water will dissolve 84g of potassium nitrate but only 33g of copper sulphate.

Besides these, all gases can dissolve in water to some extent. Examples of such gases are oxygen, hydrogen, nitrogen and carbon dioxide. In general, the solubilities of gases decrease with an increase in the temperature. Water is also a universal solvent for biochemical reactions.

2.4 Air

The atmosphere surrounding our earth is a mixture of various gases. The percentage composition of air by volume is shown in table 2.2.

Table 2.2: Percentage composition of various gases in air

Component	Percentage composition by volume
Nitrogen	78
Oxygen	21
Argon	0.9
Carbon dioxide	0.03
Neon	0.002
Helium, Krypton and Xenon	0.00055

The composition of air remains approximately constant. For example, the composition of oxygen and carbon dioxide is kept constant by the process of photosynthesis and respiration respectively.

Interesting Information

Each day a normal man breathe in 15,000 to 20,000 litres of air

Role of Oxygen in Air

Oxygen is the second most abundant gas found in air after nitrogen. It is essential for supporting life and phenomena of burning and rusting. For burning or combustion, we require three things, fuel, heat and oxygen. These make up the three principles of fire-fighting, because in the absence of any one of these, the fire goes out.

Burning or combustion is a chemical process, which is accompanied by the production of light and heat. During this process, the combustible material usually combines with atmospheric oxygen to form oxides. This oxide form acid, when it is dissolved in water.

Degradation of all kinds of food like vegetable, meat etc., is because of the oxidation of organic materials present in it. Ozone is produced from oxygen which is present in the earth atmosphere, is useful to protect the living organisms, by absorbing ultraviolet light of the sun.

Role of Nitrogen in Air

Nitrogen occur in the atmosphere as diatomic molecules. It is the major constituent of air. It is relatively inert, as compared to oxygen , but it acts as an important diluent of the air to slow down combustion and corrosion.

Nitrogen also occurs in plants and animals in the form of proteins. Animals obtain protein by consuming plants. Plants produces protein from the nitrate in the soil. Nitrates are produced from atmospheric nitrogen and ammonia present in soil. Plants get their nitrogen from nitrates present in soil. This nitrogen directly or indirectly reaches the animal. As dead plants and animals decay, some soluble nitrogen containing compounds, usually nitrates, are produced and can be absorbed by these plants. Some of these nitrates are converted into nitrogen by bacteria in the soil. This is then released back into the atmosphere. In nature the process in which nitrogen is transferred from living organisms to soil and from soil to living organisms regularly is called nitrogen cycle and this nitrogen cycle keeps the amount of nitrogen constant in air.

Role of Carbon Dioxide in Air

The atmospheric air contains only approximately 0.03% by volume of carbon dioxide. This proportion is kept constant by a balance in nature between the process of photosynthesis, which remove carbon dioxide from the atmosphere, and those of respiration, decay and combustion which return it to the atmosphere. These processes are called carbon cycle.

Carbon dioxide also plays an important part in the air by absorbing infrared rays from the sun. Thus CO_2 protects the living organisms from the harmful rays.

However, the problem will rise in the near future through the burning of too much carbon containing fuel. This could upset the balance of the carbon cycle by liberating too much carbon dioxide into the air. It is thought that if the amount of carbon dioxide increases in the air then the temperature of the earth will rise. This is called green house effect. The higher temperature would cause the ice on the mountains to melt and flooding to occur. Weather pattern on our planet would also be affected.

2.5 Important Elements for Life

Some elements are found to be essential (some in large, some in small quantities) for maintenance of our health, agriculture and daily life uses. We will only discuss the functions of some elements.

(i) Iron

Iron is the second most abundant metal found in the earth's crust after aluminium. It has been known and used by mankind for a long time. Today, it is one of the best known metals in the world because of its very great economic and industrial importance. It is used for general engineering purposes such as corrugated sheets, car bodies, nails, screws, steel pipes, tools etc.

Iron is essential to all living organisms. It is present at the active centre of molecules (Hemoglobin and Myoglobin) responsible for oxygen carrier and of other types of molecules (cytochromes and Ferredoxins) for electron transport. Normally it is slightly toxic, but excessive intake can cause siderosis and damage to some organs.

The iron content in plant tissue is normally between 50-250 ppm. It is absorbed, by plant roots from the soil as Fe^{2+} and Fe^{3+} These irons are involved in photosynthesis.

(ii) Sodium

It is used in sodium vapour lamps (which gives a bright orange-yellow light), for street lighting. It is used for the preparation of important compounds such as sodium peroxide (Na_2O_2), sodium cyanide (NaCN) which is used in the extraction of gold. It is also used for the preparation of tetraethyl lead which is added in petrol as an anti-knocking agent.

Sodium is a major component of vertebrate blood plasma. It is important in different functions of living organisms. It is associated with some forms of hypertension in some individuals.

Sodium is absorbed by plants as Na^{+1} and its concentration varies widely from 0.01 to 10% in leaf tissue. It is essential for halophytic plant species that accumulate salts in vacuoles to maintain turgor and growth. Crops that require sodium for optimum growth include spinach, sugar beet, turnip etc.

(iii) Potassium

Potassium in the form of carbonates is used in the preperation of glass and soap. One of its another compound potassium phosphate is used in preperation of detergents. Potassium nitrate is used in preperation of glass and explosive material.

It is an essential element for almost all living organisms. It plays an important role in nerve action and cardiac function.

Potassium is absorbed by plant roots as K^+. The concentration of potassium in vegetative tissue usually ranges from 1 to 4% on a dry matter basis. Many plant enzymes require potassium for their activation.

(iv) Magnesium

Because of its low density, Mg is used in preparing light but rough alloys such as magnalium (a mixture of aluminum and magnesium). These alloys are used for the construction of cars, aircrafts and moving parts of machines.

It is essential to all organisms. It is present in chlorophyll. It has electrochemical and enzyme activating functions.

Magnesium is absorbed as Mg^{2+} and its concentration in crops varies between 0.1 and 0.4%. The importance of Mg^{2+} is obvious since it is a primary constituent of chlorophyll molecule and without chlorophyll the autotropic green plant would fail to carry on photosynthesis.

(v) Calcium

This element is used as deoxidant in steel casting. It is used in extraction of uranium and in preparation of calcium fluorides and calcium hydrides.

It is an essential element for all organisms, it is used in cell walls, bones, and some shells as important compound. It is involved in blood clotting.

In plants calcium concentration ranges from 0.2 to 1%. It has an important role in the structure and permeability of cell membranes. Lack of Ca^{2+} produces a general breakdown of membrane structures.

(vi) Phosphorous

Phosphorous occurs in most plants in concentration between 0.1 and 0.4%. Plants absorb either $H_2PO_4^-$ or HPO_4^- orthophosphate ions. The most essential function of phosphorous in plants is in energy storage and transfer. Adenosine di and tri-phosphates (ADP and ATP) act as "energy currency" within the plants. In human beings during carbohydrate metabolism and in plants during photosynthesis the energy produced is stored in the form of phosphate compounds i.e. ADP and ATP. When the phosphate compounds from either ATP or ADP is split off, a relatively large amount of energy (12,000) cal/mol) is liberated. This energy is used in growth and reproductive processes.

(vii) Fluorine

Some fluorides and other compounds of fluorine are used as a refrigerant, anaesthetic, non-stick agent insulator. Hydroflouric acid is used in etching glass and in cleaning steel. Sodium fluoride in trace amount is used for the fluoridation of drinking water, while tin fluoride is used in many tooth pastes to protect the decay of tooth.

(viii) Chlorine

Although, the chlorine gas is very poisonous but it has many beneficial uses in daily life. It is used to kill germs and bacteria and is commonly used in domestic bleaches. It is also used in water purification and in swimming pools. Polyvinyl chloride is a common plastic compound of chlorine and is known as PVC. It has many uses, especially as an insulator or as a water proofing material.

It is an essential element for higher plants and mammals. Sodium salt of chloride (NaCl) act as electrolyte and hydrochloric acid as digestive juices in body. Deficiency of chloride cause the impaired growth in infants.

Chlorine is essential for higher plants. It is present in chloroplasts which is essential for photosynthesis. Plants which take up large amount of Cl^{-1} usually have a high water content.

(ix) Iodine:

Iodine is used in making dyes for colour photography and pharmaceutical chemicals. A dilute solution of iodine in ethanol, which is known as tincture of iodine, is commonly used as an antiseptic.

It is essential element in many organisms. Low iodide availability in certain areas increases the incidence of goiter. Iodine – 131 is used to treat the thyroid.

Iodine has not been shown to be essential to plants but are reputed to produce stimulating effects on plant growth at low concentrations. In healthy plants the iodine level is 0.5 ppm. at higher concentrations.

QUESTIONS

Q.1 Fill in the blanks:

(i) _____ is the process by which plants produce glucose.

(ii) The %age composition of the methane is about _____ in natural gas.

(iii) _____ is the only chemical compound found naturally as a liquid as a solid, and as a gas.

(iv) Nitrogen occurs in plants and animals in the form of _____.

(v) Dilute solution of Iodine in ethanol is called _____.

(vi) Phosphorous is an important constituent of _____.

(vii) Carbon is an important _____ for all organisms

Q.2 Choose the correct Answer

(i) The process of converting atmospheric nitrogen to useable form is called.

(a) Nitrogen Cycle (b) Carbon Cycle

(c) Nitrogen fixation (d) Water cycle.

(ii) Oxygen and nitrogen react to form

(a) Nitric acid (b) Nitrogen oxide

(c) Nitrogen peroxide (d) Nitrate.

(iii) The amount of carbon dioxide in the air is increased by

(a) Photosynthesis (b) Respiration

(c) Burning (d) Evaporation

(iv) The deficiency of Iodine in human body cause.

(a) Goiter (b) Cancer (c) Tuberculosis (d) Cholera.

(v) The contents of sodium in leaf tissues vary from.

(a) 0.01 – 10% (b) 10–15% (c) 12 –16 % (d) 16 – 20%

Q.3 Short Questions:

(i) Write any three properties of chlorine.

(ii) Name those three elements which are abundantly found in human body.

Q.4 Why do the water expands on freezing

Q.5 Write the notes on (1) Water as universal solvent (2) Properties of water

Q.6 Write the importance of any two elements found in air.

3 BIOCHEMISTRY AND BIOTECHNOLOGY

In this chapter you will learn:

- Definition of metabolism and explanation.
- Introduction to enzymes, their role in metabolism and our daily life.
- Composition of blood, its types and functions.
- Introduction to genetic engineering and its role in agriculture and live stock.
- Improvement of crops and disease control.
- Introduction to antibiotics and vaccines.
- Recycling of waste materials.

Biochemistry is a branch of chemistry which deals with all the chemical reactions taking place in living organisms like plants, animals, bacteria, etc. These chemical reactions can help in the synthesis (anabolism) or breakdown (catabolism) of biological molecules. The digested food become part of the body due to anabolic reactions while respiration is a simple catabolic reaction. Its knowledge has been used to produce a large number of material for the benefits of human beings. The term biotechnology was introduced in 1970. The techniques of biotechnology can be used to alter the genetic make up of microscopic organisms to produce useful materials like enzymes and hormones etc.

3.1 Metabolism

A large number of chemical reactions take place in animal and plant cells and cells of biological organisms which are collectively called **metabolism**. Metabolism consists of two types of reactions which can either synthesize molecules (anabolic reactions) or break the complex molecules. Catabolism is a catabolic reaction in the result of which the complex organic molecules are broken down into simple molecules. Catabolic reactions release energy. This energy can be used in several biological processes.

In the result of catabolic reactions carbohydrates, proteins and lipids are broken down and oxidized with the help of various enzymes. These reactions release energy which is used to perform many activities in the animals. Anabolism is a synthesining process and the production of carbohydrates is one of its example in which plants use sunlight, carbon dioxide and water. This process is called photosynthesis.

The sum of all energy using and energy releasing reactions is called **metabolism**.

