Contact: 9370220183

www.dnachandrapur.com

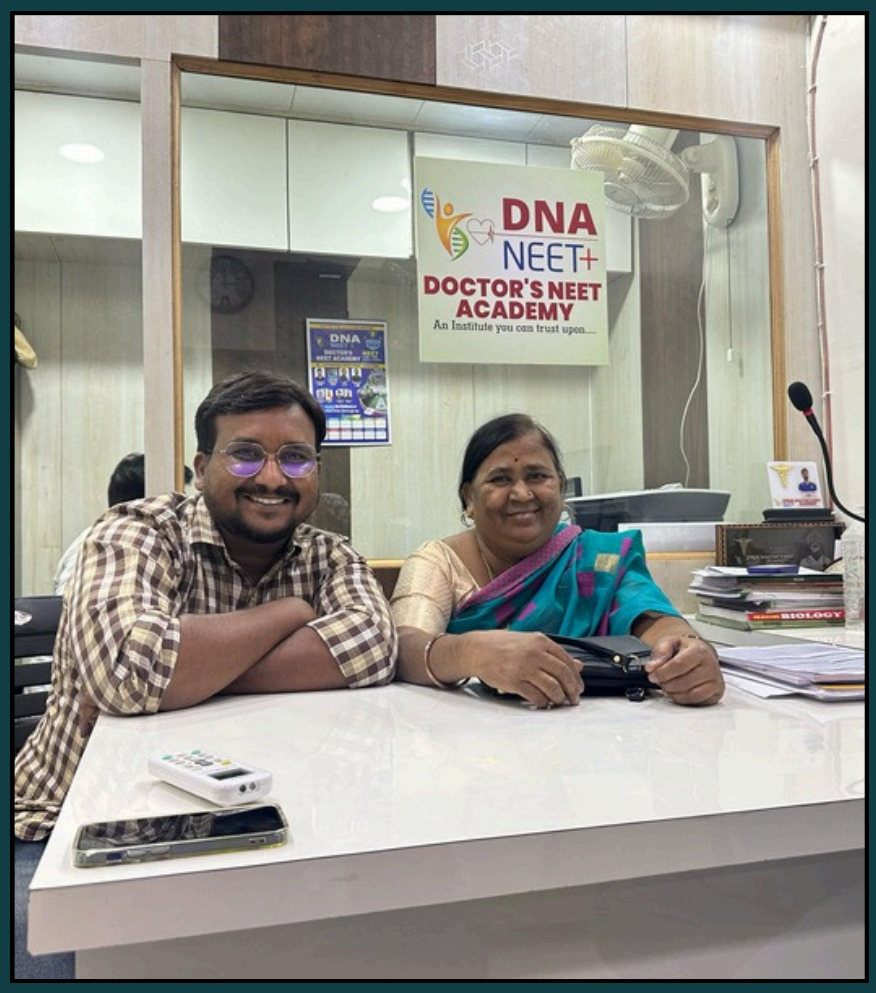
DNA NEET + JEE

INFORMATION BROCHURE

NEET | JEE | MHT-CET | UPSC | BOARDS

Maya Dental Clinic, Tadoba Rd, Sharda Nagar, Tukum, Chandrapur

9370220183, 8275215238



About DNA NEET+JEE

Dear Aspirant,

Welcome to DNA family.

I feel really glad to introduce you to DNA, the finest institute in terms of academics, discipline, result-oriented approach, and providing a healthy, competitive atmosphere for you all.

We began our journey for NEET in 2022 and now with JEE, MHT-CET, CUET, and other science-related All-India level entrance exams.

I have observed the present scenario of coaching classes, faculty changing problems, and all the problems faced by deserving students and came up with DNA, where we believe in fulfilling student's demand regarding studies.

A library, Regular doubt sessions, Boards teaching, Regular test series (BOARDS + NEET/JEE/MHT-CET), and well-designed modules & regular motivation are basic needs of any aspirant.

We promise to deliver.

Thank you.

Director

Sashikant

Dr. Sashikant Bershettiwar

MEET OUR
FACULTIES

BIOLOGY

Dr. Sashikant Sir
Director & Biology Head

Dr. Pranit Sir
Biology

Dr Rahul Sir
Biology

Dr Sakshi Mam
Biology

Chemistry

Dr Lalit Sir
Chemistry

NG sir
Chemistry

MEET OUR
FACULTIES

Physics

Manoj sir
Physics

Dr Rahul sir
Physics

Maths

Abhishek Sir
Maths

Our Results

2025

Krishna Kumar
MBBS, Patna

Shreyash Dudhbawre
MBBS, Akola

Rutika Warghane
MBBS, Washim

Chirag Dagulwar
MBBS, Jalgaon

Morvi Sadala
MBBS, Mumbai

Akansha Sakhre
MBBS, Nagpur

Shrawani adkine
MBBS, Sevagram

Nikita Chilke
MBBS, Chandrapur

Naveen Prasad
MBBS, Jalaun

Prashil Zade
MBBS, Gadchiroli

Aleena Khan
MBBS, Hyderabad

Gargy Aswar
MBBS, Nagpur

Nihal Sheikh
MBBS, Pondicherry

Shreyash Thengare
BDS, Nagpur

Nadiya Sheikh
BDS

Sneha Patil
BAMS, Nagpur

Nausheen Sheikh
BAMS

Akansha Jugnake
BAMS, Amravati

Aiman Saba
BHMS

Airman Saba
BPTH

2024

Abhas Mukwane
MBBS, Chandrapur

Rajnikant Kumar
647 Marks

Aditi Sabnis
MBBS, Nagpur

Prathamesh Yede
MBBS, Nagpur

Shrutika Manwar
MBBS, Ambarnath

Ved Kumbhare
MBBS, Chandrapur

Atharva Burle
MBBS, Nagpur

Pallavi Khokale
BHMS, Mumbai

Sanjana tekam
BPTH

OUR COURSES

- NEET (2 Year Plan)
- JEE (2 Year Plan)
- UPSC (Foundation) (2 Year Plan)
- BOARDS (2 Year Plan)
- NEET Repeater (1 Year Plan)
- MHTCET + BOARDS (2 Year Plan)

