SGK GOVERNMENT DEGREE COLLEGE- VINUKONDA

GUNTUR DIST.A.P:522647

CERTIFICATE COURSE

In

ROLE OF CHEMISTRY IN EVERY DAY LIFE

ORGANIZED BY

DEPARTMENT OF CHEMISTRY

DATE: 05.06.2023 to 12.07.2023

2022-23

ABOUT THE COLLEGE

SrimathiGangineni Kalyani Government Degree College, Vinukonda was established in 1980 to serve the higher education needs of the academically backward Palnadu region. It is located on the outskirts of Vinukonda, a small town in Guntur district. It is the only Government Degree College catering the academic aspirations of the young in palnadu region. Till 1979, students who were desirous of pursuing higher education were moving too far off places. The philanthropic intervention of Sri Gangineni Venkateswara Rao, Ex-MLA, Sri O. Venkateswarlu, Ex- MLA and Dr. V. Adi Reddy could realize the higher education dreams of the students on 11th September 1980. Initially, it rendered its services in the name of MadalaSatyannarayana and Manne Rathamma Government Degree College and later re-named after its donor and former Principal Srimati Gangineni Kalyani (late). The college is sprawled out over 21 acres of vast land area and eco-friendly environment. It provides spacious and aerated classrooms, well equipped laboratories, library with 12,500 books and reading room, modern gymnasium, virtual lab, English language lab, Jawahar Knowledge Centre (JKC) for skill development, which are all well supported by serene and iconic ambience. The college achieved the status of 2(f) and 12(B) in 1994. For the quality education it has been imparting for the last 40 years, strictly adhering to the guidelines of UGC, it has been conferred with NAAC 'B' Grade twice (2006 & 2015).The college takes pride by offering quality education to students from the competent and qualified teaching faculty. The college has 20 sanctioned teaching posts, including Principal. Of them, six faculty members have Doctoral degrees in their respective subjects, one has M.Phil. Degree and all the lecturers have qualified in NET/SLET/SET. The college also provides opportunity for students to receive online certification from Spoken Tutorial maintained by IIT,Bombay and CISCO certified courses fee of cost. Also imparting training in General knowledge and aptitude to prepare the students for competitive examinations and providing access to Jagananna Vidya Deevena and VasthiDeevena scholarships given by Government of Andhra Pradesh to support students.

OUR VISION:

The vision of the institution is to make available higher education to all the young aspirants of the region and to edify their overall personality, keeping the emerging trends of the society in the view.

OUR MISSION:

To materialize the vision mentioned above, the mission is divided into the following achievable objectives.

- Catering to the academic needs of the rural poor students
- Imparting life skills to fit the students in the job market effectively
- Inculcating the spirit of diligence to achieve their goal and build their career
- Enriching the curriculum with value-based activities for the holistic development of the students
- Fostering the spirit of confidence and sportsmanship

OBJECTIVES:

- Serving the needs of rural students
- To enable the poor and down trodden/under privileged sections of the society and access to gainful employment opportunities by imparting skill oriented education.
- To achieve the academic excellence
- To inculcate human values and social responsibilities

ABOUT THE DEPARTMENT

Department of Chemistry was established in 1983 with an objective of providing quality science education in the conventional areas of sciences. It is the major department in the college with 2 sanctioned posts with 115 chemistry students serving 2 chemistry combination groups (MPC,BZC) in chemistry undergraduate programme. The department has also dedicated, motivated, and enthusiastic group of faculty members actively involving in both teaching and research. The department encourages the students for completion of MOOCS, certificate courses and innovative activities. The Department of Chemistry recognizes and respects individual differences and we care deeply about the educational and career development of every member of our community. The department is continuously monitoring the water quality in our college water purification units. We always try to transforming the young to become good and responsible Indian citizens.Our student activities. Our students are exposed to public speech and seminars.

VISION:

To build foundation for excellence and spur development of the Institution as a premier Institution, by igniting and nurturing enthusiasm, interests and passion, in the study of chemistry, in professional courses, as a part of curricula

MISSION:

- To awaken the young minds and discover their talents both in theory and in practical chemistry, through dedication to teaching, commitment to students and innovative instructional methods.
- To support the developmental activities of the College and make the Department vibrant.
- To organize critical contributions in areas of emphasis such as faculty, modern labs, department library and demonstrate a high level of competence in the study of Engineering Chemistry.
- To introduce pioneering programs in the Department that will embrace heritage and values to the Institution.
- To produce graduates of International distinction, committed to integrity, professionalism and lifelong learning by widening their knowledge horizons in range and depth.
- To sustain efficient operating systems towards realization of our objectives, as Institution of eminence and International standards.

COURSES OFFERED

Course	Specialization	Intake	Medium
B.Sc	Maths, Physics, Chemistry	30	English
B.Sc	Botany, Zoology, Chemistry	40	English

FACULTY PROFILE:

Name of the Faculty	Qualifications	Position
Dr. K.V.S. Koteswara Rao	M.Sc., B.Ed., Ph.D.	Lecturer in Chemistry
Mr. Valaparla Bala Yesu	M.Sc.,	Lecturer in Chemistry

ABOUT THE CERTIFICATE COURSE

ROLE OF CHEMISTRY IN EVERYDAY LIFE

'Chromatography' is an analytical technique commonly used for separating a mixture of chemical substances into its individual components, so that the individual components can be thoroughly analyzed. There are many types of chromatography e.g., liquid chromatography, gas chromatography, ion-exchange chromatography, affinity chromatography, but all of these employ the same basic principles.

LEARNING OUTCOMES:

After successful completion of this course students should be able to:

- Awareness of students is increased about water pollution, air pollution, andits effects, remedies.
- Students clearly understood about different names of drugs and generic drugs.
- Students gained knowledge about trace metals in biology and their importancein maintaining health.

SGK GOVERNMENT DEGREE COLLEGE - VINUKONDA			
ACADEMIC YEAR - 2022-23			
LIST OF STUDENTS			
S.NO	**Hall Ticket Number**	**NAME OF THE STUDENT**	**PROGRAMME**
1	Y223099001	ANNEPOGU NANI	I BSC (BZC)
2	Y223099002	ARLAGADDA JANI	I BSC (BZC)
3	Y223099003	ARUDRA VENKATA RAO	I BSC (BZC)
4	Y223099004	BHAVANASI SUJATHA RANI	I BSC (BZC)
5	Y223099005	BILLA SRINIVASA RAO	I BSC (BZC)
6	Y223099006	KANCHARLA DHANALAKSHMI	I BSC (BZC)
7	Y223099007	KESANAPALLI MANOHAR BABU	I BSC (BZC)
8	Y223099008	KOYYALAMUDI SOWMYA	I BSC (BZC)
9	Y223099009	PALADUGU BRAHMESWARI	I BSC (BZC)
10	Y223099010	PALLE SANDEEP	I BSC (BZC)
11	Y223099011	PALLE SANTHOSH	I BSC (BZC)
12	Y223099012	PATRA GEORGE BABU	I BSC (BZC)
13	Y223099013	SHAIK AMEERBASHA	I BSC (BZC)
14	Y223099014	SHAIK HASEENA	I BSC (BZC)
15	Y223099015	YEPURI SIVA NAGAMANI	I BSC (BZC)

K.V.S.Kotcswar

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PALNADU DIST - 522 647

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SGK GOVERNMENT DEGREE COLLEGE - VINUKONDA			
ACADEMIC YEAR - 2022-23			
STUDENTS SIGNATURES			
S.NO	**NAME OF THE STUDENT**	**PROGRAMME**	**SIGNATURE**
1	ANNEPOGU NANI	I BSC (BZC)	
2	ARLAGADDA JANI	I BSC (BZC)	
3	ARUDRA VENKATA RAO	I BSC (BZC)	
4	BHAVANASI SUJATHA RANI	I BSC (BZC)	
5	BILLA SRINIVASA RAO	I BSC (BZC)	
6	KANCHARLA DHANALAKSHMI	I BSC (BZC)	
7	KESANAPALLI MANOHAR BABU	I BSC (BZC)	
8	KOYYALAMUDI SOWMYA	I BSC (BZC)	
9	PALADUGU BRAHMESWARI	I BSC (BZC)	
10	PALLE SANDEEP	I BSC (BZC)	
11	PALLE SANTHOSH	I BSC (BZC)	
12	PATRA GEORGE BABU	I BSC (BZC)	
13	SHAIK AMEERBASHA	I BSC (BZC)	
14	SHAIK HASEENA	I BSC (BZC)	
15	YEPURI SIVA NAGAMANI	I BSC (BZC)	