3.2 Enzymes:

Enzymes are biological catalysts. A catalyst is a substance which can change or speed up a chemical reaction. Enzymes catalyze biochemical reaction and are protein in chemical structure. Enzymes speed up different catabolic and anabolic reactions.

Enzymes are required in very small amounts. They are very specific in their reaction. For example, amylase acts on starch but not on proteins or fats. The substances on which the enzymes act are called **substrates**. The specificity of an enzyme is due to its shape.

Some enzymes need other compounds to complete catabolic reactions. These are called **coenzymes**. Coenzymes are non protein substances.

Role of Enzymes in our Daily Life

Enzymes play an important role in our daily life. They are useful in industry. Enzymes are used in chemical and pharmaceutical industry. They are used in cheese production. Enzymes are commonly used in food processing industry. The enzyme papain is obtained from papya and is used as a meat tenderizer.

3.3 Blood and its Functions

Blood is the most important fluid of human body. It transports digested food and oxygen to the cells of all parts of the body. It brings back the useless products of metabolism into kidneys and liver. Blood is a very complex fluid. It consists of a liquid blood plasma in which blood cells are suspended.

Red blood cells, (erythrocytes) white blood cells (leucocytes) and platelets float in the plasma. The fluid part of blood with out blood cells is called **plasma**. If we remove blood clotting protein (fibrinogen) from plasma then the remaining fluid is called **serum**. The blood cells are helpful in transport of gases, white blood cells control body immunity system and blood platelets are helpful in blood clotting.

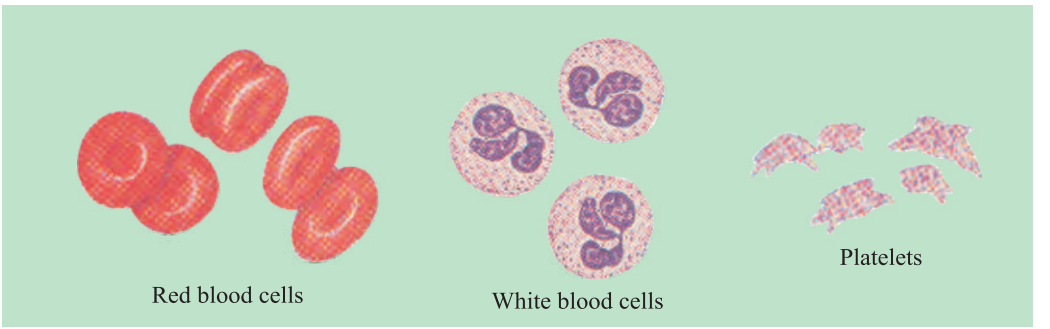


Fig. 3.1 Blood Cells

Blood Groups

Human blood appears simply same but chemically people have different types of blood . This difference is based on antigen present on the surface of red blood cells. The human blood is divided into A, B, AB, and O groups on the basis of antigens and antibodies and is called **ABO system** of blood.

Landsteiner in 1902 divided human population in four groups on the basis of blood groups

If a certain person belongs to A group of blood then this is due to the A antigens present on the surface of red blood cells. If another person's red blood cells have B antigens then he belongs to B group. Type AB individuals have both A and B antigens. Type O individuals are known as universal donor because their blood cells carry neither A nor B antigens. They can donate their blood to any person. Type AB individuals are universal recipients because their red cells have both antigens and they can receive blood from any individual.

Table 3.1 Characteristics of ABO Blood groups

Blood Group	Antigens on RBCs	Type of antibodies in plasma	Donor	Recipients
A	A	B	A, O	A, AB
B	B	A	B,O	B, AB
AB	A,B	None	A,B,AB,O	AB
O	None	A,B	O	A, B, AB, O

There is a second blood group system called **Rh system**. It is based on another red blood cell antigen called the **Rh factor**. A can be Rh-positive or Rh-negative depending on the presence or absence of Rh factor. A pregnant Rh-negative mother cannot receive Rh-Positive blood because it can harm unborn Rh-Positive blood (inherited from father). It is dangerous and the mother is injected with anti Rh antibodies after delivering her first Rh-Positive body.

Table 3.2 Rh-Factor System

Blood of the type of Rh-factor	Type of antigens or RBCs	Type of antibodies in Plasma	Matching Recipients	Matching Donors
Rh^+	Rh^+	None	Rh^+, Rh^-	Rh^+
Rh^-	None	Rh^+	Rh^-	Rh^-, Rh^+

3.4 Genetic Engineering

Genetic engineering is a set of techniques used to transfer genes from one organism to another. Individual genes can be cut off from the cells of one organism and inserted into the cells of another. The genes from different sources can be combined in a test tube and then transferred into living cells. This technique is called **genetic engineering.**

Role of Genetic Engineering in Human Welfare

Any organism which receive a foreign gene is called a **transgenic organism**. Following are the steps for the production of genetically engineered organism.

i) Identification of the gene of interest.
ii) Removal of the gene from the donor.
iii) Conversion of the gene into chromosome or DNA.
iv) Introduction of the desired gene-carrying into the recepient.

Significance of Genetic Engineering in Agriculture and Livestock.

Genetic engineering has revolutionized the agriculture which is apparent from the following examples.

i) Production of high yield crop varieties and animals (milk and meat production)
ii) Improvement in the nutritional quality of edible parts of plants.
iii) Introduction of herbicide (weed killing chemicals), pesticide (insect killing chemical)
iv) Increase in the shelf-life of fruits and vegetables
v) Transfer of nitrogen-fixing genes into non-legumes (wheat, rice, etc)
vi) Improvement in fruit quality.

1) Production of high yield crops

We can use the techniques of biotechnology to obtain genetically modified (GM) varieties of plants. It has been observed that most of the high yield crops or fruit trees are quite susceptible to diseases. It is quite desirable to introduce the disease resistant genes into high yield disease check plants.

2) Production of high yield animals

It is desirable to produce high milk and meat producing animals to feed the constantly increasing human population. A normal breeding programme in animal is quite lengthy. Biotechnology techniques can not only shorten the time for the production of desirable breed but also controls the diseases caused by crossing the closely related animals.

The cloning or the production of genetically similar individuals has already been carried out for sheep. This technique can be used for the production of animal organs in future.

Fig. 3.2 : Genetically engineered sheep (Dolly)

3.5 The Role of Biotechnology in Betterment of Crops

1. Weed killing ability

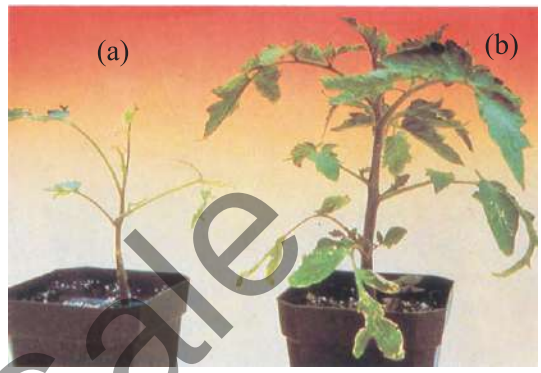
Herbicides are the chemicals which are used to control the weeds or unwanted plants growing in crops. Sometimes these herbicides also affect the crop besides killing the weeds. A

weak solution of cynamide kills weeds, but also causes some damage to tobacco plants.

Such genes are transferred in the tobacco plant due to which the plant not only shows resistance against herbicide but also gets advantage in their growth.

2. Pest resistance

BT gene, can induce pest resistance in plants. This gene has been introduced in cotton and the crop has become resistant to the attack of the insects. In 2002-2003 wheat season, the insects called aphids damaged the wheat crop on some parts of Sindh province. A huge amount of expensive pesticides were used to control aphid. This problem can be solved by producing aphid resistant varieties with the help of genetic engineering techniques.



(a) The non-engineered tomato plant that has been completely eaten by caterpillar.
(b) The engineered tomato plant that is not affected by caterpillar.

Fig. 3.3: A successful experiment in pest resistance

3. Improvement of crop yield

Classical techniques of plants breeding require several years and large amount of money for the production of new high yield crops. Through genetic engineering in a short time, high yield crops are produced.

3.6 Antibiotics and Vaccines

Compounds that inhibit the growth or kill bacteria are called antibiotics. There are millions of antibiotics, produced mainly from soil bacteria and fungi but only a few are used to control human bacterial diseases. They do not have any bad effect on humans and can not harm viruses.

Penicillins, tetracyclines, erythromycin etc. are some example of antibiotics.

Vaccines

Vaccines are harmless form of disease causing microbes that stimulate the immune system. The term vaccine is derived from vacca the Latin for cow. The first vaccine against small pox consisted of cow pox virus in the late 1700s. Edward Jenner an English physician learned from his patients that people who had contacted cow pox were resistant to subsequent small pox infections, in 1796. Jenner scratched a farm boy with needle bearing fluid from a sore of a milk maid who has cow pox. When the boy was later exposed to small pox, he resisted the disease. Vaccination stimulates the body's immune system.

3.7 Recycling of Waste and Scarce Materials

Recycling is the retrieval and reuse of waste materials for manufacturing purposes. A large number of solid wastes like iron, glass, plastic and rubber can be recovered and made reusable. Recycling is important for:

(1) Reduction in rubbish to control environmental pollution. (2) Conservation of raw materials and natural resources. (3) Treatment of sewage saves water which is scarce in many parts of world. (4) Recycling saves energy and money.

Many of the materials discarded as rubbish, such as paper, card board, plastic, rubber, metal glass etc. can be retrieved and recycled through respective industries.

We have to conserve the natural resources so that the environmental pollution could be controlled. A large amount of domestic and industrial rubbish is dumped as waste. Many of the discarded materials are valuable, which could be recycled and used. For example news papers, paper bags, card board boxes, if thrown away, represent a loss of materials. More trees would have to be cut down to make papers. This would result in deforestation. By reusing waste materials, recycling helps to reduce the problem of solid waste disposal. The recycling of solid

Fig. 3.4: Recycling (Production of new bottles from old one)

wastes means that there is less rubbish to be burnt. Many industries produce wastes that contain metals. Recovery of these metals from the wastes not only helps to conserve the metal but also reduce environmental pollution.

Recycling of sewage wastes through treatment can make it reusable. This is important in those parts of the world where water is very scarce. Sewage, if untreated, represents a loss of water. Untreated sewage also pollutes streams, rivers and lakes. This makes the water unfit for human consumption. In urban areas sewage can be treated in sewage tank. The purified effluent water is then discharged into rivers, streams or lakes, such water may flow into reservoirs, and later be treated and used for human consumption.

Recycling of waste materials can save energy and money. Some household rubbish, e.g. paper can be burnt to provide energy for domestic purposes. This can be done to provide heat for hot water and central heating system.

Broken glass bottles, cup, jars can be crushed and recycled. The use of crushed glass to make new containers saves materials. The energy and cost is reduced as this process uses less fuel.

Similarly, the recycling of aluminium cans and bottle caps can save materials, energy and money.

Organic manure and heat energy are the more practical things which we can obtain from recycling of waste materials. Some developed countries are trying to generate electricity by burning rubbish.

Disposal of rubbish.

There are three methods for waste disposal in developed countries.

(i) Compost of natural fertilizer (ii) Burning in incinerators

(iii) To bury underground according to methods of hygiene.

QUESTIONS

1. Fill in the blanks.

   (i) Vaccination stimulates the _____ system of the body.

   (ii) Human blood can be classified into A,B, AB and O groups on the bases of antigen and _____ .

   (iii) Enzymes are very _____ in their function.

2. Put a (✓) against right question and (✗) against wrong question.

   (i) Metabolism is a combination of anabolic and catabolic reaction.

   (ii) The term "Biotechnology" was introduced in 1980.

3. Each of the following question has four answers. Encircle the right answer.

   (i) The function of platelets is

   (a) Blood Clotting (b) Engulfing the bacteria

   (c) To produce antibiotics (d) Transfer of oxygen

   (ii) Enzyme Papain is obtained from

   (a) Rose plant (b) Carrot

   (b) Papaya plant (c) Wheat

   (iii) Which blood group is called universal recipient

   (a) A (b) B

   (b) O (c) AB

4. Write brief answers.

   (i) Write the names of three main types of cells in blood ?