NEET XI

STUDY PLANNER

2026-2027

PHYSICS		CHEMISTRY		BIOLOGY	
Topic Name	Classes	Topic Name	Classes	Botany Topic Name	Classes
Basic Maths	6	Some Basic Concept of Chemistry	24	Cell - The Unit of Life	12
Vectors	4	Atomic Structure	16	Cell Cycle and Cell Division	3
Units, Dimensions and Measure	6	Classification of Elements and Periodicity in P	10	The Living World	5
Kinematics	15	Chemical Bonding	24	Biological Classification	12
Newton's Laws of Motion and F	12	States of Matter	4	Morphology of Flowering Plants	12
Circular Motion	4	Thermodynamics	18	Anatomy of Flowering Plants	9
Work, Energy and Power	7	Chemical Equilibrium	10	Plant Kingdom	10
Center of Mass and Collision	8	Ionic Equilibrium	16	Revision	12
Rotational Motion	10	Redox Reactions	6	Revision	6
Gravitation	6	Revision	4	Photosynthesis in Higher Plants	12
Elasticity	3	p-Block Elements	8	Respiration in Plants	5
Fluid Mechanics and Viscosity	6	Classification and Nomenclature	12	Plant Growth and Development	6
Surface Tension	2	Isomerism	16	**Zoology Topic Name**	**Classes**
Thermal Expansion	2	General Organic Chemistry	16	Structural Organisation in Animals	6
Thermometry and Calorimetry	4	Reaction Mechanism	10	Biomolecules	8
Heat Transfer	5	Hydrocarbons	12	Revision	6
Kinetic Theory of Gases	3	Revision	4	Breathing and Exchange of Gases	7
Thermodynamics	4	Qualitative and Quantitative Analysis of Orgc	4	Body Fluids and Circulation	7
Simple Harmonic Motion	6	Total Chemistry	218	Excretory Products and Their Elimination	7
Wave Motion	8			Locomotion and Movement (Muscles)	6
Total Physics	121			Neural Control and Coordination	12
				Chemical Coordination and Integration	7
				Animal Kingdom	10
				Structural Organisation in Animals-Animal	5
				Total Biology	184

NEET XII

STUDY PLANNER

2027-2028

PHYSICS		CHEMISTRY		BIOLOGY	
Topic Name	Classes	Topic Name	Classes	Botany Topic Name	Classes
Electrostatics	18	11th Revision	8	Revision	5
Capacitance	8	Solutions	11	Sexual Reproduction in Flowering Plants	10
Current Electricity	10	Electrochemistry	11	Principles of Inheritance and Variation	20
Magnetic Effects of Current	12	Chemical Kinetics	10	Molecular Basis of Inheritance	20
Magnetic Materials	3	Revision of above topics	9	Revision	3
Bar Magnet and Earth's Magn	2	p-Block Elements	13	Microbes in Human Welfare	6
Electromagnetic Induction	8	d and f block elements	4	Organism, Population and Community	10
Alternating Current	5	Coordination Compounds	11	Ecosystem	6
Electromagnetic Waves	5	Halogen Derivatives	6	Biodiversity and Conservation	3
Ray Optics	12	Alcohols, Phenols and Ethers	6	Revision	6
Wave Optics	8	Aldehydes, Ketones and Carboxylic Acids	7		
Modern Physics	6	Amines	5	**Zoology Topic Name**	**Classes**
Nuclear Physics	5	Biomolecules	5	Revision	3
Semiconductors & Logic Gates	6	Complete 12th Revision	6	Human Reproduction	7
Total Physics	108	Total Chemistry	116	Reproductive Health	5
				Origin and Evolution	10
				Human Health and Disease	12
				Animal Husbandry	3
				Biotechnology Principles and Processes	6
				Biotechnology and its Applications	5
				Total Biology	140

JEE XI

STUDY PLANNER

2026-2027

PHYSICS	Classes	CHEMISTRY	Classes	MATHEMATICS	Classes
Basic Mathematics and Vectors	24	Mole Concept and Concentration Terms	24	Fundamental of Mathematics	10
Units and Dimensions	8	Atomic Structure	15	Logarithm	3
Kinematics-1D and Calculus	8	Quantum Number	6	Sequences and Series	6
Kinematics-2D	8	Periodic Table and Periodic Properties	10	Compound Angles	9
Relative Motion	10	Chemical Bonding	24	Trigonometric Equations	3
Newton's Laws of Motion and Friction	14	Revision	10	Quadratic Equations	6
Work, Energy and Power	10	Thermodynamics and Thermochemistry	18	Point and Straight Lines	11
Circular Motion	6	Chemical Equilibrium	12	Circle	7
Center of Mass and Collision	8	Ionic Equilibrium	18	Complex Numbers	10
Rotational Motion	15	Redox Reactions	8	Permutations and Combinations	8
Gravitation	10	Revision	7	Binomial Theorem	5
Elasticity	6	p-Block Elements	8	Parabola	6
Fluid Mechanics	10	Nomenclature	8	Ellipse	5
Calorimetry	4	General Organic Chemistry	14	Hyperbola	4
Thermal Expansion	4	Isomerism	10	Statistics	2
Heat Transfer	4	Hydrocarbons	12	Solution of Triangles	3
KTG and Thermodynamics	10	Revision	3	Mathematical Reasoning	2
Simple Harmonic Motion	10				
Waves on String and Sound Waves	15				
Error	5				
Total Physics	136	Total Chemistry	147	Total Mathematics	100

JEE XII

STUDY PLANNER

2027-2028

PHYSICS	Classes	CHEMISTRY	Classes	MATHEMATICS	Classes
Electrostatics	21	Liquid Solutions	10	Functions	10
Capacitance	10	Electrochemistry	10	Relations	2
Current Electricity	12	Chemical Kinetics	10	Inverse Trigonometric Functions	7
Magnetic Effects of Current and Magnetism	15	Revision	10	Matrices	6
Electromagnetic Induction and Alternating Current	15	p-Block Elements	18	Determinants	7
Electromagnetic Waves	6	d-Block Elements	6	Limits	3
Geometrical Optics	20	f-Block Elements	5	Continuity	3
Wave Optics	12	Stereoisomerism	10	Differentiability	2
Modern Physics-1		Alkyl Halides	8	Methods of Differentiation	4
Modern Physics-2		Alcohols and Ethers	5	Rate Measure, Tangent and Normal	6
Semiconductors		Carbonyl Compounds	5	Monotonicity	5
Principles of Communication	15	Carboxylic Acids and Amines	5	Maxima Minima	5
Total Physics	109	Aromatic Compounds	6	Indefinite Integration	8
		Coordination Chemistry	10	Definite Integration	7
		Biomolecules	6	Area under the Curve	4
		Revision	6	Differential Equations	5
		Total Chemistry	117	Vectors	7
				3D Coordinate Geometry	7
				Probability	8
				Statistics	3
				Total Mathematics	109

UPSC FOUNDATION 2026-2028

The UPSC Foundation Course is designed to build a strong conceptual base for future civil service aspirants while they are still in school. With a carefully structured curriculum, expert mentors, and an integrated approach to academics, this program ensures that students develop the mindset, discipline, and analytical thinking required to crack India's toughest exam – the UPSC Civil Services Examination.