K.V.S.Kotaiah

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Detailed Pedagogical Plan			
S.No.	**Date**	**Name of the Topic**	**Name of the Lecturer**
1	05.06.2023	Introduction & Syllabus	Dr. K.V.S. Koteswara Rao
2	06.06.2023	Terminology, Role of Chemistry	Dr. K.V.S. Koteswara Rao
3	07.06.2023	Environmental Chemistry	Dr. K.V.S. Koteswara Rao
4	08.06.2023	Terminology: Pollutant, Contaminant, Receptor, Sink.	Dr. K.V.S. Koteswara Rao
5	09.06.2023	COD, BOD, DO, TLV.	Dr. K.V.S. Koteswara Rao
6	12.06.2023	Practical Test - 1	Mr. V. Bala Yesu
7	13.06.2023	Air pollution: Causes, Effects	Mr. V. Bala Yesu
8	14.06.2023	Acid rains	Dr. K.V.S. Koteswara Rao
9	15.06.2023	Depletion in Ozone layer	Mr. V. Bala Yesu
10	16.06.2023	Green house effect.	Mr. V. Bala Yesu
11	17.06.2023	Practical Test - 2	Dr. K.V.S. Koteswara Rao
12	19.06.2023	Practical Test -3	Mr. V. Bala Yesu
13	20.06.2023	Biological Importance of Metals - Introduction	Mr. V. Bala Yesu
14	21.06.2023	Biological importance of Sodium, Potassium	Dr. K.V.S. Koteswara Rao
15	22.06.2023	Biological importance of Chloride, Magnesium, Calcium	Dr. K.V.S. Koteswara Rao
16	23.06.2023	Biological importance of Nickel, Copper and Zinc.	Mr. V. Bala Yesu
17	24.06.2023	Metalloporphyrins: Structure of Hemoglobin	Mr. V. Bala Yesu
18	26.06.2023	Metalloporphyrins: Chlorophyll, Vitamin B12.	Dr. K.V.S. Koteswara Rao
19	27.06.2023	Practical Test - 4	Dr. K.V.S. Koteswara Rao

Detailed Pedagogical Plan			
S.No.	**Date**	**Name of the Topic**	**Name of the Lecturer**
20	28.06.2023	Medicinal Chemistry: Terminology – Drug, Medicine,	Mr. V. Bala Yesu
21	30.06.2023	Medicinal Chemistry: Classification of Drugs with examples.	Mr. V. Bala Yesu
22	01.07.2023	Importances and structures of Paracetamol, Ibuprofen	Mr. V. Bala Yesu
23	03.07.2023	Importances and structures of Chloroquine, Omeprazole	Dr. K.V.S. Koteswara Rao
24	04.07.2023	Importances and structures of Penicillin and Aspirin.	Mr. V. Bala Yesu
25	05.07.2023	Chemical names, generic names and brand names.	Dr. K.V.S. Koteswara Rao
26	06.07.2023	Assignment	Mr. V. Bala Yesu
27	07.07.2023	Chemical names, generic names and brand names - 2	Dr. K.V.S. Koteswara Rao
28	10.07.2023	Practical Test – 1	Mr. V. Bala Yesu
29	11.07.2023	Practical Test – 2	Mr. V. Bala Yesu
30	12.07.2023	Practical Test – 3	Dr. K.V.S. Koteswara Rao

K.V.S. Koteswara Rao

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ACADEMIC YEAR - 2021-22 ATTENDANCE REGISTER

S.NO	NAME OF THE STUDENT	05.06.2023	06.06.2023	07.06.2023	08.06.2023	09.06.2023	12.06.2023	13.06.2023	14.06.2023	15.06.2023	16.06.2023
		1	2	3	4	5	6	7	8	9	10
1	ANNEPOGU NANI	P	P	P	P	P	P	P	P	P	P
2	ARLAGADDA JANI	P	A	P	P	P	P	P	P	P	P
3	ARUDRA VENKATA RAO	P	P	P	A	A	P	P	A	A	P
4	BHAVANASI SUJATHA RANI	P	P	A	A	A	P	P	P	P	A
5	BILLA SRINIVASA RAO	P	P	P	P	P	A	P	P	A	P
6	KANCHARLA DHANALAKSHMI	P	P	P	P	P	P	A	A	P	P
7	KESANAPALLI MANOHAR BABU	A	P	P	P	P	A	P	A	P	P
8	KOYYALAMUDI SOWMYA	P	P	P	P	P	P	P	P	P	P
9	PALADUGU BRAHMESWARI	P	A	P	P	P	P	P	P	P	P
10	PALLE SANDEEP	P	P	P	A	A	P	P	A	A	P
11	PALLE SANTHOSH	P	P	A	A	A	P	P	P	P	A
12	PATRA GEORGE BABU	P	P	P	P	P	A	P	P	A	P
13	SHAIK AMEERBASHA	P	P	P	P	P	P	A	A	P	P
14	SHAIK HASEENA	A	P	P	P	P	A	P	A	P	P
15	YEPURI SIVA NAGAMANI	P	P	P	P	A	P	P	P	A	P

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ACADEMIC YEAR - 2021-22 ATTENDANCE REGISTER

S.NO	NAME OF THE STUDENT	17.06.2023	19.06.2023	20.06.2023	21.06.2023	22.06.2023	23.06.2023	24.06.2023	26.06.2023	27.06.2023	28.06.2023
		11	12	13	14	15	16	17	18	19	20
1	ANNEPOGU NANI	P	P	P	P	P	P	P	P	P	P
2	ARLAGADDA JANI	P	A	P	P	P	P	P	P	P	P
3	ARUDRA VENKATA RAO	P	P	P	A	A	P	P	A	A	P
4	BHAVANASI SUJATHA RANI	P	P	A	A	A	P	P	P	P	A
5	BILLA SRINIVASA RAO	P	P	P	P	P	A	P	P	A	P
6	KANCHARLA DHANALAKSHMI	P	P	P	P	P	P	A	A	P	P
7	KESANAPALLI MANOHAR BABU	A	P	P	P	P	A	P	A	P	P
8	KOYYALAMUDI SOWMYA	P	P	P	P	P	P	P	P	P	P
9	PALADUGU BRAHMESWARI	P	A	P	P	P	P	P	P	P	P
10	PALLE SANDEEP	P	P	P	A	A	P	P	A	A	P
11	PALLE SANTHOSH	P	P	A	A	A	P	P	P	P	A
12	PATRA GEORGE BABU	P	P	P	P	P	A	P	P	A	P
13	SHAIK AMEERBASHA	P	P	P	P	P	P	A	A	P	P
14	SHAIK HASEENA	A	P	P	P	P	A	P	A	P	P
15	YEPURI SIVA NAGAMANI	P	P	P	P	A	P	P	P	A	P

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ACADEMIC YEAR - 2021-22 ATTENDANCE REGISTER