   (ii) What is transgenic organism?

   (iii) What is a catalyst?

5. What is metabolism?

6. What is an enzyme? What role is played by enzymes in our daily life?

7. What are the components of blood?

8. What is genetic engineering? How can it help in improving agriculture and livestock?

9. What is an antibiotic?

10. What is recycling? Give a detailed account how the waste and scarce materials can be made useable.

4 HUMAN HEALTH

In this chapter you will learn:

- Introduction to important components of our diet like proteins, carbohydrates, fats, vitamins, minerals and water.
- Importance of balanced diet for people belonging to different age groups.
- Definition and explanation of nervous system with respect to endocrine glands.
- Importance of exercise in human life.
- Use of first aid.

The health is wealth and a great gift from God Almighty. Human health not only depends upon the type of the food we take in but also on the fact whether a man is acquainted of all the phenomenon occurring in its body. Only after having a comprehensive knowledge of all these facts he can be successful to maintain his health. In this chapter, we shall not only discuss the role of diet to maintain the human health but we shall also try to investigate both intrinsic and extrinsic factors that influence human health and how a man can cope with all these challenges.

4.1 Food and its Major Components

Food is the basic necessity of human life. Scientifically speaking food is any thing which after digestion provides energy to the body for various activities and also helps in its growth and development.

Water

Water is utmost important for life. A man can survive without food for at least a month but just for a few days without water. It is the most important component of human body, it makes almost 60% of an adult body weight. Water performs a number of very important functions in human body. It helps to maintain our body temperature. It acts as a medium for various chemical reaction in body. It helps in the metabolism of various substances in the presence of enzymes in the intracellular environment. It transports the nutrients to the cells and helps in the excretion of wastes of body. It acts as a lubricant in the joints and other internal body organs.

Carbohydrates

These are the compounds of Carbon, Hydrogen and Oxygen. They occur abundantly in all the living organisms and in almost all the cells. Cellulose of wood, cotton and paper, starch present in muscles of animals, lactose of milk and sucrose of cane are all examples of carbohydrates.

They play an important structural and functional role in living organisms. They are the primary source of energy for the cell. Wheat, rice, pulses, sugarcane, potato and beat are major sources.

Fats and Oils

Lipids are classified as fats and oils. Fats are solid while oils are liquids at room temperature. Fats are obtained from animals while oils are produced from plants. The lipids are formed by the chemical combination of fatty acids with glycerol. Butter, cream, com oil, ghee are the examples of lipids.

Fats provide a large amount of energy to our body as compared to carbohydrates and proteins. They provide the body with fat soluble vitamins. They accumulate below the skin and help to conserve the body heat. In addition they also protect the vital organs of our body such as heart, liver, kidney from mechanical injuries.

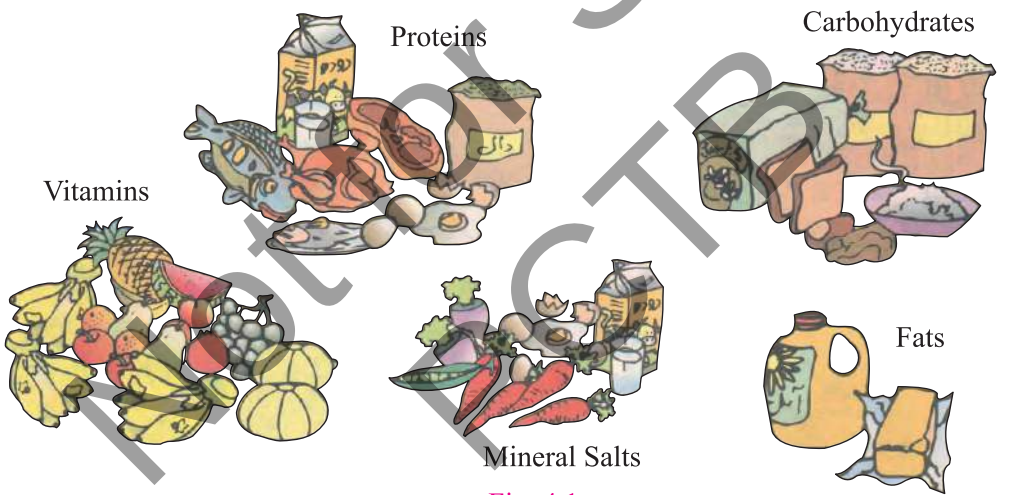


Fig. 4.1

Proteins

After water, the proteins are the most abundant of all the chemical substances in the body. The muscles, tissues and blood all are made up of proteins. They perform such important functions in body which would otherwise be impossible to occur. These are the large complex molecules made up by the condensation of amino acids that are the building blocks of proteins molecules.

They can be obtained from both plants and animals. Milk, egg, meat, fish are the animal sources of proteins whereas wheat, beans, pulses etc are its botanical sources.

All the proteins are made up of twenty different types of amino acids.

Proteins act as enzymes to catalyze various chemical reactions of the body. They act as hormone and bring about coordination in various physiological activities of the body.

They defend the body against various diseases by producing antibodies and so induce an immune response. They also help in transporting various materials from one part of the body to

the other e.g. hemoglobin.

Vitamins

These are the organic substances which are needed in the body in fractions only. They act as coenzymes in most of chemical reactions in the body. The body cannot grow normally if they are not taken in regularly. They can be divided into two groups.

1. Fat Soluble Vitamins (A,D,E,K) 2. Water Soluble Vitamins (B,C)

Fat Soluble Vitamins

Vitamin A: It is found in abundance in the green leafy vegetables. It is present in large concentration in carrot, spinach, pea, cabbage and tomatoes. In addition, it is also present in wheat, corn, cream, butter, cod liver oil and liver of other animals. It helps to control the cellular metabolism and body growth. Vitamin A deficiency results in night blindness. The patients suffering from this disease are unable to see at night. Its deficiency also retards the growth in children. It may also cause various skin and dental diseases.

Vitamin D: Sun is the cheapest source of this vitamin. Human skin has the ability to synthesize this vitamin in the presence of sunlight. In addition, It may also be obtained from fish liver oil, milk butter, cream and egg yolk. Presence of proper amount of this vitamin in our daily diet promotes bone formation and calcium absorption in our body. Its deficiency results in softening, weakening and deforming of bones. Its deficiency in childhood causes rickets while in adulthood its deficiency results in osteomalacia.

Vitamin E: This vitamin can be obtained from seeds, wheat and egg. It can also be obtained from green leafy vegetables. Deficiency of vitamin E in the blood leads to serious muscular and nervous disorders. Its deficiency may also lead to infertility.

Vitamin K: It can be obtained from spinach and other green leafy vegetables. It is also found in meat in small quantities. This vitamin is helpful in blood clotting.

Deficiency of vitamin K slows down the blood clotting mechanism.

Water Soluble Vitamins

Vitamin B: Vitamin B is the name of a group of various chemical compounds that is why it is known as vitamin B complex. It includes such vitamins as B_1, B_2, B_6 and B_{12}.

Vitamin B_1: It can be obtained from wheat. It is also present in vegetables, almond and pistachu Its deficiency in diet leads to weakness of muscles causing a disease known as beriberi.

Vitamin B_2: It can be obtained from diets full of cream butter, eggs and milk. Other than this they are found in liver, heart and kidney in large quantities. It is also found in meat and wheat. Deficiency of this vitamin leads to deficiency of blood causing a disease known as pernicious anemia. This vitamin is also needed for better digestion and proper functioning of nervous system. It also helps to synthesize hemoglobin. Deficiency of vitamin B_2 affects the growth of the children.

Vitamin B_{12}: It is obtained from milk, eggs and liver.

Vitamin C: It can be obtained from fresh citrus fruits like oranges, grape fruit and lemon. In addition it can also be obtained from banana, guava and other fruits. It is also found in tomatoes and other vegetables. Vitamin C deficiency lead to a disease known as scurvy.

Mineral Salts

In addition to organic compounds, our body also requires some inorganic compounds to maintain its proper functioning. These inorganic compounds are obtained from mineral elements present in our food and include calcium, iron, iodine, fluorine, magnesium and phosphorus. They perform a number of important functions in our body. Some of their functions are described below:

1. **Calcium** plays a vital role in blood clotting, transmission of impulses, contraction and relaxation of muscles and formation of bones.
2. **Iron** is a part of hemoglobin which is a transport protein and helps in the transport of oxygen to all the body cells. Deficiency of iron leads to anemia.
3. **Iodine** is required for the synthesis of thyroxine in the thyroid gland. Deficiency of it causes goiter and retards mental growth.
4. **Sodium** and **potassium** play very important role in generating nerve impulse. Sodium and chloride control different functions of body.
5. **Fluorides** are essential for healthy development of teeth.

4.2 Balanced Diet

Dietetics always emphasize to use a balanced diet but most of us are unaware of the exact definition of balanced diet. A balanced diet is one that contains well proportionate quantity of all the macro and micronutrients according to our body demands in such a way that neither any nutrient is in excess nor is deficient. A balanced diet maintains our health in such a way that we neither loose weight nor become overweight. A balanced diet varies according to the caloric needs of a person whereas the caloric needs depend on the weight, age, sex, body physiology and working condition of that person.

Diet for Infants

Milk is the best food for babies that contains all the necessary nutrients therefore breast feeding is matchless. It provides not only the nutrients but also the prepared antibodies to the infants. But if breast feeding is not possible under certain unavoidable circumstances then cow or buffalo milk can also be used. It is necessary to dilute it by adding two parts of water against one part of cow or buffalo milk. They can also be served with light solid foods such as cereals, egg yolk or boiled minced meat after fourth month of their life. Infants between 6 to 18 months should be given fruits and eggs in addition to milk.

Diet for Youngs:

They need more food as they are more active and agile. Their diet should have higher content of carbohydrate and fatty foods. As the young body is passing through rapid growth phase, they also need high protein diet. Balanced diet should strictly be administered between the age of 13-16 years. Milk and milk products should be an integral part of their food.

Diet for Old:

They require less energy than the above two categories for diminishing physical faculties. They should not use diets with higher fat contents. Instead they should take diet having moderete amount of proteins and carbohydrates.

Diet for Pregnant and Lactating Women

They need double the amount of food than an ordinary women as they have to fulfill the

requirement of the developing embryo. If they do not take a well balanced diet, the development of the body may be affected and they will be born under weight. The pregnant women should therefore, take a balanced diet with high protein profile, vitamins and minerals. Lactating women should also use milk, sugar, fats, wheat, fruits and eggs regarding so that they should fulfill energy demands of their breast-feeding offspring.

4.3 Co-ordination and Integration in Body Functions

All the living organisms are bestowed with some common characteristics. One of them is to respond the stimulus. Whether the stimuli are extrinsic or intrinsic, at cell, tissue, organ or body level. Coordination and integration in various human body functions to respond to these stimuli is of extreme importance.

The coordination and integration in human body is brought about by two systems. One of these is nervous system while the other is endocrine system. Nervous system consists of brain, spinal cord and two types of nerves. These nerves interpret the internal and external stimuli and show suitable response. In addition to showing response they also coordinate between different organs. Endocrine system comprises of ductless glands which secrete secretions known as hormones. These glands also receive the internal and external stimuli through nervous system and secrete hormones. These hormones are helpful in coordinating the functions of different organs and also show response. The hormones are the chemical messengers that are transported from their site of synthesis to their site of action through blood and bring about coordination in body functions.

Endocrine glands

Following endocrine glands are present in our body.

Pituitary Gland

It is a small gland equal to the size of pea. It is attached to the brain. As this gland controls the activities of all other glands, it is also known as “Master gland”. This gland controls the growth and many activities of the body.

Thyroid Gland

It is situated in the neck region on the front of trachea. It secretes two types of hormones. The hormone thyroxine needs iodine for its secretion. These hormones bring normal body growth and control calcium level in blood. The deficiency of iodine causes thyroid to increase in size than normal and results in goiter.