Why Start in Class 11th & 12th?

- Builds a strong foundation in NCERT concepts – the core of UPSC preparation.
- Develops reading habits, analytical skills, and answer-writing abilities early.
- Helps students choose the right optional subject later.
- Saves 2-3 years of future preparation time by early orientation.

COURSE HIGHLIGHTS

- 📚 Integrated Learning: UPSC-oriented coverage of History, Polity, Geography, Economy & Current Affairs.
- 🧠 Skill Development: Focus on logical reasoning, communication, and critical thinking.
- ✍️ Answer Writing Practice: Regular tests and guided feedback for written expression.
- 🗞️ Current Affairs & Newspaper Analysis: Simplified and explained weekly.
- 🎯 Mentorship Sessions: Guidance from experienced educators and UPSC mentors.
- 💬 Personality Development: Public speaking, debating, and interview confidence training.

WHAT OUR STUDENT SAYS

Kiddhi M. Dhawas

Extremly good and supportive faculty with good atmosphere for study.
Regular doubt session :....
Blessed to study in this institute ....

Dhawas...

Siddhi M. Dhawas.

A wonderful experience about DNA institute with a great faculty of physics, chemistry and biology. Also with this experienced doctor's Excited to become a doctor - ....

Dhawas.

Aarya Deshkar

I has been almost 4 months since I am studying in DNA and my experience in this institute is the most motivating one. Here, the teachers are so experienced who guide us well & the staff and faculty is also very friendly and approaching. We also have a well equipped library and personal doubt solving sessions which helps us to clear even our silliest doubts which arise frequently. This institute provides us with the best faculty and material which I hope will surely help us to brighten our future

School - Carmel Academy CISCE
Percentage - 93%

Aarya

Prajoni R. Umare

one of the best faculty for NEET, Providing friendly Competitive & motivating environment.

Umare

School :- Shree Maharishi vidya Mandir
Marks :- 77.8 %.

Aarya Deshkar

I has been almost 4 months since I am studying in DNA and my experience in this institute is the most motivating one. Here, the teachers are so experienced who guide us well & the staff and faculty is also very friendly and approaching. We also have a well equipped library and personal doubt solving sessions which helps us to clear even our silliest doubts which arise frequently. This institute provides us with the best faculty and material which I hope will surely help us to brighten our future

School - Carmel Academy CISCE
Percentage - 93%

Aarya

Anuchi Meshram

DNA provides a greatly motivating, interactive as well as friendly environment to its students. I have been obtaining their classes since class 10th & found my basics to strengthen more.
DNA institute provides personalized interaction with regular doubt clearence sessions, regular mock tests & excellent faculty which makes it one of the best coachings in Chandrapur.

School → CARMEL ACADEMY-CISCE
Percentage → 92.2 %

Kartika paddle

DNA is a super coaching in chandrapur in my experience till today, as it provides enquisiting and friendly enviorment to with all the students. ~~Till now~~ from April till now I have learned very interesting tricks and something which I didn't learn earlier. DNA provide good facilities and so friendly enviorment which I liked very much...

School → PODAR INTERNATIONAL
per → 70%

WHAT OUR STUDENT SAYS

Name : Shrawani . P. Adkine
College : Mahatma Gandhi Institute of Medical scince, Wardha
course : MBBS

I would like to thank Shashikant sir for their guidance. they helped me a lot during this journey. Thank You sir for everything.

Adkine
4.10.25

Name

Name → Nausheen Firoj Sheikh
College → pharate phatil A.C, pun
Course → BAMS.

Journey of NEET become so easy with DNA faculty, special thanks to Dr. Sashikant sir for his guidence, support it would not be possible without them. Thanking DNA Team.

Nausheen
4. 10. 2025

Name :- Akansha A. Sakhare.
college :- IGGMC Nagpur.
cource :- MBBS.

I would like to thanks Shashi sir and the team. for guidence. I really like the helping nature of Shashi sir. they are very kind, very understanding, they help the students very much, In ~~our~~ colleges have no ability to pay for institute, ~~they~~ ~~teach~~ Shashi sir teach them ~~free~~ free. In these generation very less People are this type of kind, understanding and helpfull. Really very thankfull ~~to~~ for this. and all the Best ~~for~~ Afterthe Drip and tears.

Name :- Sneha Rajesh Patil
College :- GIAC Nagpur
Course :- BAMS

I would like to thank Shashi Sir for all his efforts & Support. In every Possible way he helped me through my entire journey. DNA will give you every possible thing you need, you just have to give them your hard work and dedication.

Patil
04/10/25

Name :- Afnan Saba Aijaz Khatib.
College :- Dhanwantari college Nashik
Course :- B.H.M.S in 1st round

First of all very very Thanks to my favourite, my mentor dr. sashikant sir for always supporting me in every point of my journey. you always motivate me towards the exam in every situation. Thank you for everything. you will be the reason of successful dnq.

Afnan
4.10.2025

Name : Nadiya firdous sheikh Majid
College : Chhattisgarh Dental & Research Institute, Rajnandgaon
course : BDS

I would like to thanks DNA & Dr. Shashikant Bershetti sir for guidence. without them its not possible. Thank you.

Nadiya
4. 10. 2025

FACILITIES

AASHRAY LIBRARY

A peaceful, Wi-Fi enabled study space stocked with the latest NEET & JEE books, modules, and previous year papers — perfect for focused revision and self-study.