S.NO	NAME OF THE STUDENT	30.06.2023	01.07.2023	03.07.2023	04.07.2023	05.07.2023	06.07.2023	07.07.2023	10.07.2023	11.07.2023	12.07.2023
		21	22	23	24	25	26	27	28	29	30
1	ANNEPOGU NANI	P	P	P	P	P	P	P	P	P	P
2	ARLAGADDA JANI	P	A	P	P	P	P	P	P	P	P
3	ARUDRA VENKATA RAO	P	P	P	A	A	P	P	A	A	P
4	BHAVANASI SUJATHA RANI	P	P	A	A	A	P	P	P	P	A
5	BILLA SRINIVASA RAO	P	P	P	P	P	A	P	P	A	P
6	KANCHARLA DHANALAKSHMI	P	P	P	P	P	P	A	A	P	P
7	KESANAPALLI MANOHAR BABU	A	P	P	P	P	A	P	A	P	P
8	KOYYALAMUDI SOWMYA	P	P	P	P	P	P	P	P	P	P
9	PALADUGU BRAHMESWARI	P	A	P	P	P	P	P	P	P	P
10	PALLE SANDEEP	P	P	P	A	A	P	P	A	A	P
11	PALLE SANTHOSH	P	P	A	A	A	P	P	P	P	A
12	PATRA GEORGE BABU	P	P	P	P	P	A	P	P	A	P
13	SHAIK AMEERBASHA	P	P	P	P	P	P	A	A	P	P
14	SHAIK HASEENA	A	P	P	P	P	A	P	A	P	P
15	YEPURI SIVA NAGAMANI	P	P	P	P	A	P	P	P	A	P

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An ISO 9001:2015 Certified Institution, Affiliated to Acharya Nagarjuna University

BRIEF REPORT

Department of Chemistry organized a Certificate Course ‘**“Role of Chemistry in Everyday Life”**. The duration of the course is 1 Month (30 Hours) and the course was conducted from **05.06.2023 to 12.07.2023**. This course is designed for people who want to learn the knowledge and skills they need to work in **“Role of Chemistry in Everyday Life”**. **15** students of **I B.Sc. (BZC)** registered in this course. Sri. Valaparla Bala Yesu, Lecturer in Chemistry, as the Resource Person for this Course. During the course, students are evaluated using assignments, Quizzes and a final exam. All the **15** students successfully completed the course and received certificates of completion.

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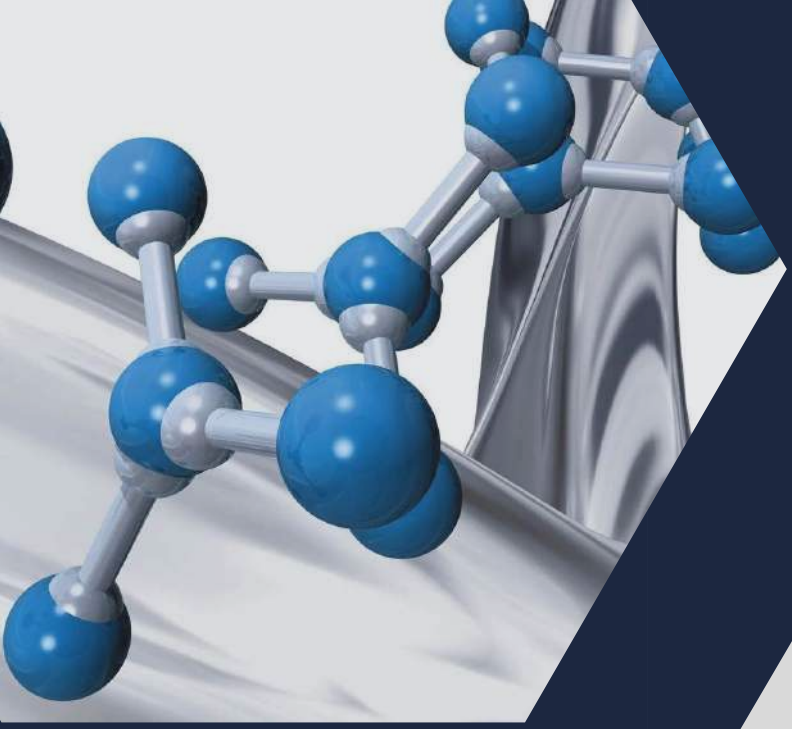


Batch Starts Onwards
05.06.2023

Certificate Course in

Role of Chemistry in Every Day Life

SGK Government Degree College, Vinukonda

Project Marketing

Contact Us

Phone : 8886771033
Email: vinukonda.jkc@gmail.com
Address : Room No - 3
Department of Chemistry
SGK Govt. Degree College, Vinukonda

SYLLABUS

Unit-I:Environmental Chemistry

- Environmental Chemistry: Terminology (Pollutant, Contaminant, Receptor, Sink, COD, BOD, DO, TLV.
- Air pollution: Causes, Effects, Acid rains, Depletion in Ozone layer, Green house effect.
- Water pollution: Causes, Effects, Eutrophication, Effects of fluorides.

Unit-II:Biological importance of metals

- Classification of metals: essential and nonessential elements
- Trace elements: Biological importance of Sodium, Potassium, Chloride, Magnesium, Calcium, Iron, Cobalt, Nickel, Copper and Zinc.
- Metalloporphyrins: Structure of Hemoglobin, and Chlorophyll, Vitamin B_{12}.

Unit-III:Medicinal Chemistry

- Medicinal Chemistry: Terminology – Drug, Medicine, Pharmacy etc. Classification of Drugs with examples.
- Importances and structures of Paracetamol, Ibuprofen, Chloroquine, Omeprazole, Ciprofloxacin, Penicillin and Aspirin.
- Chemical names, generic names and brand names.

The world has achieved brilliance without wisdom, power without conscience. Ours is a world of nuclear giants and ethical infants.

UNIT - I :: ENVIRONMENTAL CHEMISTRY

Terminology

1. **Pollution:** The presence or introduction of contaminants into the environment, causing harm to living organisms, ecosystems, and natural resources.
2. Greenhouse effect: The process by which certain gases in the Earth's atmosphere, such as carbon dioxide and methane, trap heat and contribute to global warming.
3. **Acid rain:** Rainfall that has a pH level lower than the neutral value of 7, usually caused by emissions of sulfur dioxide and nitrogen oxides from burning fossil fuels, which can have detrimental effects on soil, water, and vegetation.
4. **Ozone depletion:** The reduction in the concentration of ozone (O3) in the Earth's stratosphere, particularly in the ozone layer, caused by the release of chlorofluorocarbons (CFCs) and other ozone-depleting substances.
5. **Renewable energy:** Energy derived from natural resources that are replenished at a rate equal to or greater than the rate of consumption, such as solar, wind, hydro, geothermal, and biomass energy, which are considered more sustainable and environmentally friendly compared to fossil fuels.
6. **Contaminant:** Any substance or agent that is present in an environment at levels higher than naturally occurring or desirable levels, and has the potential to cause harm to living organisms, ecosystems, or natural resources. Contaminants can include pollutants, toxins, chemicals, and other harmful substances.
7. **Receptor:** In environmental chemistry, a receptor refers to any living organism or system that is exposed to a contaminant or environmental stressor, and may be impacted by it. Receptors can include humans, animals, plants, and ecosystems. They can serve as indicators of the effects of contaminants on the environment.
8. **Sink:** A sink in environmental chemistry refers to a natural or engineered system that can absorb or remove contaminants from the environment. For example, forests can act as a sink for carbon dioxide by absorbing and storing it through the process of photosynthesis. Wetlands and soils can also act as sinks for pollutants through processes such as adsorption, precipitation, and microbial degradation.
9. **COD:** COD stands for Chemical Oxygen Demand, which is a measure of the amount of oxygen required to chemically oxidize organic and inorganic contaminants in water or

wastewater. It is used as an indicator of the pollution strength of wastewater or the organic content of water bodies. High COD levels can indicate high pollution loads and can impact water quality and aquatic life.

10. **BOD:** BOD stands for Biological Oxygen Demand, which is a measure of the amount of oxygen required by microorganisms to break down organic matter in water through biological processes. It is used as an indicator of the organic pollution level in water bodies and the effectiveness of wastewater treatment. High BOD levels can indicate poor water quality and reduced oxygen availability for aquatic organisms.
11. **DO:** DO stands for Dissolved Oxygen, which is the amount of oxygen dissolved in water. DO is a critical parameter in environmental chemistry as it affects the survival of aquatic organisms and is an indicator of water quality. Low DO levels can indicate pollution or other environmental stressors that can impact the health and survival of aquatic organisms.