Adrenal Glands

These glands are in the form of a pair, each member lying above the upper end of kidney. Both parts secrete different hormones. The hormones of adrenal cortex control glucose level in the blood and maintain balance in the sodium and water concentration in the body. The hormones of adrenal medulla control the involuntary actions of the body. They prepare the human body to face emergency situations like fear, light or sorrow. They increase heart beat and metabolic rate of human body.

Pancreas

Pancreas is a long, soft and leaf like organ present below the stomach at the junction of lower end of stomach and small intestine. It synthesizes two hormones: the insulin and glucagon. Both these hormones function antagonistically to control the sugar level while glucagon works in an opposite manner and increases the blood sugar level. Under secretion of insulin causes diabetes in human.

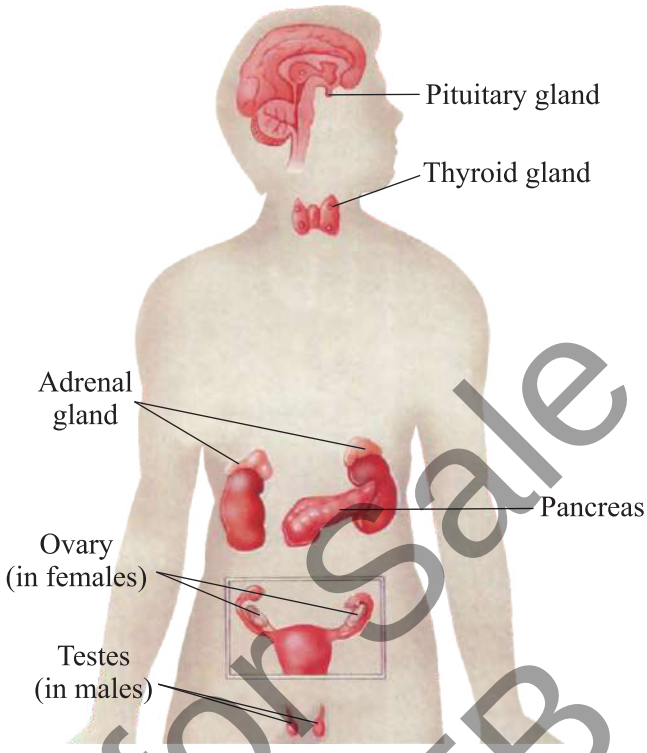


Fig. 4.2: Various endocrine glands

Gonads

The sex organs are called as gonads. The hormones of **testes** are responsible for the development of male sex organs and secondary male sex characters. For example increase in size of larynx and change of voice in body. In addition they also play a role in the appearance of hairs on the face and body.

The hormones of **ovary** are responsible for the development of female sex organs and secondary female sex characters.

4.4 Exercise and Health

Whether you are doing exercise alone or in group, it is always a happy experience. Exercise maintains the elasticity of the body and due to this elasticity the muscles and joints never get strained. When the muscles are strong, a person can perform tough physical jobs. Strong muscles not only help to perform strenuous physical tasks but also provide support to our bones and joints.

People who do not take exercise are unable to burn their excess fat energy that accumulates in their body. Such people become obese. Exercise is the only way to save yourself from obesity as it helps to burn all the supply of energy.

Every one can take exercise, even the people suffering from heart disease and diabetes can take exercise after consulting their physician.

We are Muslims . We are naturally benefitted by our prayers both physically and spiritually. Prayer is also a light exercise during which almost all the muscles of the body move.

During prayer the metabolism of muscles increases due to their increased energy needs.

Fig. 4.3: The children doing exercise

4.5 First Aid

First aid is a help given at the place of accidents till the patients reach the hospital to save their life.

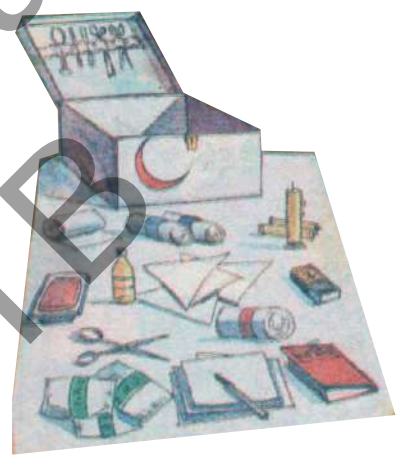


Fig. 4.4: First aid box

Animal Bite

If any animal bites or scratches the body of a person, it may be dangerous. The wound may become infected. When a kitten scratches the body of a person, the bacteria enter into his body that may cause rabies or tetanus. Sometimes the scratched or bitten part of the body may also bleed. In such cases pressure bandage should administered until it stops bleeding. This is only possible if it is a minor injury. Cover the damaged area with clean cotton or piece of cloth. Patient should immediately be taken to the hospital.

Burn

Every year thousands of people die of burning. If some part of the body burns then put off the cloths from the burnt part. Run off the tap water on burnt area. Do not administer butter, grease, oil, tooth paste, egg or any cosmetic powder on the burnt area. In case of severe injury rush to the nearest hospital.

Fig. 4.5: Run off the tap water on burnt area

Eye Injury

Ordinary irritation in the eye stops by washing it in clean tap water. If sand or dust particle enters in the eye do not rub it as it may injure the upper protective covering of the eye. Eye should be washed carefully to remove the dust or sand particle. If this cannot be done by yourself take the help of some first-aider who should first of all clean his own hands. He should open the eye of the patient to have a close look in it. Take the patient to wash basin and wash the eye carefully by opening the eye lids so that the particle or hair is removed. If the dust or sand particle still persists and irritation continues, the patient should be taken to the hospital.

Coma

The state of coma can be very seriously dangerous in the life of a patient in two ways. During coma, the tongue may stick to the palate resulting to suffocation or heart may stop functioning. So in coma, first the breathing must be ensured. If the patient is breathing , lay it straight without any pillow below the head. Lift the legs and arms towards the head and take the patient to the hospital.

If the patient is breathless lift the chest of the patient slightly upward so that the respiratory tract may become straight. Open the mouth of the patient and remove any blood, vomiting or secretion accumulated in the mouth. Clean the mouth with your fingers or handkerchief. The respiratory pathway become clear and the patient may start breathing. If the patient is still breathless, try to breath it artificially. If breathing starts take the patient to the hospital.

Fig. 4.6: Lifting of the chest cavity if the patient is breathless

Snake Bite

If snake bites then immediately take the following steps:

1. Tie up the arm or leg tightly with some rope or cloth so that poison may not move further.
2. Wash the wound with water.
3. Lay down the patient and restrict its movement.
4. Don't try to suck the patient's blood as it may prove fatal to the first aider.
5. Let the wound bleed.
6. Take the patient to hospital as soon as possible so that some antivenome drugs should be administered.

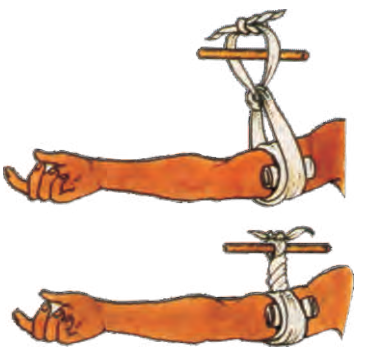


Fig. 4.7: Tie up the arm tightly in case of snake bite

QUESTIONS

Q1. Fill in the blanks

(i) The most abundant naturally occurring carbohydrate of the world is _____ .
(ii) Fats and oils are formed by chemical combination of fatty acids with _____ .
(iii) Deficiency of vitamin _____ causes night blindness.
(iv) Goiter is caused by the deficiency of _____ .
(v) Insulin and _____ are formed in pancreas.
(vi) Rabies is caused by _____ bite.

Q. 2 Place (✓) in front of correct statement and (✗) in front of wrong statement.

(i) Glucose is the building block of proteins.
(ii) Vitamin A is a fat soluble vitamin
(iii) Rickets is caused by vitamin C deficiency.
(iv) Thyroxin hormone is secreted by parathyroid gland.

Q3. Encircle the correct answer from multiple choices

(i) The compound which is required in very small amount is
(a) Carbohydrate (b) Proteins (c) Fats (d) Vitamins

(ii) The amount of energy gained from one gram of fats is
(a) 9.3 Kcal (b) 18 Kcal (c) 27 Kcal (d) 36 Kcal

(iii) The disease which is caused in children due to vitamin D deficiency is
(a) Scurvy (b) T.B. (c) Rickets (d) Anaemia

(iv) The hormone which controls involuntary action of body is
(a) Thyroxin (b) Epinephrine (c) Adrenal (d) Insulin

(v) The disease caused by deficiency of iodine is
(a) Goiter (b) Night blindness (c) Malaria (d) Cough

Q4. Short Questions:

(i) What are the basic components of food?
(ii) What is the role of vitamin B in body?
(iii) What is the role of iron in the body?
(iv) Which disease is caused by dog bite?
(v) What is the role of insulin?

Q5. Write a note on important components of food.
Q6. What do you know about protein?
Q7. What are vitamins? Describe them in detail.
Q8. What is balanced diet?Describe the balanced diet for various people of our society.
Q9. Why exercise is important for health?
Q10. Discuss the role of various endocrine glands in our body.

5 DISEASES - CAUSE AND PREVENTION

In this chapter you will learn:

- Diseases caused by viruses, bacteria, parasites and fungi, their spread and their preventive measures.
- Spread of microorganisms through air, contact, faeces, animals and skin abrasions and wounds.
- Preventive measures against microbial diseases.
- Diseases caused by smoke and smoking.
- Mental diseases and their treatment .
- Differentiation between drugs, medicines and addiction, their uses, abuses and effects on society.

Microorganisms are the living cells which are present all the time around us in the environment such as earth, air, water. All the infectious diseases are caused by microscopic bacteria and viruses. These organisms are of different shapes and sizes. Nevertheless some disease producing organisms can be seen by human eye, such as intestinal worms etc. The fungus look like plants but they have no roots, stems and leaves and these can also cause many diseases.

5.1 Diseases Caused by Germs

Virus, bacteria, fungus and worms can cause many diseases.

Viral Diseases

Small pox

It is an acute infectious disease. Now this virus is non-existent in the world as an

Dengue Fever

It is caused by Dengue Virus. Dengue Fever is also know as Break Bone Fever due to severe joint pain. Detail is given on page 176

infectious agent but it is kept in the laboratory for further experiments in South Africa, Russia, Great Britain and America (USA). The common symptoms of this disease are acute fever, headache, backache, vomiting and fits which occur often in children. On third or fourth days of fever spots may occur on arms and legs.

This virus may affect both sexes at all ages. One attack of smallpox may produce immunity for whole life and second attack is very rare. The virus spreads by the coughing, sneezing, talking to the patient and thus enters the respiratory tract of the healthy people.

Poliomyelitis

Polio is an infectious viral disease. Poliomyelitis is very common in the children below 2 years of age. It is primarily an infection of the human alimentary tract, the virus gains entry by the

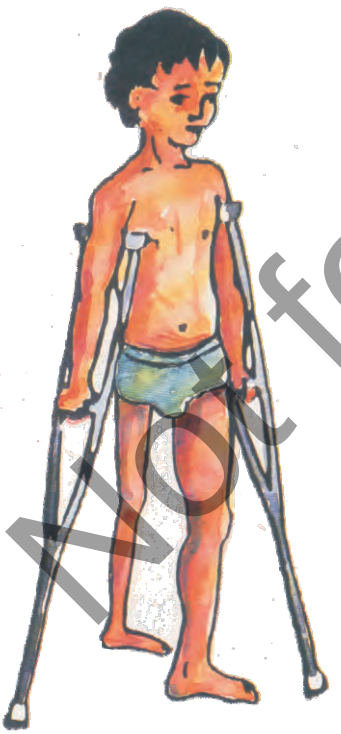


Fig. 5.1: The effects of polio

Polio Day

Give your children the drops of polio till 5 years of age to save them from this disease.