Hostel

Safe, clean, and fully-supervised accommodation with nutritious meals, study-friendly rooms, and round-the-clock security — giving students a comfortable home-away-from-home during their NEET & JEE journey.

FEE STRUCTURE

NEET

Premium Batch

(50 STUDENTS ONLY)

2 YEARS PLAN	₹1,50,000
XI NEET + BOARDS COACHING FEES	₹55,000
XII NEET + BOARDS COACHING FEES	₹55,000
XI BATCH 22 MODULES+ DPP, CLASS TEST	₹10,000
XII BATCH 22 MODULES+ DPP, CLASS TEST	₹10,000
NEETPREP + GCI TEST SERIES (200 TEST)	₹20,000

Elite Batch

(70 STUDENTS BATCH)

2 YEARS PLAN	₹1,30,000
XI NEET + BOARDS COACHING FEES	₹45,000
XII NEET + BOARDS COACHING FEES	₹45,000
XI BATCH 22 MODULES+ DPP, CLASS TEST	₹10,000
XII BATCH 22 MODULES+ DPP, CLASS TEST	₹10,000
NEETPREP + GCI TEST SERIES (200 TEST)	₹20,000

FEE STRUCTURE

NEET (Repeaters Batch)

Premium Batch

1 YEARS PLAN	₹60,000
XI & XII NEET COACHING FEES	₹30,000
MODULES+ DPP, CLASS TEST	₹10,000
NEETPREP + GCI TEST SERIES (200 TEST)	₹20,000

FEE STRUCTURE

JEE

Premium Batch

(50 STUDENTS ONLY)

2 YEARS PLAN	₹1,50,000
XI JEE + BOARDS COACHING FEES	₹55,000
XII JEE + BOARDS COACHING FEES	₹55,000
XI BATCH MODULES+ DPP, CLASS TEST	₹10,000
XII BATCH MODULES+ DPP, CLASS TEST	₹10,000
XI & XII TEST SERIES	₹20,000

Elite Batch

(70 STUDENTS BATCH)

2 YEARS PLAN	₹1,00,000
XI JEE + BOARDS COACHING FEES	₹45,000
XII JEE + BOARDS COACHING FEES	₹45,000
XI BATCH MODULES+ DPP, CLASS TEST	₹10,000
XII BATCH MODULES+ DPP, CLASS TEST	₹10,000

FEE STRUCTURE

MHTCET & BOARDS

MHTCET & BOARDS

2 YEARS PLAN	₹80,000
XI BOARDS COACHING FEES	₹30,000
XII BOARDS COACHING FEES	₹20,000
MHTCET BOARDS COACHING FEES	₹30,000
(INCLUDING NOTES,TEST SERIES, DPP MODULES)	

Boards Batch

(70 STUDENTS BATCH)

2 YEARS PLAN	₹50,000
REGISTRATION	₹5,000
DURING JOINING	₹5,000
EVERY 2 MONTHS TIIL 40K	₹5,000
(INCLUDING NOTES,TEST SERIES, DPP MODULES)	

SCIENCE

Chemical Reactions & Equations

Balancing chemical equations

- Number of atoms of each element remains the same before and after chemical reaction.
- Start balancing with the compound that contains maximum number of atoms.
- We cannot alter the formula of the compound or element.
- Mention physical states of reactants and products along with chemical formula.

Types of chemical reactions

- **Combination Reaction :** Two or more substances combine to form single substance. e.g.,

  $CaO(s) + H_2O(l) \rightarrow Ca(OH)_2(aq)$

- **Decomposition Reaction :** A single reactant breaks down to give simpler products. e.g.,

  $CaCO_3(s) \rightarrow CaO(s) + CO_2(g)$

  - **Thermal decomposition** Decomposition reaction which take place by absorption of heat
  - **Photo decomposition :** Decomposition by absorption of light

- **Double displacement reaction :** Two compounds react by exchange of ions to form two new compounds e.g.,

  $BaCl_2(aq) + Na_2SO_4(aq) \rightarrow BaSO_4(s) + 2NaCl(aq)$

- **Displacement Reactions :** In such reactions more reactive element displaces less reactive element from its compound e.g.,

  $Zn + CuSO_4 \rightarrow ZnSO_4 + Cu$

- **Redox Reactions :** If a substance gains oxygen during a reaction or loses hydrogen, it is said to be oxidised. If a substance loses oxygen or gains hydrogen during a reaction, it is said to be reduced In a chemical reaction when one reactant gets oxidised while the other gets reduced such reactions are called redox reactions. e.g.,

  $\overset{+2}{Cu}O + \overset{0}{H_2} \rightarrow \overset{0}{Cu} + \overset{+1}{H_2}O$

- **Exothermic and Endothermic Reactions** Exothermic is liberation of heat Endothermic is absorption of heat.

Corrosion

Chemical process of slow eating up of the surfaces of certain metals when kept in open for a long time.
For e.g., rusting of iron, tarnishing of silver and copper metal.
Rancidity : Oxidation of food items containing fat and oil.

Acids, Bases and Salts

Acids

- Sour in taste
- Changes blue litmus to red
- Acid + metal → salt + $H_2\uparrow$
- Metal carbonate/metal hydrogen carbonate + acid → salt + CO_2 + H_2O
- Base + acid → salt + H_2O
- Metal oxide + acid → salt + H_2O
- Aqueous solution conduct electricity due to presence of H^+ ion
- H^+ ion of acids cannot exist alone, they exist after combining with H_2O molecules.

Bases

- Bitter in taste
- Change red litmus to blue
- Non-metallic oxides + Base → salt + H_2O
- Gives OH^- ion in water

pH

- Used for measuring H^+ concentration in a solution.
- Neutral solution pH = 7.
- Acidic solution pH < 7.
- Basic solution pH > 7.

Salts

- Salts can be acidic, basic or neutral.

Same common salts :

- NaOH : Formed by chlor-alkali process used in soaps, detergents paper making etc.
- $CaOCl_2$: $Ca(OH)_2 + Cl_2 \rightarrow CaOCl_2 + H_2O$
- Used for bleaching cotton and linen, as oxidising agent etc.
- $NaHClO_3$: $NaCl + H_2O + CO_2 + NH_3 \rightarrow NH_4Cl + NaHCO_3$
- Used as ant acid, in soda acid fire extinguishers etc.
- Na_2CO_3 : Used in glass, soap and paper industry for removing permanent hardness of water.