AIR Pollution:

Air pollution is a pressing environmental issue that affects the health and well-being of both humans and the environment. It refers to the presence of harmful substances in the air at levels that exceed natural or acceptable limits, resulting in adverse effects on air quality, climate, ecosystems, and public health.

Air pollution can arise from both natural and human activities. Natural sources of air pollution include volcanic eruptions, forest fires, and dust storms. However, human activities are the major contributor to air pollution, with industries, transportation, energy production, and agricultural practices being significant sources of pollution. Burning of fossil fuels such as coal, oil, and gas for energy production and transportation releases large amounts of pollutants into the air, including particulate matter, sulfur dioxide, nitrogen oxides, volatile organic compounds, and greenhouse gases like carbon dioxide, methane, and nitrous oxide.

The impacts of air pollution on human health are significant. Inhalation of polluted air can cause respiratory and cardiovascular diseases, such as asthma, bronchitis, lung cancer, and heart disease. It can also affect the nervous system, reproductive system, and immune system, and may have adverse effects on cognitive development in children. Vulnerable populations such as children, elderly individuals, and those with pre-existing health conditions are particularly at risk.

Additionally, air pollution can have detrimental effects on the environment, including damage to crops, forests, and water bodies, and disruption of ecosystems and biodiversity.

Air pollution also contributes to climate change. Greenhouse gases released into the atmosphere trap heat, leading to global warming and climate disruption. Air pollution can also result in the formation of smog, which is a type of air pollution that occurs when emissions from vehicles and industrial activities react with sunlight and form ground-level ozone. Smog not only reduces visibility, but also poses health risks, especially for respiratory health.

Causes:

Air pollution is caused by a variety of factors, including both natural and human activities. Some of the major causes of air pollution include:

1. Burning of Fossil Fuels: The combustion of fossil fuels, such as coal, oil, and gas, for energy production and transportation is a significant source of air pollution. It releases pollutants such as particulate matter, sulfur dioxide (SO2), nitrogen oxides (NOx), and volatile organic compounds (VOCs) into the air.
2. Industrial Emissions: Industries release various pollutants into the air, including emissions from manufacturing processes, power plants, and other industrial activities. These emissions can contain harmful chemicals, particulate matter, and other pollutants that contribute to air pollution.
3. Transportation: Emissions from vehicles, including cars, trucks, buses, and airplanes, are a major source of air pollution, especially in urban areas with high traffic congestion. Vehicle emissions release pollutants such as nitrogen oxides, particulate matter, and VOCs into the air.
4. Agricultural Practices: Agricultural activities, such as livestock production and crop burning, can release pollutants such as ammonia, methane, and particulate matter into the air, contributing to air pollution.
5. Indoor Air Pollution: Indoor sources of pollution, such as cooking and heating with solid fuels, tobacco smoke, and indoor chemicals, can contribute to indoor air pollution, which can have adverse effects on human health.

Effects:

The effects of air pollution can be detrimental to both human health and the environment. Some of the major effects of air pollution include:

1. Respiratory and Cardiovascular Health Impacts: Inhalation of polluted air can have serious health effects, particularly on the respiratory and cardiovascular systems. Air pollution has been linked to respiratory diseases such as asthma, chronic bronchitis, and lung cancer, as well as cardiovascular diseases such as heart disease and stroke.
2. Environmental Damage: Air pollution can have detrimental effects on the environment, including damage to crops, forests, and water bodies. Pollutants from the air can settle on plants, soil, and water, leading to reduced crop yields, forest degradation, and water pollution, which can have far-reaching ecological impacts.
3. Climate Change: Air pollution contributes to climate change by releasing greenhouse gases, such as carbon dioxide, methane, and nitrous oxide, into the atmosphere. These gases trap heat, leading to global warming and climate disruption, with impacts on weather patterns, sea level rise, and ecosystem dynamics.
4. Economic Costs: Air pollution has significant economic costs, including healthcare costs associated with the treatment of pollution-related health issues, lost productivity due to illness and absenteeism, and damage to infrastructure, crops, and natural resources.
5. Social Disparities: Air pollution can disproportionately affect vulnerable populations, such as children, elderly individuals, and low-income communities, who may be exposed to higher levels of pollution due to factors such as location of residences, occupational exposure, and lack of access to clean air resources.

Acid Rains:

Acid rain refers to rain or any other form of precipitation that has a pH level lower than the neutral value of 7, indicating increased acidity. It is caused by the emission of sulfur dioxide (SO_2) and nitrogen oxides (NO_x) into the atmosphere from human activities, such as burning fossil fuels for energy production, industrial processes, and transportation.

When sulfur dioxide and nitrogen oxides are released into the air, they can combine with water vapor and other atmospheric components to form sulfuric acid (H_2SO_4) and nitric acid (HNO_3). These acids can then fall back to the Earth's surface as acid rain, causing a range of environmental and ecological impacts.

Some of the major causes of acid rain include:

1. **Fossil Fuel Combustion:** Burning of coal, oil, and gas in power plants and other industrial processes releases large amounts of sulfur dioxide and nitrogen oxides into the atmosphere, contributing to acid rain formation.
2. **Transportation Emissions:** Emissions from vehicles, such as cars, trucks, and airplanes, also release significant amounts of nitrogen oxides into the atmosphere, contributing to acid rain.
3. **Industrial Emissions:** Emissions from various industrial processes, such as manufacturing, smelting, and refining, can release sulfur dioxide and nitrogen oxides into the air, contributing to acid rain formation.

The effects of acid rain can be damaging to both the environment and human health. Some of the major effects of acid rain include:

1. **Damage to Vegetation:** Acid rain can damage forests, crops, and other vegetation by leaching important nutrients from the soil and disrupting nutrient cycling. It can also directly damage plant leaves, reducing photosynthesis and inhibiting growth.
2. **Water Pollution:** Acid rain can acidify lakes, rivers, and streams, making them more acidic and potentially harmful to aquatic life. Acidic water can also leach toxic metals, such as aluminum, from the soil and rocks, which can have detrimental effects on aquatic ecosystems.
3. **Soil Degradation:** Acid rain can leach important nutrients, such as calcium and magnesium, from the soil, leading to soil degradation and reduced fertility. This can have impacts on agricultural productivity and ecosystem dynamics.
4. **Damage to Buildings and Infrastructure:** Acid rain can corrode buildings, monuments, and infrastructure made of materials such as limestone, marble, and metal. This can result in costly repairs and loss of cultural heritage.
5. **Human Health Impacts:** While direct health impacts of acid rain on humans are relatively limited, the release of pollutants that cause acid rain, such as sulfur dioxide and nitrogen oxides, can contribute to air pollution, which can have adverse effects on human health, particularly on the respiratory system.

Depletion in Ozone Layer:

“Ozone layer depletion is the gradual thinning of the earth’s ozone layer in the upper atmosphere caused due to the release of chemical compounds containing gaseous bromine or chlorine from industries or other human activities.”

The ozone layer is a region of the Earth's stratosphere that contains a high concentration of ozone (O_3) molecules. It plays a critical role in protecting life on Earth by absorbing and blocking most of the harmful ultraviolet (UV) radiation from the sun. However, human activities have led to the depletion of the ozone layer, particularly in the polar regions, which has significant environmental and health implications.