Fig. 5.2: Preventive measure against polio

eatables and water. It may affect the central nervous system resulting in varying degrees of paralysis. The patient feel cold and fever, vomiting and pain of muscles. Often paralysis does not occur but if the infection is severe then paralysis of any part may occur. Poliomyelitis may paralyse one or both legs which causes weakness and retards the growth of the limb. Once paralysis of poliomyelitis occurs then no medicine can cure it. Antibiotic are also of no help. The child who is paralyzed by poliomyelitis, should be given balanced diet to promote defence system of his body. He should do regular exercise and

physiotherapy to strengthen the other muscles of the body. During the first year of the disease some improvement is expected.

The sick child should be isolated, from other children in a separate room. Polio vaccine is the main protective method available. The expanded programme on immunization in Pakistan is a milestone in polio vaccination.

Influenza or Flue

Influenza virus is of three types, type A, type B and type C influenza virus, but type A and type B are more dangerous.

The main symptoms of influenza are sore throat, fever, cough, watery nose, watery eyes, headache, and muscular cramps. After a minor work the patient gets tired.

The virus spreads by droplets released by coughing, sneezing and even talking to the patient in the air and inhalation of the same viruses in the droplets by the healthy people. The hand kerchief, towels and other articles in patients use also play an important role in the spread of influenza. Influenza is a notifiable disease to the health department. This disease is prevented by vaccination.

AIDS (Acquired Immune Deficiency Syndrome)

The AIDS virus is present in the blood and in the secretions of the sex organs of the patient. The virus is also present in saliva (secretion of mouth), tears (secretion of eyes) urine and in the sweat of the patient. The HIV virus spreads by the transfusion of blood or blood products, donated by an AIDS patient to a healthy recipient.

The early symptom is as simple as minor flue and then the man is free for any symptoms for months and years. Slowly he develops the apparent AIDS symptoms. There is a rapid loss of weight of the affected person, and loose motion may persist for a month or so. Fever, cough and pneumonia may develop. Some depigmented areas may develop on the skin.

The preventive measures of AIDS are to obey the laws of Quran. Always use disposable syringes. HIV screening of blood must be done before donating the blood.

Hepatitis

Hepatitis is the inflammation of the liver. The hepatitis virus is of many different types and similarly are the types of hepatitis. The main types of hepatitis are:

Hepatitis A: Hepatitis A is caused by HAV (Hepatitis A Virus). The main symptoms of Hepatitis A are anorexia (loss of hunger), nausea, and inflammation of the liver and later on jaundice. The hepatitis A virus is discharged in the faeces of the patient and spreads to others by water, food and milk. Usually one attack may develop life long immunity.

There is no vaccine against hepatitis A. The main protective measures include prevention of adulteration of food and milk. Also HAV screening of blood should be done before donating the blood.

Hepatitis B: Hepatitis B, which is caused by a dangerous HBV is a dreadly disease with a high mortality rate.

Hepatitis B-virus spreads by infected blood, tears, sweat, and other body fluids of an infected person to other healthy individuals. The severity of the problem can be judged by the fact that in Pakistan one person out of every ten people is a carrier of Hepatitis B virus. Carrier is a person who is apparently looking healthy and is harbouring the disease organisms in his body, but he spreads the disease in the community. The only prevention against this disease is vaccination. Two injections of Hepatitis B vaccine are given with one month interval each, and a booster injection is given at six months interval of the first dose. The hepatitis B patient should take rest and use excess amount of water and juices. Sugar cane juice is very useful. More and more juices should be given if the patient is unable to eat food, but if he can eat food then balanced diet should be given to him. Beans, meat, poultry and boiled eggs are best for this purpose.

Hepatitis C: This disease produces inflammation of the liver. It is caused by hepatitis C virus. It is more prevalent from 20-39 years age group.

Hepatitis C virus predominantly spreads through transfusion of infected blood, repeated use of syringes and needles and accidental needle prick in the laboratory workers. Loss of appetite, vomiting, fatigue, weakness, joint pain and fever are the main symptoms of this disease.

Hepatitis C patient should be isolated. No vaccine is available against this disease. Immediately destroy the blood and other body fluids of the patient, such as sputum and urine. Wash hands thoroughly with soap after attending the patient.

Bacterial Diseases

These are the diseases caused by bacteria.

Tuberculosis (TB)

It is a chronic disease of long duration. Tuberculosis is a treatable disease, even then hundreds and thousands people die due to it. Tuberculosis should be diagnosed and treated in early stages. This disease involves mainly the lungs but it can affect any organ of the body. The patient should be given well balanced diet as a routine.

Fig. 5.3: The effects of TB

All the people living with a T.B patient should be screened for tuberculosis. The children

should be vaccinated against tuberculosis. The patient should be isolated from healthy children. The T B patient should cover his mouth during coughing and should not spit on the floor because when a T B patient cough, sneeze or spit very minute droplets of salvia are discharged in the atmosphere which contain millions of germs of tuberculosis. These mycobacteria get entry through the air into the lungs of healthy people during respiration and cause tuberculosis.

T B is a dangerous and rapidly spreading infectious disease. It can be prevented by B C G vaccination given at birth.

The main symptoms include over one month continuous cough, bloody sputum, continuous fever, night sweating , loss of appetite, loss of weight and feeling of tiredness after a little work.

Whooping cough

Whooping cough is basically a disease of the young children. Its incidence is higher below 5 years of age and it is more fatal in female children than the male children. Its other symptoms are mild fever, throat irritation, severe cough accompanied by loud crowing voice. If it is not treated in time, it leads to pneumonia.

Fig. 5.4: Spreading of whooping cough

Diphtheria

The disease starts with flue, fever, headache and sore throat. The bacteria attack the mucus membrane of the throat and nose and produces inflammation of the membrane and changes its colour to dark brown. It may cause swelling of the neck. The breath of the child become foul smelling.

The diphtheria germs may affect the cardiac muscles, cause their weakness which may result in death of the patient. Diphtheria is an air borne disease affecting other healthy people.

The patient should use plenty of liquid diet. He should be isolated from other healthy children and first aid be provided immediately. He must gargle with light warm salt water. Steam inhalation is also recommended. The child should be shifted immediately to hospital if suffocation occurs.

Diphtheria is a fatal disease. It can be prevented through D P T vaccination.

Tetanus

Tetanus is an acute disease. Their germs remain alive in the dust, faeces of the man and animals. If a person is injured in a roadside accident, these germs enter the wound and produce toxins. There is also danger of tetanus if an animal like cat, dog, etc. bites a person.

All the body muscles become stiff and remain stiff during the whole course of disease and then severe jerking movements occur in the muscles. This causes severe pain to the patient. The stiffness of the mouth muscles cause closing of the mouth, which is called **lock-jaw**. There is a difficulty in swallowing food. Later on muscles of the neck become stiff. There are severe fits and if the patient is touched the muscles again go into spasm as in fits. Tetanus injection should be given if a person gets injury.

Fig. 5.5: The effects of tetanus

The D.P.T vaccination save the child from tetanus.

Typhoid

The bacteria responsible for typhoid remain alive in the human body. The patient or the carriers of typhoid excrete the bacteria in their faeces. When these bacteria mix with food, water, milk, etc., is transmitted through a man or fly then any person consuming these items may also ingest these germs which causes typhoid fever in that person. This disease is manifested by headache and fever of long duration. Usually typhoid fever is common in 10-30 years of age group and more in the rainy season and flies are important for its spread. Typhoid fever may occur by drinking the polluted water or by taking contaminated food.

Some preventive measures of typhoid are to drink boiled cool water, thorough washing of fruits and vegetables in plenty of clean water, cover milk and milk products. Do not eat stale food, avoid from ice creams and ice balls. Screen the houses and shops from the flies. Protect all age groups by vaccination as one injection may protect for 3 years.

Interesting Information

The germs of typhoid multiply and grow rapidly in milk without changing its taste and colour.

Parasitic Diseases

Malaria

Malaria is caused by a parasite called *Plasmodium*, which is transmitted by the bite of female *Anopheles* mosquito. The first symptom of malaria is feeling of chill and then the temperature rises upto 104° F . The size of spleen can increase if there is chronic fever. In the

third stage the patient perspire and temperature decreases. In Pakistan malaria occurs between July to November. The most important step in 61controlling malaria is to kill the mosquito. It is done by spraying insecticides in the houses and filling of ponds and other breeding places. Crude oil is sprayed on the surface of water which kills the mosquitoes and their larvae. During night mosquito repellant oil should be used on the exposed parts of the body, use mosquito nets during night and lastly use chloroquinine for the protection against malaria.

The doors, windows, ventilators should be screened by net to prevent the entrance of the mosquitoes. The ponds around the houses should be filled with soil to cut down their breeding places while on other ponds, used mobile oil is spread so that the mosquitoes do not lay their eggs. Insecticides should be sprayed in the houses. During spray all the household things should be taken out and for the next 2 months the rooms should not be white washed.

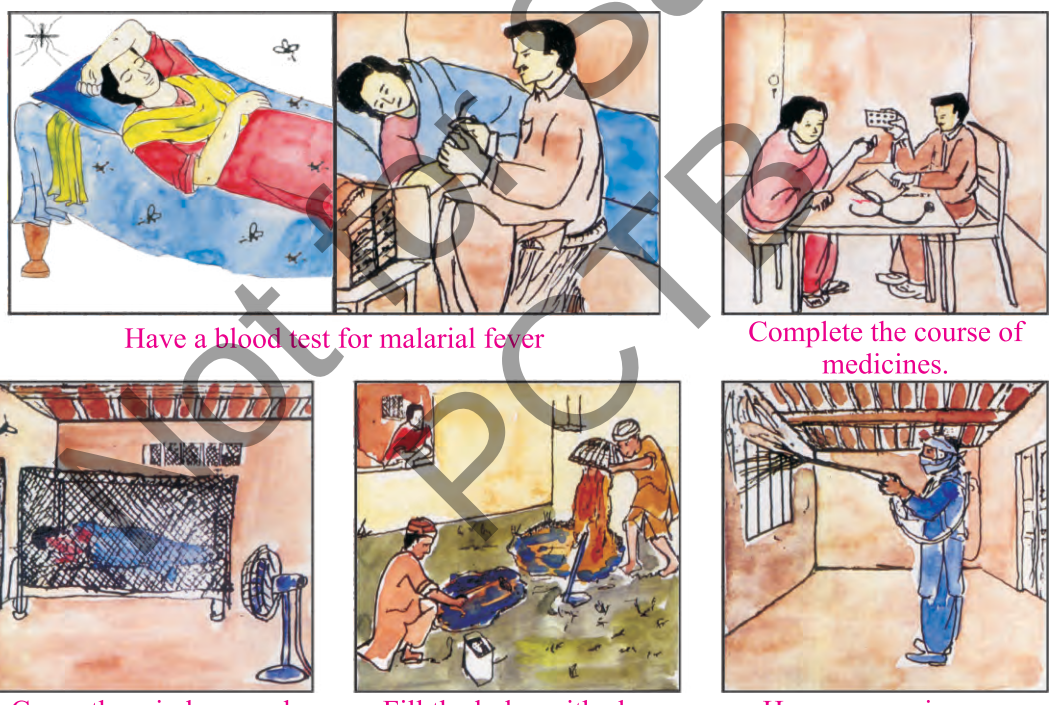


Fig. 5.6: The preventive measures against malaria

Round worm

Round worm is the common name of *Ascaris lumbricoides*. The worm is about 20 centimetre to 30 centimetre long and is pink in colour. The worm is clinically manifested by symptoms of nausea, vomiting, gastritis and cough. The live worms may pass through the faeces or may be vomited out.

These worms live in human intestine and move freely there. Their eggs are discharged through faeces in the soil and become infective in 2-3 weeks. On ingestion by man these embroynated eggs hatch in the small intestine. These eggs hatch and larvae are released in the small intestinal wall and are carried to the liver and lungs via the blood stream. The larvae are coughed up through the wind pipe and then swallowed by the man into the stomach and then into small intestine. On reaching the intestine, they become mature. The life span of an adult is between 6-12 months.