Metals and Non-metals

Physical properties of metals
- Metallic lusture
- Usually solid (except Hg which is a liquid)
- Show ductility and malleability.
- Good conductor of heat and electricity.

Chemical properties of metals
- Form basic oxides with oxygen (Al and Zn forms amphoteric oxides)
- Form metal oxide and H_2 gas with H_2O
- Na and K react violently with cold water.
- Mg reacts only with hot water.
- Al, Zn and Fe react with steam.
- Form salts and H_2 gas with acids.
- Reactive metals displace less reactive metals from their compound.

Activity Series of Metals or Reactivity

The series of metals in decreasing order of reactivity

K > Na > Ca > Mg > Al > Zn > Fe > Sn > Pb > H > Cu > Hg > Ag > Au > Pt

Chemical properties of non-metals
- with chlorine form covalent compounds.
- do not react with acids on room temperature. On heating oxidised to respective oxides.
- chlorine dissolves in water and form acidic solution.
- Hydrogen burns with a pop sound.
- C and S form oxide with oxygen.

Physical properties of Non-metal
- poor conductors weak and brittle
- low density non- sonorous

Extraction of metals

Ore

- Metals of high reactivity → K, Na, Ca Mg, Al → Electrolysis of molten ores → Purification of metal → Pure metal
- Metals of Medium reactivity → Zn, Fe Pb
  - Carbonate ore → Calcination
  - Sulphide ore → Roasting
  - → Oxide of metal → Reduction to metal → Purification of metal → Pure metal
- Metals of low reactivity → Cu, Ag, Au → Sulphide ore → Roasting → Metal → Purification of metal → Pure metal

Reaction of metals with non metals
- Metal loses the valence electrons while non-metal accepts these electron of form ionic bond.
- **Properties of ionic compounds :**
- Generally solids exist in the form of crystals.
- High melting and boiling points.
- Soluble in water, insoluble in kerosene, petrol etc.
- Conduct electricity in molten state and not in solid state.

Corrosion

Corrosion is a natural process that causes the transformation of pure metal into undesirable substance when they react with substance like water and air

Prevention of Corrosion
- By painting, oiling, greasing
- By making Alloys
- By Galvanisation

Carbon and its Compounds

- Soaps and detergents
  - Soaps
    - •Na or K salts of long chain carboxylic acids
    - •Form micelles that has polar head and non-polar tail.
    - •Form scum in hard water.
  - Detergents
    - •Ammonium or sulphate salts of long chain carboxylic acids
    - •Remains effective even in hard water.
    - •Used to make shampoos and products for cleaning clothes.
- Important Carbon Compound
  - Ethanol
    - **Ethanol :** CH_3CH_2OH
    - **Properties**
    - $2Na + 2CH_3CH_2OH \rightarrow 2CH_3CH_2ONa + H_2\uparrow$
    - $CH_3CH_2OH \xrightarrow[H_2SO_4/443K]{\text{Hot conc.}} CH_2 = CH_2 + H_2O$
  - Ethanoic acid
    - **Ethanoic Acid :** CH_3COOH
    - **Properties : Esterification**
    - $CH_3COOH + CH_3CH_2OH \xrightarrow{H^+} CH_3COOCH_2CH_3$ (Ester)
  - **Saponifcation Reaction:**
    - $CH_3COOC_2H_5 + NaOH \xrightarrow{Heat} CH_3COONa + C_2H_5OH$
- Chemical Properties of carbon and its compounds
  - **Chemical Properties**
  - **Combustion:**
    - $C + O_2 \rightarrow CO_2 + Heat + Light$
    - $CH_4 + O_2 \rightarrow CO_2 + H_2O + Energy$
    - $CH3CH2OH + O_2 \rightarrow CO_2 + H_2O + Energy$
  - **Oxidation:**
    - Carbon compounds undergo oxidation in presence of oxidising agents
    - $CH_3CH_2OH + (O) \rightarrow CH_3COOH$
  - **Addition reaction:**
    - $R_2C=CR_2 + H_2 \xrightarrow{Ni} R-\underset{H}{\overset{H}{C}}-\underset{H}{\overset{H}{C}}-R$
  - **Substitution:**
    - Saturated hydrocarbons react with Cl_2 in presence of sunlight
    - $CH_4 + Cl_2 \xrightarrow{sunlight} CH_3Cl + HCL$
- Unique properties of carbon
  - •Forms covalent bonding
  - •Shows catenation property
  - •Tetravalent in nature
  - •Forms allotropes
- Types of carbon compounds
  - Saturated
    - Containing single bonds
      - Alkane C_nH_{2n+2}
  - Unsaturated
    - Containing double or triple bonds
      - Alkene (double bond) C_nH_{2n}
      - Alkyne (Triple bond) C_nH_{2n-2}
- Allotropes of carbon
  - Graphite
    - •Forms layer structure
    - •Good conductor of electricity
  - Diamond
    - •Forms a rigid three dimensional structure
    - •Hardest known substance
  - Fullerene
    - •Has shape like a soccer ball
- Homologous series
  - Series of carbon compounds that differ from each other by a $-CH_2-$ unit e.g. CH_4 and C_2H_6

Life Process

LIFE PROCESS : It includes - nutrition, respiration, transpiration, translocation in plants, Transportation in human beings and excretion.

NUTRITION : It is a process of intake and utilization of nutrients by an organism.

- **Autotrophic :** They synthesize their own food.
  - **Photo autotrophic:** Get energy from light e.g., green plants.
  - **Chemoautotrophic:** Get energy from chemical reaction e.g., some bacteria.
- **Heterotrophic:** They depend on other organisms for food.
  - **Saprophytic:** Get nutrients from decaying matter e.g., mushroom.
  - **Parasitic:** Get nutrients from a living host e.g., tapeworm.
  - **Holozoic:** Get complex organic food into body and then digests, absorbs and assimilates it e.g., man.

RESPIRATION : It is an oxidative process involving the consumption of oxygen and liberation of CO_2 and H_2O.