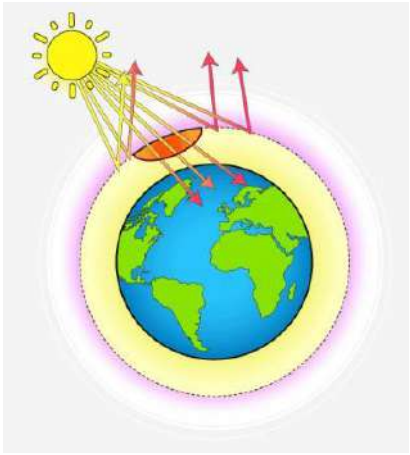
The main cause of ozone layer depletion is the release of chlorofluorocarbons (CFCs), halons, and other synthetic halogenated hydrocarbons into the atmosphere. These chemicals were commonly used in various industrial and consumer applications, such as refrigeration, air conditioning, foam insulation, and fire suppression. Once released into the atmosphere, these chemicals can persist for a long time and eventually reach the stratosphere, where they can interact with ozone molecules and deplete the ozone layer.

The effects of ozone layer depletion are far-reaching and include:

1. **Increased UV Radiation:** Depletion of the ozone layer allows more UV radiation to reach the Earth's surface, posing health risks to both humans and wildlife. UV radiation can cause skin cancer, cataracts, and other health issues in humans. It can also harm aquatic ecosystems by damaging phytoplankton, which forms the base of the marine food chain.
2. **Environmental Impacts:** Ozone layer depletion can have detrimental effects on terrestrial and aquatic ecosystems. It can affect plant growth and productivity, disrupt food chains, and alter ecosystems' structure and function. It can also impact the reproductive success of certain animals, such as amphibians and marine organisms.
3. **Climate Change:** Ozone depletion can contribute to climate change. Some of the chemicals responsible for ozone depletion, such as CFCs, are also potent greenhouse gases that can trap heat in the atmosphere, leading to global warming and climate change.

Efforts to address ozone layer depletion have been made through international agreements, such as the Montreal Protocol, which aims to phase out the production and use of ozone-depleting substances. As a result of these efforts, the ozone layer has shown signs of recovery in recent

years, with a decrease in the production and use of ozone-depleting substances. However, complete recovery of the ozone layer is expected to take several decades.



Green House Effect:

The greenhouse effect is a natural process that occurs in the Earth's atmosphere and plays a vital role in regulating the planet's temperature. It refers to the trapping of heat by certain gases in the atmosphere, known as greenhouse gases, which include carbon dioxide (CO2), methane (CH4), nitrous oxide (N2O), and fluorinated gases.

The greenhouse effect is essential for supporting life on Earth, as it helps to maintain an average global temperature that is suitable for the survival of humans, animals, and plants. However, human activities, particularly the burning of fossil fuels such as coal, oil, and gas, have led to an increase in the concentration of greenhouse gases in the atmosphere, enhancing the natural greenhouse effect and causing what is known as anthropogenic or human-induced climate change.

The increased concentration of greenhouse gases in the atmosphere is leading to several negative effects, including:

1. **Global Warming:** The enhanced greenhouse effect is causing the Earth's average temperature to rise, leading to global warming. This can result in changes in climate patterns, such as more frequent and severe heatwaves, extreme weather events, and changes in precipitation patterns.
2. **Sea Level Rise:** As the Earth's temperature rises, it causes melting of glaciers and ice caps, leading to the expansion of seawater and resulting in sea level rise. This can lead to the

flooding of coastal areas, threatening human settlements, freshwater sources, and coastal ecosystems.

3. **Ecological Impacts:** Climate change caused by the greenhouse effect can have profound impacts on ecosystems, including changes in species distribution, altered timing of seasonal events, and disruption of ecosystem dynamics. This can lead to the loss of biodiversity and changes in ecosystem services, such as pollination, water purification, and carbon sequestration.
4. **Human Health Impacts:** Climate change associated with the greenhouse effect can also have direct and indirect impacts on human health. This includes increased risks of heat-related illnesses, respiratory diseases due to poor air quality, and changes in disease patterns of vector-borne diseases.

UNIT - II :: BIOLOGICAL IMPORTANCE OF METALS

Metals play a critical role in biological systems, serving as essential components of enzymes, proteins, and other biomolecules. These metals are called essential trace elements, as they are required in small amounts for proper physiological functioning. Here are some examples of the biological importance of metals:

1. **Enzyme Cofactors:** Many enzymes, which are biological catalysts that facilitate chemical reactions in cells, require metals as cofactors for their activity. For example, zinc is an essential cofactor for over 300 enzymes involved in various cellular processes, including DNA synthesis, immune function, and wound healing. Iron is another important cofactor for enzymes involved in energy production, oxygen transport, and DNA synthesis.
2. **Oxygen Transport:** Metals are crucial for oxygen transport in the bloodstream. Hemoglobin, a protein found in red blood cells, contains iron that binds to oxygen, allowing it to be transported from the lungs to tissues and organs throughout the body. Similarly, myoglobin, a protein found in muscles, also contains iron and facilitates oxygen transport within muscle cells.
3. **Electron Transfer:** Metals such as copper, iron, and manganese are essential for electron transfer reactions in cells, which are critical for energy production. For example, iron is a key component of the electron transport chain, a series of protein complexes in the mitochondria that generate energy in the form of ATP (adenosine triphosphate) through oxidative phosphorylation.
4. **Structural Support:** Metals are important for providing structural support in biological systems. For instance, calcium is essential for the formation and maintenance of strong bones and teeth. Magnesium is also required for the structure and function of proteins and nucleic acids, such as DNA and RNA.
5. **Signal Transduction:** Metals play a role in cellular signaling processes. For example, calcium ions act as important secondary messengers in many cellular signaling pathways, regulating processes such as muscle contraction, neurotransmitter release, and cell division.
6. **Defense against Oxidative Stress:** Metals such as copper, zinc, and manganese are involved in antioxidant defense systems that protect cells from damage caused by reactive oxygen species (ROS), which are toxic molecules produced during normal cellular

metabolism. These metals are components of antioxidant enzymes such as superoxide dismutase, catalase, and glutathione peroxidase.

7. **Nutrient Uptake and Transport:** Metals such as iron, copper, and zinc are involved in the uptake and transport of essential nutrients in plants and animals. They play important roles in the absorption, storage, and distribution of nutrients such as iron, copper, and zinc themselves, as well as other essential elements like calcium, magnesium, and manganese.

Classification:

Metals can be classified into two categories based on their biological importance: essential elements and nonessential elements.

1. **Essential Elements:** Essential elements are metals that are required for the proper physiological functioning of living organisms and are necessary for their growth, development, and overall health. These elements are typically required in small amounts and serve as essential cofactors for enzymes and proteins, participate in electron transfer reactions, provide structural support, act as signaling molecules, and play other critical roles in cellular processes. Examples of essential elements include iron (Fe), zinc (Zn), copper (Cu), manganese (Mn), magnesium (Mg), calcium (Ca), selenium (Se), and others. Deficiency or excess of essential elements can lead to various health problems, including metabolic disorders, impaired growth and development, and other physiological imbalances.
2. **Nonessential Elements:** Nonessential elements are metals that are not required for the normal physiological functioning of living organisms and do not have any known essential biological roles. They may be present in biological systems due to environmental exposure or contamination, but they do not play critical roles in cellular processes and are not necessary for the growth, development, or overall health of organisms. Examples of nonessential elements include lead (Pb), mercury (Hg), cadmium (Cd), and others. These metals can be toxic to living organisms and can cause various health issues, such as neurotoxicity, nephrotoxicity, and other toxic effects.

Trace Elements:

Sodium (Na): Sodium is an essential mineral and electrolyte that is important for many biological processes in the human body. Here are some of the biological functions of sodium:

1. Fluid balance: Sodium helps regulate the balance of fluids in the body by controlling the amount of water that is retained or excreted by the kidneys. This is important for maintaining blood volume and blood pressure.
2. Nerve function: Sodium is involved in the transmission of nerve impulses throughout the body. It plays a key role in generating electrical signals that allow muscles to contract and nerves to communicate with each other.
3. Muscle function: Sodium also helps muscles contract and relax properly. It is particularly important for the function of skeletal muscle, which is responsible for movement and posture.
4. Acid-base balance: Sodium helps regulate the pH balance of the body by controlling the amount of acid or alkaline substances in the blood.
5. Nutrient absorption: Sodium is necessary for the absorption of certain nutrients, such as glucose and amino acids, in the small intestine.
6. Hormone production: Sodium is required for the production of several hormones, including aldosterone, which helps regulate blood pressure and electrolyte balance.