Fig. 5.7: Ascaris

The infection rates are high in children than the adult, and children are the most important source of spread of the worms. They contribute to malnutrition especially in children who may show growth retardation. The onward transmission of the worms may be accomplished by strictly implementing the primary hygienic principles.

Water should be boiled before use. The salad, vegetables and fruits should be thoroughly washed before eating. Hand should be washed before and after eating and before cooking of food. The food should be covered from the flies and dust.

Thread worms

The thread worms are small, thread like measuring one centimetre in length. They are white in colour. These lay eggs around the anus in thousands. They cause an irritation especially during night. Due to unhygienic conditions these eggs pass in the faeces of one person and are ingested by another. The eggs may also be spread through affected persons nails. This cause the onward transmission of the threadworm in other children by the ingestion of eggs. The eggs mature in the intestine and hatch in larvae which transform into adults in the intestine.

The thread worms are not dangerous but due to anal irritation these disturb the child during sleep. The anal area of the child should be washed thoroughly early in the morning and after each defecation. Hand and nails be washed properly with soap. The clothes of the child should be changed and washed properly and dried up in the sun. The important preventive step against thread worms is personal hygiene of the child.

5.2 Agents Spreading the Germs

The germs spread by different ways as air, water, and animals etc.

Air

Those diseases which spread by inhalation of microorganisms in the air through

respiratory track are called "Air Borne" diseases. When a patient of such diseases talks, coughs, laughs or sneezes then thousands of droplets of the secretions of mouth and nose are expelled in the air and remain suspended for some time. The microorganisms also remain suspended along with these droplets and gain entry through the mucous membrane of the respiratory tract during respiration in other healthy people around. Some air borne diseases are flue, measles, whooping cough, and tuberculosis. These diseases spread more rapidly if the patient coughs and spits openly in over crowding and poor ventilation.

Touch

The germs spread from a patient to other healthy people by either direct or indirect contact. The disease producing germs may affect other healthy person by direct touch of his skin as in scabies. In the indirect method the germs spreads by touching the different items of his use such as clothes, bedding and utensils etc.

Faeces

The organisms passed out through faeces and spread disease via soil, food, water and hands. The faeco oral diseases are diarrhoea, polio, hepatitis, typhoid and worms.

Animals

The disease producing germs may spread in the humans by animal bites through saliva as rabies spread by the bite of dog which transmits the rabies virus into the human blood. The malaria is also transmitted through the mosquito bite.

Fig. 5.8: Animal bite

Scratches and Cuts

The germs get entry into the human body through wounds and scratches. For example in a new born when the umbilical cord is cut with an infected knife or blade, through burn skins, wounds of animal bite, and infected nail may spread the disease producing germs through the wounds.

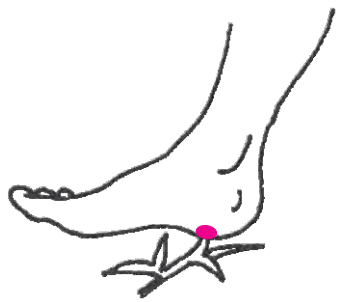


Fig. 5.9: Scratch by thorn

Water

Water is a great gift of God. Water is a basic constituent of health and human body. Every drop of water is a life for man.

The untreated water discharged by factories, domestic used water mixed with phenyl and acid, insecticides used in crops, and use of fertilizers may pollute the water. This causes many diseases in human body e.g. typhoid, cholera, heart diseases, liver, intestinal diseases and kidney problems.

5.3 Harmful Effects of Smoke and Smoking

Some people chew the tobacco while other use it in cigarettes. Tobacco smoke consists of many chemical substances. Nicotine, tar and carbon monoxide are the most important chemical substances. Nicotine is a very poisonous chemical compound which causes addiction and which makes difficult to quit smoking in the smokers. Another most important effect of nicotine on the human body is that it causes the narrowing of the blood vessels which hinders the blood supply to all the organs of the body.

Tar is a gelatinous material which collects around the lung tissues and the function of the lung is affected. Tar also causes lung cancer.

Carbon monoxide present in the cigarette smoke combines with the haemoglobin of the blood and reduces the oxygen content of the blood. Because all the tissues of the body require oxygen for their proper function, just to compensate the low oxygen supply, the heart has to work more, which causes more burden on the cardiac muscles. These are some of the reasons, that smokers have more incidence of heart diseases than the non-smokers.

Man is making progress in industries. The population of the world is also increasing at a rapid pace. Along with the human activities, the amount of smoke is also increasing in the atmosphere, by industrial and domestic activities. The smoke consists of carbon monoxide, chloroflourocarbon, (CFC's) oxides of nitrogen and sulphur.

This smoke collects below the ozone layer and by increasing its thickness. It causes rise in temperature of atmosphere of earth and that changes the climate. Sometime these gases in smoke start eating ozone and produce holes in ozone layer. These holes in ozone layer cause genetic mutations in the man, plants and animals. It also increases the incidence of skin cancers in the humans.

Respiratory Diseases due to Smoking

Cigarette smoke causes the inflammation of the bronchi, bronchioles and the lungs which is the main reason of cough and sputum. The inflammation of the wind pipe (trachea) and bronchi is called bronchitis. The smoking damages the air sacs in the lungs. This reduces the oxygen exchange in the blood. The patient has to breathe faster to compensate this if causing damage to him. This disease is called emphysema.

Heart Diseases due to Smoking

Smoking predisposes to heart attacks, hypertension and other heart ailments which are the main cause of death in smokers. The blood vessels including arteries and arterioles become narrow and especially the coronary arteries of the heart are more affected. This increases the heart attack chances more.

Skin Diseases Caused by Smoking

Most common skin disease is skin allergy. The skin colour also changes because of low oxygen content in the blood. The skin wrinkles and aging symptoms begin to appear.

It is our duty to make free our society from smoking.

5.4 Mental Diseases

Psychosis and neurosis are the important mental diseases. The detailed description of these ailments is as under.

Psychosis

Delerium and depression are common diseases of psychosis.

Delerium

This disease appears acutely and is caused by addiction of certain diseases, electrolyte imbalance in the body and oxygen deficiency. The main signs and symptoms of the disease are incoherent speech, fits, rapid movements of the eyes, double vision. Insomnia, anxiety, stupor, sightedness, and fear from people. There should be counselling to patients that they should trust on other people.

Depression

In this disease a person is always in tension and in low spirit. Mostly the person is depressed in early morning. The patient's thinking and decision making power is reduced. He is under the influence of inferiority complex and self blaming. The patient complains the loss of sleep (insomnia), loss of appetite and thus he loses his weight. He also suffer from headache and back pain. It is recommended that all his business and domestic responsibilities be cancelled and through counselling his life pattern should be made better.

Neurosis

In neurosis hysteria and phobia are noteworthy.

Hysteria

The females are more prone to this disease. During the hysterical fit a patient may experience blindness, deafness, headache, ringing in the ears, stammering, paralysis, and fits etc. The patient may refuse to eat due to loss of appetite. The patient should be counselled for longer periods and encouraged to talk more about his problems. Try to solve his/her problems otherwise the same attack may recur.

Phobia

In this disease the patient feels undue fear from any place or person or things like bus, open space etc. The patient starts avoiding from that place or thing. Consult the doctor for his treatment.

past. He becomes negative particularly about his future. His decision making power also decreases and he starts forgetting the things. If these symptoms persist then he can try for suicide.

5.5 Drugs and their Effects

Drug is usually any type of medicine which is used to treat the disease. These are used to relieve pain to prevent diseases and to save the life. Some drugs are used for protection from diseases, and are called vaccines. The vaccines produce antibodies in the body and these antibodies protect our bodies from many diseases. As for example if a child is given injection of measles vaccine, he is protected from measles because vaccine produces antibodies against measles virus.

Many people think it as unlawful drugs which produce sleep. In fact there are the drugs which are harmful and dangerous for the users and it is also unlawful to keep them and to trade. Almost all types either lawful or unlawful drugs are dangerous to some extent, but people have to use drugs to treat the disease and to relieve the pain.

Medicines

The drugs which are used according to the prescription of doctor and in suitable amount for treatment of disease are called **medicines**.

Pain killers

These are those medicines which remove headache. Examples are aspirin and paracetamol.

Narcotics

Those drugs which relieve pain, promote sleep, produce addiction are called **narcotics** e.g. opium, morphine. The unlawful drugs which cause addiction, their danger lies in the fact that these drugs produce addiction in the user and then he is unable to leave the drugs. His will power ends and at last he reaches that point where he neglects his official duties, family life, self respect, honour and dignity and he indulges in theft and even murder to get addiction. The addiction of drugs are of the following categories.

Sedatives

Those drugs which cause sedation are called sedatives e.g. diazepam, lorazepam etc.

Hallucinogens

Those substances which disrupts the brain function to the extent that the person is unable to recognize time, place, sound, colour and vision are called hallucinogens e.g. cannabis.

QUESTIONS

Q1. Fill in the blanks:

(i) Bacteria can be seen by a _____

(ii) E.P.I. stands for _____

(iii) The AIDS virus is called _____

(iv) Hepatitus virus spread by faeco _____ route through food and water.

(v) B.C.G injection protects from _____

Q2. Put (✓) against right statements and (✗) against wrong statements.

(i) Polio virus affects the nervous system.

(ii) Antibiotic drugs are used against the viral diseases.

(iii) Tuberculosis is a non treatable disease.

(iv) AIDS is not an infectious disease.

(v) Cigarette smoker remains protected from lung and heart diseases.

Q3. Select and encircle the right answer

(i) The drinks which can be used more in hepatitis are

(a) Water (b) Sugarcane juice

(c) Juices (d) All

(ii) The age of the child in which he is given first injection of BCG is

(a) First month (b) At Birth

(c) Third month (d) Ninth month

(iii) The chemical present in smoke of cigarette which makes the person addict is

(a) Tar (b) Nicotine

(c) Carbon monoxide (d) Nitrogen dioxide

Q4. Short Questions

(i) What is the name of AIDS virus?

(ii) In which diseases DPT injection gives immunity to the body?

(iii) How does the malaria spread?

(iv) Write the name of different agents causing diseases?

Q5. How does the AIDS spread? Write its preventive measures?

Q6. Write different methods to prevent from malaria?

Q7. What are the effects of smoke and smoking?

Q8. Briefly describe some of the mental diseases.

6 ENVIRONMENT AND NATURAL RESOURCES

In this chapter, you will learn about

- Depletion of ozone layer and its effects on earth.
- Absorption and reflection of energy on earth and green house effect.
- Climatic changes due to human activities.
- Types of pollution and their impact on human life.
- Use and conservation of minerals and fossil fuels.
- Crops of Pakistan, mechanized farming and modern trends in agriculture.
- Development of dairy and poultry farming.
- Wildlife, national parks and conservation of wildlife.
- Effects of over population on environment, poverty and quality of life.

6.1 Depletion of Ozone Layer

Ozone is a gas present in the upper stratosphere. It forms a protective covering around the earth, which prevents UV-radiations from reaching the earth.

Certain chemicals are released from refrigerator, air conditioners, spray cans and factories manufacturing packing foams. These chemicals are called chlorofluorocarbons (CFCs). CFCs react with ozone causing its depletion and thinning of ozone layer. Consequently greater number of UV-radiations reach the earth. These radiations may cause cancer and eye diseases.

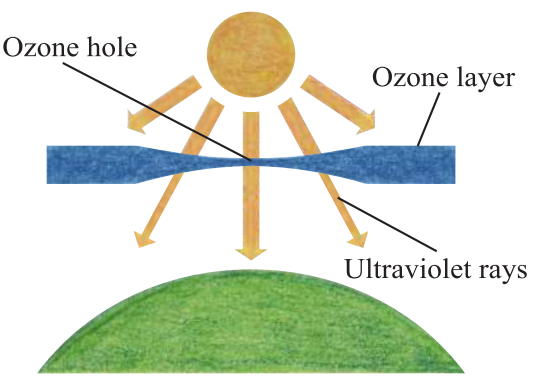


Fig. 6.1: Ozone layer

The Energy Radiations and their Absorption in the Atmosphere

Sun is the biggest source of energy (light, heat). Radiations from the sun in the form of light come uninterrupted to the earth. These radiations have short wave length. On striking the earth they are absorbed and raise its temperature.