- **Aerobic :** It occurs in the presence of O_2
- **Anaerobic :** It occurs in the absence of O_2

TRANSPIRATION : Loss of water from aerial parts of the plant. It is of four kinds : stomatal, cuticular, lenticular, bark.

TRANSLOCATION : It is a transport of sucrose, hormones and minerals from the size of synthesis to utilization site in plants.

EXCRETION : It is removal of toxic material from the body e.g., CO_2 & NH_3.

Excretory wastes : It includes - respiratory wastes (CO_2), nitrogenous wastes (NH_3), bile pigments.

Excretory organ : Kidneys (remove urea, uric acid), Lungs (remove CO_2), Liver (urea) & Skin (salt urea).

TRANSPORTATION
It includes the circulation of nutrients and O_2 through blood.

- **Blood** : Consists of RBC, WBC, platelets and plasma.
- **Blood Vessels** : It includes - arteries (oxygenated blood) veins (deoxygenated blood) and capillaries.

Control and Coordination

It includes — plant growth and movement, control and coordination in animals, human nervous system, endocrine system in human beings.

PHYTOHORMONES
These are chemical substances affecting growth and development in plants.

- **Auxin:** Promotes cell elongation,
- **Gibberellins:** Induces stem elongation,
- **Cytokinin:** Promotes cell division
- **Abscisic Acid:** Accelerates abscission of leaves
- **Ethylene:** Fruit ripening hormone

MOVEMENT (in Plants)

PLANTS SHOW TROPISM

- Geotropism
- Hydrotropism
- Chemotropism

HUMAN NERVOUS SYSTEM

CNS

BRAIN
The highest coordinating centre surrounded by meninges.

SPINAL CORD
It is slender measuring 45 cm long, originating from medulla oblongata.

PNS

Autonomic nervous system Involuntary

Somatic Nervous System

Sympathetic Nervous System

Parasympathetic Nervous System

ENDOCRINE SYSTEM :
It consists of ductless glands secreting hormones to carry messages to the target organs. These are - **Pituitary gland** (producing growth hormone), **Pineal gland** (regulating sexual cycle), **Thyroid gland** (secreting thyroxine), **Thymus** (helping immunity), **Adrenal Gland** (preparing the body for emergency situation), **Pancreas** (secreting insulin), **Gonads :** Testes (producing testosterone) Ovary (secreting estrogen)

How do Organisms Reproduce

HOW DO ORGANISMS REPRODUCE :
It includes Reproduction, Types of reproduction, Sexual reproduction in plants, Human reproduction & Reproductive Health.

REPRODUCTION
The ability of an organism to produce their own kind is called reproduction

SEXUAL REPRODUCTION
In Plant : Flower is a reproductive part of a plant taking part in sexual reproduction. It has some parts - sepals, petals, stamens & pistils.

POLLINATION
Transfer of pollen grains from stamen to gynoecium is called pollination.

FERTILIZATION
It involves the fusion of a male gamete with female gamete.

REPRODUCTIVE HEALTH
It involves reproductive disorders e.g., infertility in males & females and different types of contraceptive methods, such as Condom, Copper-T, *Saheli* pills.

Asexual Reproduction
The production of off springs by a single parent without the formation of gametes is called a sexual reproduction

Sexual Reproduction
It involves the union of male and female gametes

Anther : It is male reproductive unit producing pollen grains

Gynoecium
It is female reproductive unit having parts-stigma, style & ovary.

Human Reproductive System
It is of two types - male reproductive system and female reproductive system

Types of Asexual Reproduction
(i) Fission
(ii) Fragmentation
(iii) Budding
(iv) Regeneration
(v) Spore formation
(vi) Vegetative propagation in plants
(vii) Tissue culture

Syngamy
It shows permanent fusion of two haploid gametes to form a diploid zygote, e.g., yeast

Conjugation
It is a temporary pairing of two parents is exchange male and female gamete, e.g., human being, birds, amphibians

Self Pollination
It involves the transfer of pollen grains from the anther of a flower to the stigma of same flower through wind, water and insects.

Cross Pollination
It is the transfer of pollen grains from the anther of one flower to the stigma of another plant through wind, bird and insects.

Male Reproductive System
It includes a pair of testes, a pair of sperm ducts, a penis.

Female Reproductive System
It consists of a pair of ovaries, a pair of oviduct, uterus, vagina & vulva

Menstruation
It is a reproductive cycle occuring after 28-29 days in the female human beings. It lasts for 3-5 days.

Heredity

HEREDITY : It includes - Heredity, Variations, Mendel's laws and Sex determination.

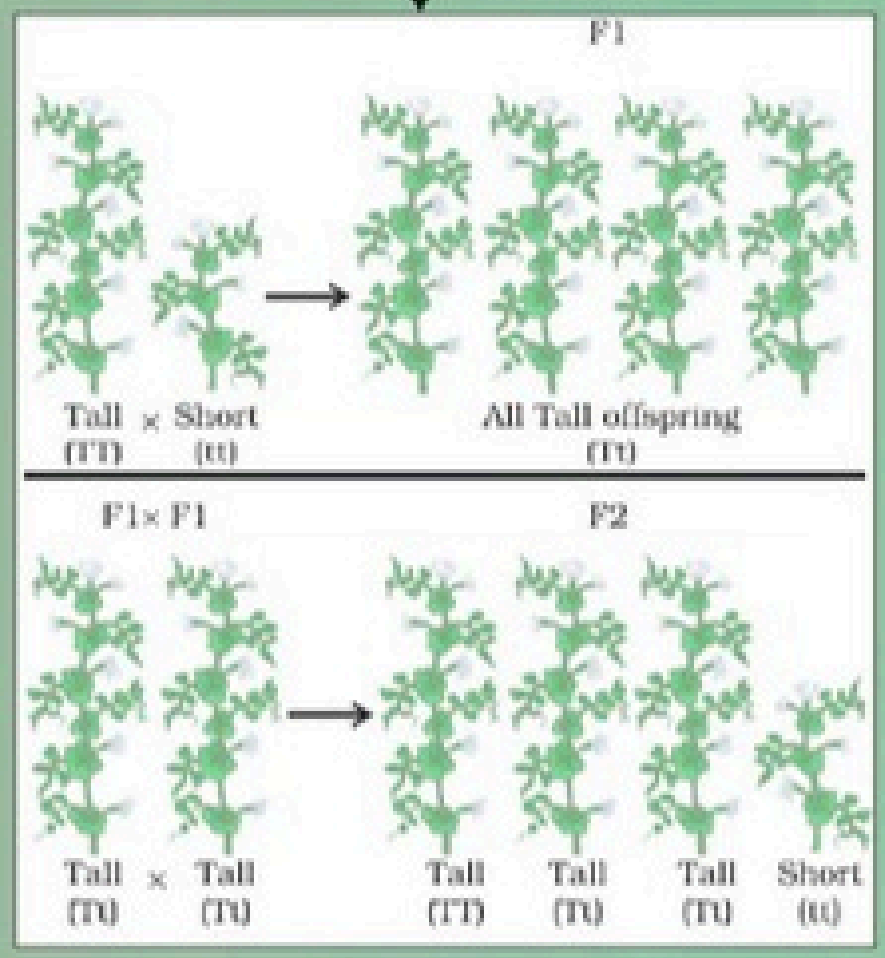
HEREDITY
Transmission of characters from one generation to the next is called heredity.