Potassium (K): Potassium is an essential mineral and electrolyte that is important for many biological processes in the human body. Here are some of the biological functions of potassium:

1. Nerve function: Potassium is involved in the transmission of nerve impulses throughout the body. It plays a key role in generating electrical signals that allow muscles to contract and nerves to communicate with each other.
2. Muscle function: Potassium helps muscles contract and relax properly. It is particularly important for the function of smooth and cardiac muscle, which are found in organs such as the heart, digestive system, and urinary tract.
3. Fluid balance: Potassium helps regulate the balance of fluids in the body by controlling the amount of water that is retained or excreted by the kidneys. This is important for maintaining blood volume and blood pressure.

4. Acid-base balance: Potassium helps regulate the pH balance of the body by controlling the amount of acid or alkaline substances in the blood.
5. Heart function: Potassium is critical for the normal function of the heart. It helps regulate the heart's rhythm and prevents abnormal heartbeats.
6. Bone health: Potassium plays a role in maintaining strong bones by reducing the amount of calcium excreted in the urine.

Chlorides (Cl^-): Chloride is an essential mineral and electrolyte that is important for many biological processes in the human body. Here are some of the biological functions of chloride:

1. Fluid balance: Chloride helps regulate the balance of fluids in the body by working with sodium to control the amount of water that is retained or excreted by the kidneys. This is important for maintaining blood volume and blood pressure.
2. Acid-base balance: Chloride helps regulate the pH balance of the body by balancing the levels of acid and base in the blood.
3. Digestion: Chloride is a component of hydrochloric acid, which is produced by the stomach to help digest food.
4. Immune function: Chloride plays a role in the immune response by helping to activate white blood cells to fight infections.
5. Oxygen transport: Chloride helps transport carbon dioxide from the tissues to the lungs, where it can be exhaled.

Magnesium (Mg): Magnesium is an essential mineral that is important for many biological processes in the human body. Here are some of the biological functions of magnesium:

1. Muscle and nerve function: Magnesium plays a critical role in the proper functioning of muscles and nerves. It helps to regulate the electrical signals that allow muscles to contract and nerves to communicate with each other.
2. Energy production: Magnesium is involved in the process of ATP (adenosine triphosphate) production, which is the primary source of energy for cells.
3. Protein synthesis: Magnesium is necessary for the synthesis of proteins, which are essential for the growth, repair, and maintenance of tissues in the body.

4. Bone health: Magnesium is important for bone health, as it helps to regulate the levels of calcium and vitamin D in the body, which are both important for bone growth and maintenance.
5. Blood pressure regulation: Magnesium helps to regulate blood pressure by relaxing the blood vessels and improving blood flow.
6. Heart health: Magnesium plays a critical role in maintaining a healthy heart by regulating the heart's rhythm and preventing abnormal heartbeats.

Calcium (Ca): Calcium is an essential mineral that is important for many biological processes in the human body. Here are some of the biological functions of calcium:

1. Bone health: Calcium is essential for the growth and maintenance of healthy bones. It provides the structure and rigidity necessary for bones to support the body and protects against osteoporosis, a condition where bones become weak and brittle.
2. Muscle function: Calcium is critical for muscle function, including muscle contraction and relaxation.
3. Nerve function: Calcium plays a key role in the transmission of nerve impulses throughout the body, allowing for communication between nerves and muscles.
4. Blood clotting: Calcium is necessary for blood clotting, which is important for preventing excessive bleeding after injury.
5. Enzyme activity: Calcium is required for the activity of many enzymes in the body, which are involved in a wide range of biochemical processes.
6. Hormone secretion: Calcium is involved in the secretion of hormones, including insulin, which regulates blood sugar levels.

Iron (Fe): Iron is an essential mineral that is important for many biological processes in the human body. Here are some of the biological functions of iron:

1. Oxygen transport: Iron is a component of hemoglobin, the protein in red blood cells that transports oxygen from the lungs to the body's tissues. It is also a component of myoglobin, a protein found in muscles that helps to transport oxygen to the cells.
2. Energy production: Iron is involved in the production of ATP (adenosine triphosphate), the primary source of energy for cells.

3. Immune function: Iron plays a role in the immune response by helping to activate white blood cells to fight infections.
4. Brain function: Iron is important for normal brain function and development, as it is involved in the production of neurotransmitters that transmit signals between brain cells.
5. DNA synthesis: Iron is necessary for the synthesis of DNA, the genetic material that controls cell growth and division.
6. Hormone synthesis: Iron is involved in the synthesis of hormones, including thyroid hormones and the hormone erythropoietin, which stimulates the production of red blood cells.

Cobalt (Co): Cobalt is an essential trace mineral that is important for a few biological processes in the human body. Here are some of the biological functions of cobalt:

1. Vitamin B12 synthesis: Cobalt is a crucial component of vitamin B12, which is necessary for the production of red blood cells, DNA synthesis, and the proper functioning of the nervous system.
2. Energy production: Cobalt is involved in the production of ATP (adenosine triphosphate), the primary source of energy for cells.
3. Enzyme activity: Cobalt is a component of some enzymes that are involved in various biochemical processes, such as the conversion of amino acids to other substances, the metabolism of fatty acids, and the detoxification of harmful chemicals in the body.
4. Red blood cell production: Cobalt helps stimulate the production of red blood cells by working in conjunction with vitamin B12.
5. Bone health: Cobalt may play a role in bone health by promoting the growth and development of bone tissue.

Nickel (Ni): Nickel is an essential trace mineral that is important for a few biological processes in the human body. Here are some of the biological functions of nickel:

1. Enzyme activity: Nickel is a component of some enzymes that are involved in various biochemical processes, such as the metabolism of carbohydrates and lipids, and the synthesis of DNA.
2. Immune function: Nickel may play a role in the immune response by stimulating the production of certain immune cells.

3. Hormone synthesis: Nickel is involved in the synthesis of the hormone insulin, which regulates blood sugar levels.
4. Iron metabolism: Nickel may play a role in the absorption and metabolism of iron in the body.
5. DNA repair: Nickel may play a role in DNA repair by activating certain enzymes involved in the process.

Copper (Cu): Copper is an essential trace mineral that is important for many biological processes in the human body. Here are some of the biological functions of copper:

1. Enzyme activity: Copper is a component of many enzymes that are involved in various biochemical processes, such as the production of energy, the metabolism of iron, and the synthesis of connective tissue.
2. Iron metabolism: Copper is necessary for the absorption and transport of iron in the body.
3. Immune function: Copper plays a role in the immune response by helping to activate white blood cells to fight infections.
4. Brain function: Copper is important for normal brain function and development, as it is involved in the production of neurotransmitters that transmit signals between brain cells.
5. Connective tissue synthesis: Copper is involved in the synthesis of collagen and elastin, which are important components of connective tissue.
6. Pigment synthesis: Copper is necessary for the production of melanin, the pigment that gives color to skin, hair, and eyes.

Zinc (Zn): Zinc is an essential mineral that is important for many biological processes in the human body. Here are some of the biological functions of zinc:

1. Enzyme activity: Zinc is a component of many enzymes that are involved in various biochemical processes, such as the metabolism of carbohydrates, protein, and fat.
2. Immune function: Zinc plays a role in the immune response by helping to activate white blood cells to fight infections.
3. Growth and development: Zinc is important for normal growth and development, as it is involved in cell division, DNA synthesis, and protein synthesis.
4. Wound healing: Zinc is necessary for the process of wound healing, as it is involved in the synthesis of collagen, which is a major component of connective tissue.