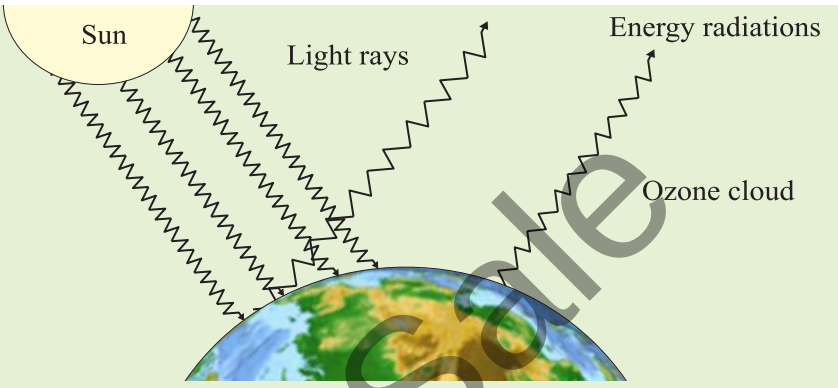


Fig. 6.2 : Energy absorption and reflection

The hot earth reflects the absorbed radiations in the form of long wave length heat radiations. Carbon dioxide and water vapour allow radiations coming from the sun to pass through. However, they prevent the reflected heat radiations from going back into the space. Thus the atmospheric temperature is maintained.

Greenhouse Effect

Greenhouse is a room made up of glass. It is used to grow plants. Solar radiations (short wave length) can enter through the glass into the greenhouse but heat waves (long wave length) cannot go out of the greenhouse. This results in higher temperature inside the greenhouse. This phenomenon is called **greenhouse effect**.

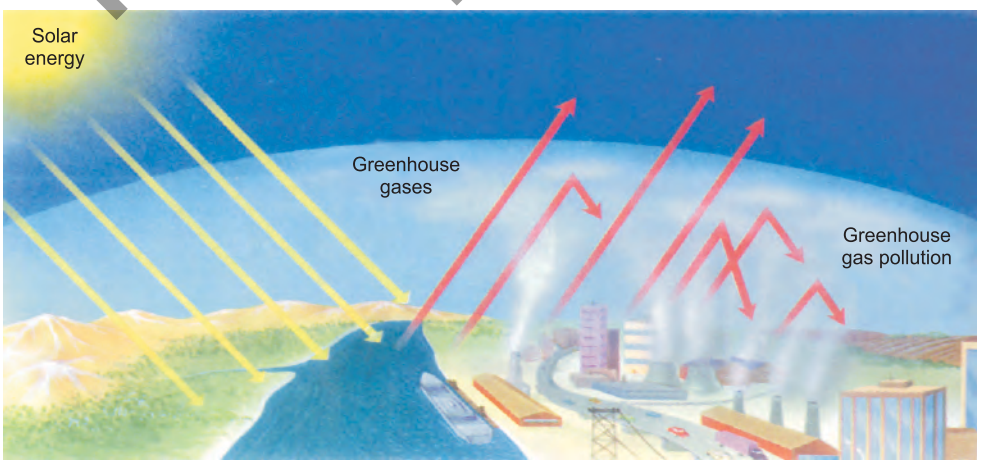


Fig. 6.3: Green house effect

Atmospheric pollution due to industrialization in modern times has increased the proportion of carbon dioxide, chloroflurocarbons and methane in air. These gases produce greenhouse effect. Because of greenhouse effect global temperature is increasing. This is called **global warming**.

Greenhouse effect and global warming have many undesirable effects. For example:

1. Earth's climate and weathers may change.
2. Melting of ice caps on poles and mountains and excessive rains may raise sea level. Many coastal areas may go under sea.

6.2 Environmental Pollution.

Pollution means, any change in the properties of air, water or land which have undesired effects on man or other living things or may have such effects in future.

Any excess or waste substance that can cause pollution is called a pollutant.

Types of Pollution

According to the part of the environment being affected pollution is categorized into three types:

1. Air or atmospheric pollution 2. Water pollution 3. Land pollution

1. Air pollution

Air is considered polluted when a change occurs in its composition or quality. This change in quality of the air is due to the addition of different gases, smoke and particles. Some important sources of these materials are:

Fig. 6.4 : Air pollution

(i) Burning of fuels in factories, vehicles and fuel driven power stations.

(ii) Materials released during the preparation of goods in the factories or coming out stacks of furnaces. For example asbestos fibres, particles of lead and zinc.

(iii) Release of chlorofluorocarbons from spray cans and during the preparation of packing foam.

(iv) Dust, chemical fertilizers and insecticides blown into the atmosphere by wind.

Effects: Air pollution affects plant, animal and human life in many ways:

Hydrocarbons, carbon monoxides, lead particles and asbestos fibres may cause cancer and respiratory and eye diseases.

Fig. 6.5: Acid rain

A brown coloured gas called nitrogen peroxide combines with some other gases in the presence of light and form a compound called smog. Smog causes lung diseases. Other than this, the things cannot be seen clearly.

Excess of carbon dioxide in the atmosphere produces green house effect. Earth's temperature is said to be rising due to the greenhouse effect. Sulphur dioxide and oxides of nitrogen in air cause acid rain, which damages plants, aquatic animals and buildings.

Fig. 6.6: The things can not be seen clearly due to smog

2. Water pollution

Water pollution is generally caused when industrial wastes, trash and sewage from cities is discharged into the water bodies like rivers, streams, ponds, lakes and oceans. Water pollution is a problem chiefly of industrialized countries but now a days many developing countries like Pakistan are also facing this problem.

Heavy metals like chromium, lead, mercury are produced as wastes in the leather, textile, plastic and other chemical factories. They get entry into the water bodies. When heavy metals and other toxic materials enter into bodies of living organisms, they may cause cancer and various other diseases.

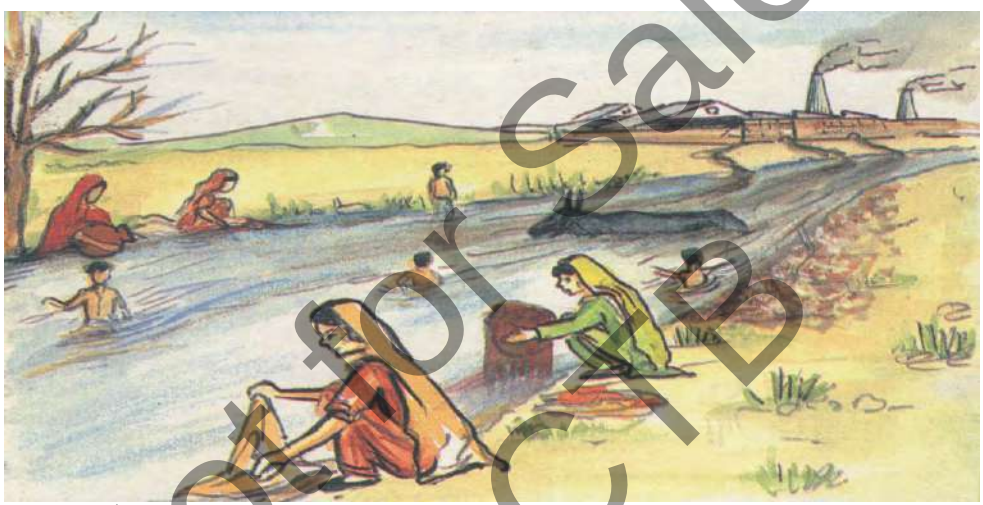


Fig. 6.7: Water pollution

Sewage and domestic wastes contain left over food, detergents and human excreta. On entering into the water bodies they increase the concentration of salts and organic matter in water. This results in the decrease of amount of oxygen in water. Consequently, aquatic life (fish and aquatic plants) is badly affected. Fishes have disappeared from Nallah Dek and river Ravi near Lahore due to water pollution.

In addition to the above effects, polluted water becomes unfit for drinking as well as for domestic and industrial use.

Disease causing germs are another serious cause of water pollution. They cause cholera, typhoid and disease due to worms of digestive tract. Especially the children are affected by these diseases.

Chemical fertilizers and pesticides sprayed on crops are washed off with rain water and enter into rivers, streams and underground water. Oil spills from oil tankers have dangerous effects on the life of marine plants and animals as they form thick layer of oil on the surface of

sea water. In July 27, 2003 a Greek oil tanker Tasman Spirit met accident near Karachi harbour and split up into two sections. About 20,000 tons of crude oil spilled into the sea, most of it reaching the Clifton beach. This oil spill badly affected coast line environment, marine life and recreational spots like Manora. Dumping of nuclear wastes into the sea or oceans may become another source of water pollution.

3. Land pollution.

Municipal trash, sewage sludge, agricultural wastes and chemicals from industries are the major sources of land pollution.

Fig. 6.8: Land pollution

Solid wastes are often disposed of either by burning in or dumping into the ground. From the environmental view point both these methods are not completely safe. Germs and toxic substances from heaps of trash enter into the environment or food by wind, water or flies. Germs and toxic substances thus carried cause a number of diseases. Waste polythene bags are not decomposed and are often seen flying in streets and open places. They also cause choking of drains.

Measures to Reduce Pollution

Pollution and environmental degradation can only be prevented if individuals, society and government feel their responsibility. Everyone should be aware of and sensitive to the environmental problems. All should play an active role in the solution of these problems.

Fig. 6.9: Recycling of the materials

Agriculture and industry are essential for economic development and better living but keeping pollution to the minimum level is also necessary, so that human beings, other organisms (Plants, Animals) and thus future generations live a healthy and happy life.

We should:

i. not throw waste articles here and there or into the water bodies. Dispose of the things properly.

ii. make minimum and only necessary use of resources. Do not waste them.

iii. prefer things that can be reused. Materials can also be recycled.

iv. prefer things which are biodegradable i.e. they can easily be decomposed into simple harmless substances by the action of microorganisms.

v. throw domestic industrial and hospital wastes into air, land or water only after treating to make them harmless.

vi. at government level, minimum environmental standard must be set and enforced. The owners of industries and factories be bound to the measures that should minimize pollution.

v. Implant more and more trees and should take care of them.

6.3 Minerals and Fossil Fuels

Development and progress of a country depends upon what type of land, water, minerals, forests and wild life etc are present there and how they are being utilized. All the things mentioned above are called resources. God has blessed Pakistan with all types of resources which are basis for the development of any nation.

Fossil Fuels

Coal, oil and gas are called fossil fuels. Energy required for transport, power generation, agriculture and industry comes mainly from these sources. They are called fossil fuels because they were formed from the remains of plants and animals of remote past, which were buried under the earth. With the passage of time they changed into coal, oil and gas due to excessive pressure and temperature in the earth.

Coal

It is one of the oldest sources for obtaining thermal (heat) power. Coal was formed millions of years ago by burying of trees and remains of plants growing in marshes. In Pakistan coal is mostly used in brick kilns. However, it is also being used in production of electricity.

Petroleum

Petroleum is a liquid fossil fuel. It is formed in shallow seas from marine plants and animal remains, which were buried under earth and changed later on into petroleum due to pressure and high temperature. Gas was also formed along with petroleum.

Petroleum is one of the most important resource in the modern times. Various products are obtained by refining crude oil pumped out from the earth. Gasoline (Petrol), diesel, furnace oil and kerosene oil all are petroleum products used as fuels in vehicles, ships, power station, industries and homes. Grease, asphalt, synthetic fibre (such as nylon, polyester), and plastic are some other petroleum products.

Natural gas

Natural gas is a mixture of different gases including methane, ethane, propane etc. Large deposits of natural gas exist in Pakistan. Natural gas, like petroleum and coal, is a major source of energy. It is used in electricity generation in power plants, production of cement and chemical fertilizers, industries and homes for heating and cooking. Many vehicles now a days are also being run on compressed natural gas.