DNA provides information in the form of gene

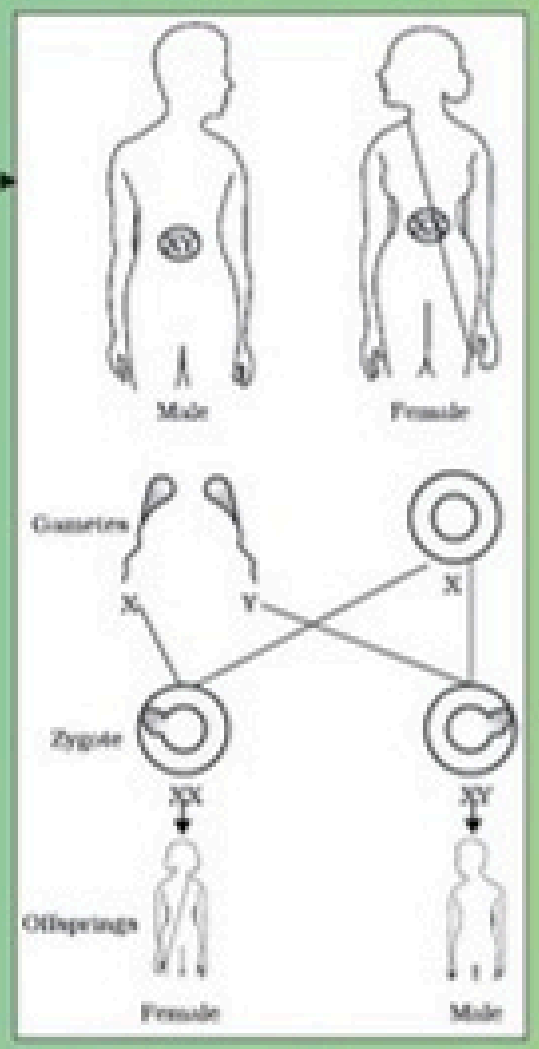
VARIATIONS
It happens during meiosis, mutation and gamete formation.

MENDEL'S PRINCIPLES
- Gregor Johann Mendel is known as 'Father of Genetics'.
- It includes three principles -

(i) Law of Dominance
(ii) Law of Segregation
(iii) Law of Independent Assortment.



SEX DETERMINATION
It is a biological system that determines the development of sexual characters (male and female) in an organism.



Light-Reflection and Refraction

LIGHT
It is a form of energy that produces the sensation of vision in eyes.

CHARACTERISTICS OF LIGHT

- Rectilinear propagation of light
- Light travels with a speed of 3×10^8 m/sec in air/ vacuum.
- Speed of light depends on the medium.
- Light shows behaviour such as reflection, refraction, interference, diffraction, polarisation etc.

REFLECTION
Turning back of light in the same medium

Laws:
- Angle of incidence(i) = angle of reflection(r)
- Incident ray, normal and reflected ray all lie in the same plane.

PLANE MIRROR
Is a looking glass, highly polished on one surface.
- Forms virtual and erect image.
- Distance of object from mirror = distance of image from mirror.
- The size of the image is same as object.
- Image is laterally inverted.
- Mirror formula $\frac{1}{v}+\frac{1}{u}=\frac{1}{f}$
- Used in kaleidoscope periscope, etc.

CONCAVE MIRROR
Spherical glass polished on the outside. It is also known as converging mirror.
- Images produced are always real, inverted, can be enlarged based on the position except when object is placed between pole and focus.
- Uses: Make-up and shaving mirrors, dentist mirror, in floodlight etc.
- For spherical mirror, Radius of curvature (R) = 2× focal length (f)

CONVEX MIRROR
Spherical glass polished inside. It is also known as diverging mirror.
- It forms virtual, upright and small images.
- Uses: For security purposes, in vehicles as rear-view mirror and street lighting.

REFRACTION
Bending of light ray while passing from one medium to other medium.

Laws:
- $\frac{\sin i}{\sin r}$ = constant
  Also called Snell's law
- Incident ray, normal and refracted ray all lie in the same plane.

REFRACTIVE INDEX
Ratio of speed of light in free space(c) to that in a medium(v).
$n = c/v$

Power of a lens $P = \frac{1}{f \text{ (in meter)}}$

LENS
Piece of transparent material with two refracting surfaces, at least one is curved and refractive index should be different as that of the surrounding.

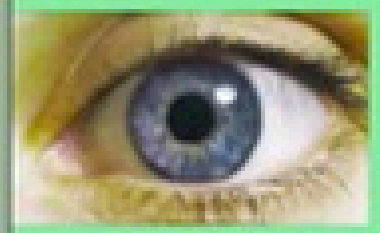
CONCAVE LENS
Central portion of lens is thinner than marginal. It is also known as diverging lens.

CONVEX LENS
Central portion of lens is thicker than marginal. It is also known as converging lens.