5. Taste and smell: Zinc is necessary for the proper function of taste and smell receptors.
6. Reproductive health: Zinc plays a role in reproductive health, as it is important for the development of healthy sperm and eggs, and for proper fetal development during pregnancy.

Metalloporphyrin's:

Metalloporphyrin's are a class of organic molecules that contain a central porphyrin ring structure coordinated with a metal ion. The metal ion is typically a transition metal such as iron, cobalt, or nickel, and is often bound to a nitrogen atom in the porphyrin ring.One of the most well-known examples of a metalloporphyrin is heme, which is found in hemoglobin, the protein in red blood cells that carries oxygen throughout the body. Heme contains an iron ion coordinated with a porphyrin ring.Metallocenes, such as ferrocene, are also considered to be a type of metalloporphyrin, as they contain a central metal atom coordinated with cyclopentadienyl ligands.metalloporphyrin's have a variety of applications in biochemistry, medicine, and catalysis. In addition to their role in haemoglobin, metalloporphyrins are also used as catalysts for various chemical reactions, such as the oxidation of organic compounds. They have also been investigated as potential therapeutics for a range of medical conditions, such as cancer and Alzheimer's disease, due to their ability to interact with biological molecules and affect cellular processes.

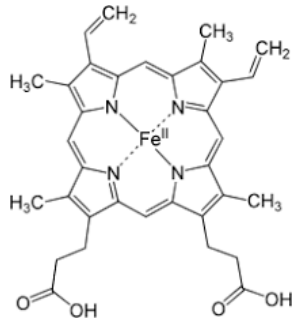
Haemoglobin (Hb): Haemoglobin (Hb) is a type of globular protein present in red blood cells (RBCs), which transports oxygen in our body through blood. It is a tetrameric protein and contains the heme prosthetic group attached to each subunit. It is a respiratory pigment and helps in transporting oxygen as oxyhaemoglobin from the lungs to different parts of the body. Some amount of carbon dioxide is also transported back via haemoglobin as carbaminohaemoglobin.

Haemoglobin Structure: Max Perutz described the molecular structure of haemoglobin in 1959. Haemoglobin is a tetrameric protein. The main type of haemoglobin in adults is made up of two subunits each of 'α' and 'β' polypeptide chains. Each polypeptide chain is linked to a heme prosthetic group.

- α subunit – It is made up of alpha polypeptide chain having 141 amino acid residues.
- β subunit – It is made up of beta polypeptide chain having 146 amino acid residues.

- Heme group – It is an iron-containing prosthetic group, which is attached to each polypeptide chain. It contains iron in the centre of the porphyrin ring.

In the quaternary structure, there is a strong interaction between α and β subunits. On mild treatment with urea, haemoglobin partially dissociates but $\alpha\beta$ dimers remain intact. The subunits are bound together by mostly hydrophobic interactions, hydrogen bonding and a few ion pairs or salt bridges.



Chlorophyll: Chlorophyll is a green compound found in leaves and green stems of plants. Initially, it was assumed that chlorophyll was a single compound but in 1864 Stokes showed by spectroscopy that chlorophyll was a mixture. If dried leaves are powdered and digested with ethanol, after concentration of the solvent, 'crystalline' chlorophyll is obtained, but if ether or aqueous acetone is used instead of ethanol, the product is 'amorphous' chlorophyll.

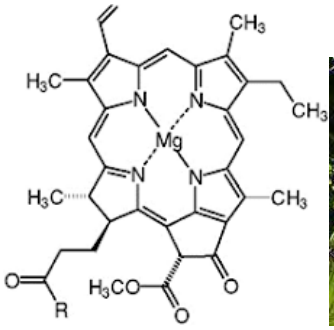
In 1912, Willstatter *et al.* (1) showed that chlorophyll was a mixture of two compounds, chlorophyll-*a* and chlorophyll-*b*:

The word chlorophyll is derived from the Greek word khloros (green) and phyllon (leaves). Chlorophyll is a green pigment that acts as a photoreceptor. It is a pigment that absorbs light energy and aids in the photosynthesis. Chlorophyll exists in many forms, such as chlorophyll a, chlorophyll b, etc.

The chlorophyll absorbs light energy of red and blue wavelengths. Whereas, the green light is not absorbed and is reflected back. Thus, the leaves appear green.

- Chlorophyll is a derivative of porphyrin. The central chemical structure of chlorophyll has a magnesium atom.
- Also, four nitrogen atoms are found around the magnesium. There is a pyrrole ring structure with four carbons and nitrogen.

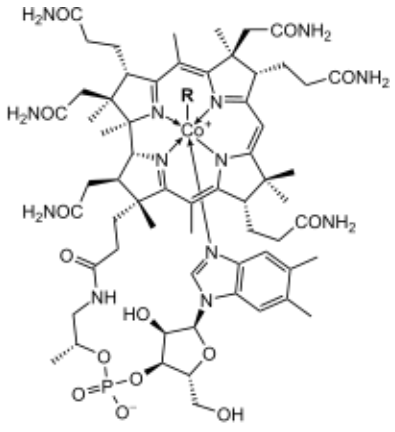
- A hydrocarbon end is also seen.
- The four pyrrole rings with nitrogen and magnesium are together termed the porphyrin head.
- The hydrocarbon end is the phytol tail.



Vitamin B_{12} : Vitamin B_{12} is the only known essential biomolecule with a stable metal-carbon bond, that is, it is an organometallic compound. The cobalt can link to:

1. a methyl group - as in methylcobalamin
2. a 5'-deoxyadenosine at the the 5' positon - as in adenosylcobalamin (coenzyme B_{12}
3. a cyanide group - as in Vitamin B_{12} - as supplied from drug companies

The particular link in the cobalamin has a profound effect upon the mechanism of the enyme reaction.A methyl-nickel intermediate on acetyl-CoA synthase is also known, but only as an intermediate rather than a stable, isolable compound as the three cobalamins. Other organometals such as the methylmercury ion are highly toxic, it is interesting that there is an unfortunate connection between CH_3Hg^+ and methylcobalamin.



R = 5'-deoxyadenosyl, CH_3, OH, CN

UNIT - III :: MEDICINAL CHEMISTRY

Terminology: Here are some commonly used medicinal chemistry terminology related to drug, medicine, and pharmacy:

1. **Drug:** A drug is a chemical substance that produces a biological effect in the body. Drugs are typically used to treat or prevent disease, relieve symptoms, or improve bodily functions.
2. **Medicine:** Medicine is a substance or preparation used to treat or prevent disease or alleviate symptoms. Medicines can be prescription or over-the-counter (OTC), and are regulated by governmental agencies to ensure safety and efficacy.
3. **Pharmacy:** Pharmacy is the science and practice of preparing, dispensing, and managing medications and other healthcare products. A pharmacy is a place where drugs and other healthcare products are dispensed and sold to patients.
4. **Prescription:** A prescription is an order from a licensed healthcare provider for a specific medication or treatment. Prescription medications are typically stronger or more potent than over-the-counter medications, and require a prescription from a licensed healthcare provider.
5. **Over-the-counter (OTC):** Over-the-counter medications are medications that can be purchased without a prescription. OTC medications are typically used to treat minor illnesses or symptoms.
6. **Generic drug:** A generic drug is a medication that is equivalent to a brand-name medication in terms of active ingredients, dosage form, and route of administration. Generic drugs are typically less expensive than brand-name medications.
7. **Pharmacology:** Pharmacology is the study of how drugs interact with biological systems. It encompasses the study of drug mechanisms of action, pharmacokinetics, pharmacodynamics, and toxicity.
8. **Pharmacotherapy:** Pharmacotherapy is the use of drugs to treat or prevent disease. It involves selecting the most appropriate drug for a particular patient based on their medical history, symptoms, and other factors.
9. **Dosage form:** A dosage form is the physical form in which a medication is administered, such as a tablet, capsule, liquid, or injection.