Effects of fossil fuels on environment

Although fossil fuels are a cheap and convenient source of energy but at the same time these are creating many environmental problems. As already discussed under air pollution, burning of fossil fuel produces smoke and a number of gases, which cause environmental pollution. Large areas of fertile land, forests and natural habitats of many animals are destroyed during exploration and drilling of coal and oil.

Minerals

Minerals include those elements (e.g. gold, iron, copper) and compounds (e.g. gypsum, mica) which are found in solid state in the earth crust and are important for human use. Mostly minerals are in rock form. The rocks from which minerals can be obtained are called **ores**.

Minerals are important for us in many ways. Metals (iron, silver, copper, aluminum etc.) and non-metals (sulphur, lime stone, granite etc.) have become part of our daily life. Gypsum is used in cement and plaster making and for reclamation of saline (salt affected) soils. Chromium is obtained from chromite. In addition to making alloys chromium is used in many industries. Gemstone is source of gems and diamonds. Silicon is obtained as silica (SiO_2), which is used in glass making. Now a days silicon is used in making microprocessors of computers.

God has gifted Pakistan with great minerals wealth. Especially Balochistan is rich in minerals.

Conservation of Natural Resources (fossils fuels and minerals)

Use of natural resources is essential for industrial development, progress, prosperity and better quality of life. However, it is also a fact that fossil fuels and mineral are non-renewable resources. They are called **non-renewable resources** because either they cannot be reproduced or it takes long time to reform. For example, millions of years are needed for the formation of fossil fuels. Also, the amount of minerals on earth is limited. They may end up soon if their excessive use is continued. Resources must be conserved for future use. Measures like recycling of used materials, substitution (use of alternatives) and reuse of articles of common use may be adopted in this regard.

6.4 Agriculture and Crops of Pakistan

Food is the basic human need. It is fulfilled by agriculture as are clothing, housing and many other requirements. Increasing human population at global level demands increase in agricultural production.

Pakistan is an agricultural country. About 60 percent of its population depends directly or indirectly on agriculture. Almighty Allah has blessed Pakistan with large areas of fertile agricultural land. We also have an extensive and world's one of the best canal irrigation system. Pakistan has attained self-sufficiency in cereal foods (wheat, rice) and fruits. This has become possible because of favorable climate, application of chemical fertilizers, and insecticides, mechanized farming, and efforts of our hard working farmers. Certain cash crops, such as cotton, rice and fruits, are also being produced in substantial quantities. These cash crops are a big source of earning foreign exchange. In spite of these successes, there is still need for growing and increasing the production of some crops e.g. pulses and crops yielding edible oils.

Mechanized Farming and Production Trends

Till recently, farming in Pakistan was labour-intensive, depending mainly upon muscle power. However, since last few decades production trends have emerged in agriculture. This means that now the crops are not grown only for substantive living but also for the purpose of export sale and earning money. Mechanized farming is getting popular in order to obtain more crop yield. Irrigation by tube wells, ploughing and

Fig. 6.10: Mechanized farming

tilling of land by tractors, and the use of harvester and threshers are common practice these days.

Many disease-resistant varieties have been produced through research in agriculture. Use of chemical fertilizers and insecticides is also increasing and become popular among the farmers. All these trends have resulted in increased crop production leading to betterment in the economic and social life of our people.

On the other hand, some environmental problems have also surfaced as a consequence of these development. Canals and distributors are often not lined with bricks and so water seeps down from them. This results in rising water table. Consequently the irrigated areas are becoming victim to the twin menace of water-logging and salinity. As a result of this problem large area of fertile land has been rendered unfit for agriculture. Insecticides and fertilizer application is adding to environmental pollution. The number of insects that have become resistant to insecticides and pesticides has increased. Cultivation of the same crop year after has led to decreased soil fertility. Sustainable agriculture, which incorporates rotation of crops, conservation of soil and land, and minimum use of fertilizer is the need of the day.

6.5 Dairy and Poultry Farming

Balanced diet is a requirement for proper development and good health. Milk, butter cheese, meat and eggs are important constituents of balanced diet, these constituents are obtained from cattle (cow, buffalo and goat), chicken and fish.

Man has been raising domestic animals since ancient times. However, in recent times dairy farming, cattle farming and poultry farming is carried out on scientific principles. Using the knowledge of biology, improved varieties of cattle and chicken have been produced that give better yields of milk, meat and eggs. These animals are also raised and taken care of on scientific lines. Now a days we do not depend for fish on natural sources such as rivers and oceans, but instead fish are grown in specially built fish farms.

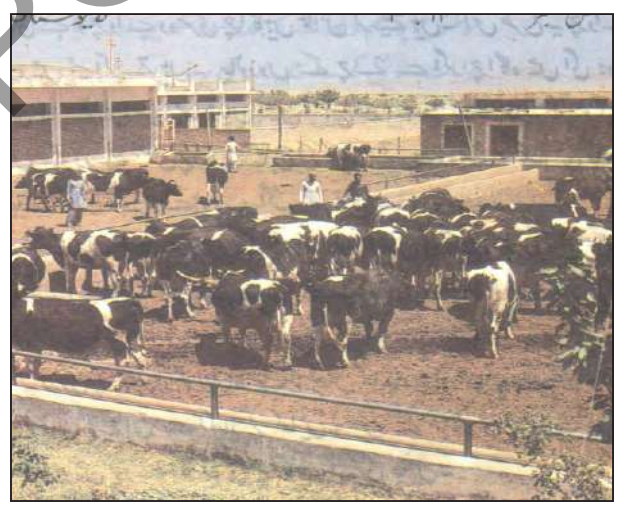


Fig. 6.11: Dairy farm

Dairy Products

Sufficient quantity of milk and butter is produced in Pakistan. However, large bulk of this milk and butter is not processed and packed properly. That is why country needs are not adequately fulfilled. Due to the application of biotechnology standard of dairy products has much improved.

Fig. 6.12 : Poultry farm

Poultry Products

Protein rich food like meat and eggs is obtained from chicken. Development of poultry farming on scientific lines has helped greatly in increasing overall production of food in the country.

Fisheries

Fish is a source of highly nutrient diet. Fish are found in streams, rivers, lakes and oceans. Rahu, thalah and trout are fishes of our fresh water streams. Their meat is very delicious and full of nutrients. Modern aquaculture techniques have led to many fold increase in fish production.

6.6 Wildlife and National Parks

All non-cultivated plants and wild (non-domesticated) animals of an area are called wild-life of that area. As wildlife is integral part of the natural environment of an area, elimination of species or decrease in its population may upset the natural balance.

Importance of Wildlife.

i. Many products obtained from wildlife are used in our homes, industry and agriculture. Food, timber and medicines are few examples.

ii. Wildlife maintains balance in nature.

iii. Wildlife satisfies our aesthetic sense. Colorful flowers and plants, forests, beautiful animals and hunting of game animals add to our happiness.

iv. Wildlife (plants and animals) of today will determine what types of plants and animals will be found in future.

Endangered Species.

About 200 species of mammals, 600 kinds of birds, 150 types of reptiles and 700

different types of fishes are found in Pakistan. Destruction of habitats as a result of human activities and over-hunting is resulting in the local extinction of many types of wildlife.

Those organisms which are threatened of extinction are called **endangered species**.

Fig. 6.13: Endangered species

Cheetah, musk dear, wild ass, alligator and red-headed gooze have disappeard before our eyes. Morcopolo sheep, Musk deer, Snow leopard, Ibex of Suleman range, Urial of Punjab, Houbara bustard, Crocodile, Indus river blind dolphin, Balochistan bear, sea Turtle and Gizzale are among the animals which are listed endangered in Pakistan.

Conservation of wildlife

Wildlife can be saved from extinction if their habitats are re-established. For this purpose certain areas are marked and specified for wildlife. Such areas are called wildlife reserves and wildlife parks.

For the sake of wildlife conservation it becomes very necessary to ban hunting of some animals or to restrict their hunting or trading. Laws exist in this regard but they need to be enforced strongly.

National Parks

Nationals Parks play an important role in the conservation of wildlife. National parks are natural areas which are kept in their original setting along with their natural plants and animals for future generation. All sort of human interference except for educational and research purpose is strictly prohibited.

Fig. 6.14: National park near Bahawalpur

6.7 Effects of Rising Population on Environment

The Population

The total number of people living in an area at a particular time is called **population**. For example in 2017, 207.68 million people, were living in Pakistan. We call it the population of Pakistan in 2017.

Fig. 6.15: Increase in population

Increase in Population

Human population at global level is fastly increasing in the modern period. It can be easily judged from the fact that population on earth has doubled during the last forty one years Population growth rate in under-developed countries is much higher than that of developed countries.

Population Growth and Balance in Nature

Resources in any ecosystem are limited. Thus, every ecosystem has a capacity to support (provide requirements of housing, food and protection) a definite number of individuals. If population exceeds the carrying capacity of an ecosystem, the population has to face problems. In case of human populations we can say that faster growth in population of an area affects the economic progress of that area. Resources come under pressure and development stops.

Population and Environmental Problems

Rising populations affect the environment in many ways. Consequently, a number of environmental problems of physical, economic and social nature arise. Basic necessities of life such as clean air, water, housing and food are not properly fulfilled. Facilities of health and education are not available for all. Inspite of all out efforts for development quality of life falls. Increase in population also produces social-cultural and moral problem. Crime, violence, uncertainty, hunger and sense of deprivation cast very negative effects on society.

Some important environmental problems are poverty; poor quality of life; pollution; degradation of land; destruction of forests; expansion of cities; migration.

People come to live in an area for the sake of better job opportunities, more health and educational facilities, and for sociopolitical reasons. This act is called **migration.** Migration from rural to urban areas leads to huge increase in city population. Consequently,

many people are forced to live in slums. The quality of life of a nation is judged by certain indicators, which are education, health, nutrition, housing and other facilities such as clean water, electricity. Due to increased population and shortage of resources, number of illiterate children is increasing day by day.

Fig. 6.16: Slums

Forests are cleared to fulfill the needs of growing population. This action leads to unfavourable climatic changes. Soil erosion occurs and fertile agricultural land is wasted.

QUESTIONS

Q No. 1 Fill in the blanks:

(i) Ozone prevents _____ from reaching the earth.

(ii) Radiation of _____ wavelength can not go out of greenhouse.

(iii) Substances that cause pollution of the environment are called_____

(iv) Fossil fuels and minerals are _____ resources.

(v) One reason for the extinction of many species is _____ destruction.

(vi) Areas reserves for wildlife are called _____.

(vii) Moving out from an area and settling in another area is called. _____

Q No. 2 Four answers have been provided for each question. Encircle the right answer.

(i) The proportion of carbon dioxide in air is

(a) 40 percent (b) 0.4 percents

(c) 0.04 percent (d) 0.004 percent

(ii) Major cause of depletion of ozone layer is

(a) Oxygen (b) Hydrogen

(c) Chlorofluorocarbons (d) Hydrocarbon

(iii) About _____percent population of Pakistan is dependent upon agriculture

(a) 90% (b) 80%

(c) 60% (d) 50%

(iv) The total number of persons living in an area is called

(a) Species (b) Population

(c) Community (d) Habitat

Q No. 3 **Short questions**

(i) Define

(a) Pollution (b) Pollutants

(c) Recycling (d) Endangered species

(ii) Write any two effects of greenhouse effect on environment.

(iii) Write two methods of conservation of natural resources.

(iv) Write two benefits of wildlife .

Q No. 4 Write a note on depletion of ozone layer.

Q No. 5 What is meant by greenhouse effect? Describe its causes and effects on environment.

Q No. 6 How human activities affect environment?

Q No. 7 Write down causes, effects and measures of controlling aquatic pollution.

Q No. 8 Explain use and environmental effects of fossil fuels.

Q No. 9 Write a note on conservation of resources.

Q No. 10 Write brief notes on: -

(a) Mechanized farming and modern trends in agriculture.

(b) Dairy, poultry and fish farming.

(c) Wildlife conservation and National parks .

(d) Importance of wildlife.

Q No. 11 Explain environmental problems arising due to increase in population.