10. **Adverse drug reaction:** An adverse drug reaction is a harmful or unintended effect of a medication. Adverse drug reactions can range from mild side effects to serious or life-threatening events.

Drugs: Drugs are chemicals that alter or affect the physiology of a living system when taken in, they have a low molecular mass (~100 to 500u). These drugs produce a biological response when they interact with macromolecular targets. If the biological response is useful and therapeutic, we use them as medicines and are used for the diagnosis, prevention, and treatment of diseases. Medicines are the drugs that are legally administered by doctors when required under very small doses. Higher doses can be lethal and are potential poisons. Most of these interact with the nervous system, mostly the brain, to produce the required biological response. This usage of chemicals for a therapeutic effect is called chemotherapy.

Classification Of Drugs

Drugs can be classified into several different types. It is done to ensure that the drugs are taken with ease. Drugs are classified on the basis of the following,

1. Based on their pharmacological effect
2. Based on their drug action
3. Based on their chemical structure and
4. Based on their molecular targets.

Based on their Pharmacological Effect: Drugs can be classified on the basis of their pharmacological effects as follows:

- This drug classification is on the basis of the pharmacological effects of the drugs.
- The pharmacological effect is how the drug influences or affects the cells of the organism taking the drug.
- Different types of drugs have varying pharmacological effects on organisms.
- Doctors find these drugs useful as they provide them with a wide range of options for treatments of different health issues.
- For example, analgesics have pain-killing effects, antiseptics kill or halt the growth of microorganisms, and anti-inflammatory drugs reduce the inflammation of the body.

Based on their Drug Action: Drugs can be classified on the basis of their drug action as follows:

- Contrary to pharmacological effects, these drugs are classified on the action they have on specific biochemical processes.
- Drug Action specifies how each drug generates a response from the organism.
- For example, histamine causes inflammation in the body and all antihistamines inhibit the action of the given compound. There are several ways by which the action of histamine can be blocked.
- Another example is that there are several medicines to reduce hypertension, but each type of drug has a different action and works in a different way.

Based on their Chemical Structure: Drugs can be classified on the basis of their chemical structure as follows:

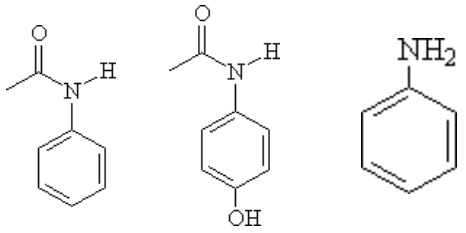
- Drugs that are classified according to chemical structures share several common structures and usually have the same pharmacological activity.
- Basically, these drugs have the same skeletal structures and are branched differently.
- This is also one of the reasons why some drugs are more powerful than others though being of the same class and structures.
- For example, all sulphonamides have a common structural feature.

Sulphonamides of the same skeletal structure

Based on their Molecular Targets: Drugs can be classified on the basis of their molecular targets as follows:

- Drugs interact with biomolecules such as proteins, carbohydrates, lipids, and nucleic acids.
- These are called drug targets or target molecules.
- Drugs with common structures can have a similar mechanism of action on targets.
- This classification is generally preferred by medicinal chemists for clinical trials.
-

Paracetamol (Acetaminophen): The painkilling properties of paracetamol were discovered by accident when a similar molecule (acetanilide) was added to a patient's prescription about 100 years ago. But since acetanilide is toxic in moderate doses, chemists modified its structure to try and find a compound that was less harmful but which still retained the analgesic properties. One of these compounds is *N*-acetyl-*para*-aminophenol, which is also known as acetaminophen in the US and paracetamol (from ***para*-acet**yl-**am**ino-phen**ol**) in the UK. When mixed with codeine it goes by the tradename *Tylenol*.

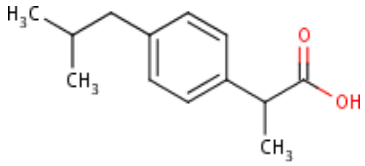


Acetanilide Paracetamol Aniline

In fact, in the body, the original compound, acetanilide is partially converted into a mixture of paracetamol and aniline. The paracetamol provides the painkilling properties, but the aniline is toxic. Paracetamol has a very similar structure to aspirin, and because of this they are recognised by the same enzyme. This enzyme is responsible for the biosynthesis of prostoglandins, which are involved in the dilation of blood vessels that causes the pain experienced in a headache. Reduction of the amount of prostoglandin, therefore, helps prevent headaches and other pain.

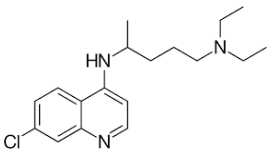
Ibuprofen: Ibuprofen is a nonsteroidal anti-inflammatory drug (NSAID) that is used to relieve pain, fever, and inflammation. This includes painful menstrual periods, migraines, and rheumatoid arthritis. It may also be used to close a patent ductus arteriosus in a premature baby. It can be used by mouth or intravenously. It typically begins working within an hour.Common side effects include heartburn and a rash. Compared to other NSAIDs, it may have other side effects such as gastrointestinal bleeding. It increases the risk of heart failure, kidney failure, and liver failure. At low doses, it does not appear to increase the risk of heart attack; however, at higher doses it may. Ibuprofen can also worsen asthma. While its safety in early pregnancy is unclear, it appears to be harmful in later pregnancy, so is not recommended. Like other NSAIDs, it works by inhibiting the production of prostaglandins by decreasing the activity of the enzyme cyclooxygenase (COX). Ibuprofen is a weaker anti-inflammatory agent than other NSAIDs.Ibuprofen was discovered in 1961 by Stewart Adams and John Nicholson

while working at Boots UK Limited and initially marketed as Brufen. It is available under a number of trade names, including Nurofen, Advil, and Motrin. Ibuprofen was first marketed in 1969 in the United Kingdom and in 1974 in the United States.

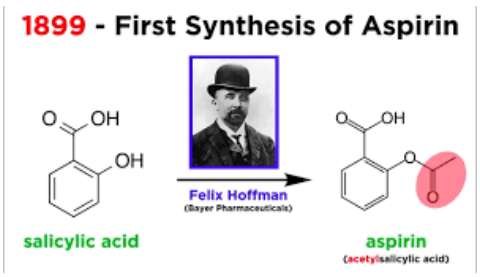


Chloroquine: Chloroquine is a synthetic drug mainly used for the treatment of malaria. Chloroquine was discovered in 1934, it started to practice for the medical needs in the 1940s. It is one of the quinoline derivatives and a member of chemically related antimalarial agents. This chloroquine is tearmed chloroquine phosphate. chloroquine hydrochloride can also use as an intramuscular injection. Chloroquine and hydroxychloroquine are closely related to each other. This is another derivative of quinoline. Hydroxychloroquine can also be used for treating inflammatory rheumatic diseases and malaria.

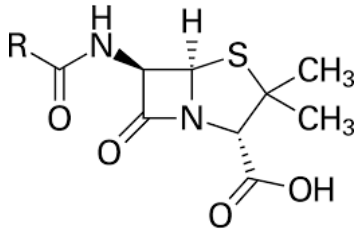
Chloroquine Uses: Chloroquine is an effective agent to act against the susceptible strains of malarial parasites Plasmodiumovale, Plasmodium vivax, and Plasmodium falciparum and some parasitic worms and amoebas. It can also be used for the treatment of inflammatory rheumatic diseases namely rheumatoid arthritis and lupus erythematosus.



Aspirin: Aspirin It is a common antipyretic and is chemically known as acetyl salicylic acid. y It may ulcerate the stomach wall and cause bleeding (Gastric irritant) by producing salicylic acid, when taken taken emptystomach. y Sodium and calcium salts of aspirin are more soluble and are less harmful.



Pencicillin: Penicillin is a widely used antibiotic prescribed to treat staphylococci and streptococci bacterial infections. Penicillin belongs to the beta-lactam family of antibiotics, the members of which use a similar mechanism of action to inhibit bacterial cell growth that eventually kills the bacteria.



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