LENS FORMULA
Relation between focal length, distance of object and image from optical centre
$\frac{1}{f}=\frac{1}{v}-\frac{1}{u}$

MAGNIFICATION
Ratio of distance of image to the distance of object from the optical centre or pole.
Also equal to height of image to height of object
$m=\frac{I}{o}=\frac{v}{u}=\frac{h_i}{h_o}$

The Human Eye and the Colourful World



HUMAN EYE
The organ which gives us the sense of light or enables us to see. It interprets the shapes, color and dimensions of the object

POWER OF ACCOMODATION
The ability of the eye lens to adjust its focal length so as to see the objects clearly located anywhere and Near point of the human eye is 25 cm far point of the human eye is infinity

REFRACTION :
Bending of light when it passes obliquely from one medium to another medium

PARTS OF THE HUMAN EYE

RETINA : It is a light sensitive screen on which image is formed.
It contains rods sensitive to intensity of light and cones sensitive to colour.
Persistence of vision – Image retained on retina for 1/16th of a second.

CORNEA : Thin membrane acts like a lens which allow light to enter the eye.

SCLERA : Outer part of the eye, protects interior of the eye.

EYE LENS : Convex lens made of transparent, crystalline and flexible jelly like material.

CILIARY MUSCLES :
Modify the shape of eye lens.

PUPIL : Hole in the middle of iris through which light enters.

IRIS : Controls the amount of light entering the eye by changing the size of pupil.

OPTICAL NERVE : Nerves take the image to the brain in the form of electrical signals.

DEFECTS OF HUMAN EYE

MYOPIA or Short Sightedness: can see nearby objects but can't see far off objects distinctly.
Corrected by using concave lens.

HYPERMETROPIA or Long Sightedness : can see far off objects clearly but cannot see nearby objects clearly.
Corrected by convex lens

PRESBYOPIA: It is due to lessening of flexibility of the crystalline lens and weakening of ciliary muscles. Corrected using bifocal lenses.

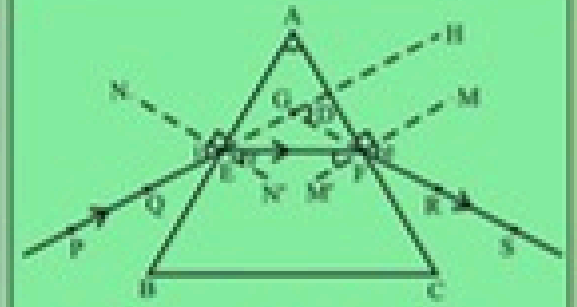
DISPERSION :
Splitting of white light into its component colours – VIBGYOR.
Red colour deviates least and violet deviates most.

SPECTRUM :
Band of seven component colours VIBGYOR on a white screen

RAINBOW :
Seven colours band of sunlight in the form of bow in the sky.
It is formed due to reflection, refraction and dispersion of sunlight by tiny water droplets.

ATMOSPHERIC REFRACTION
Refraction of light by atmosphere

SCATTERING OF LIGHT



Refraction of light through a glass prism

The peculiar shape of the prism makes the emergent ray bend at an angle to the direction of the incident ray. This angle is called the angle of deviation.

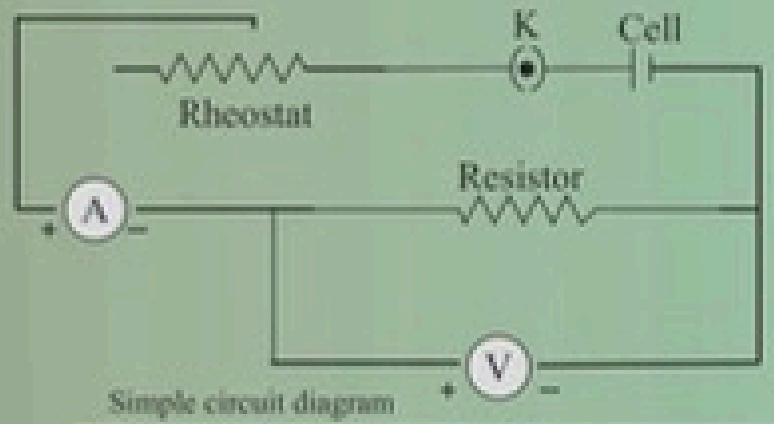
Twinkling of stars

Advance sunrise and delayed sunset

Tyndall effect
The smoke particles become visible

Blue colour of sky

Electricity



Simple circuit diagram

ELECTRICITY
Study of electric charges at rest and in motion

ELECTRIC CIRCUIT
The arrangement of various electrical components along which electric current flows

ELEMENTS OF CIRCUIT
- Cell
- Rheostat
- Switch
- Ammeter
- Voltmeter
- Fuse
- LED

CHARGE
Something associated with matter due to which it produces and experiences electric and magnetic effects.
Resides on the outer surface of conductor.
$Q = ne$
S.I. unit is coulomb (C)

ELECTRIC CURRENT
Flow of charge (electron) per unit time across the section of the conductor.
$I = Q/t$
S.I. unit is ampere (A)

ELECTRIC POTENTIAL
Work done per unit charge.
$V = \frac{W}{Q}$
S.I. unit is volt

RESISTANCE
Obstruction offered to the flow of electric current
$R = V/I$
S.I. unit is ohm

ELECTRIC POWER
Rate at which electric energy is dissipated or consumed in a circuit.
$P = VI$
S.I. unit is watt

OHM'S LAW
Current passing through a conductor is directly proportional to the potential difference.
$I \propto V \Rightarrow V = RI$

HEATING EFFECTS OF ELECTRIC CURRENT
As current flows through a conductor, the free electrons lose energy which is converted into heat.
Joule's heating law
$H = I^2Rt = VIt$

SAFETY DEVICES
When too much current flows or short circuit these devices breaks the circuit.
They have less melting point.

COMBINATION OF RESISTANCES

SERIES COMBINATION
First end of the first resistance and second end of the last resistance are connected to the two terminals of a cell
$R_{eq} = R_1 + R_2 + R_3$

PARALLEL COMBINATION
One end of the resistances are connected to one terminal and the second ends are connected to another terminal of a cell.
$\frac{1}{R_{eq}} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$

FACTORS AFFECTING RESISTANCE

Length of wire (l). Resistance $R \propto l$

Area of cross-section of wire (A).
$R \propto \frac{1}{A}$

Nature of material of the wire. Low resistance – Silver, Copper, etc. High resistance nichrome, constantan, etc.
$R = \rho \frac{l}{A}$, ρ = resistivity

Temperature (T). Resistance of all pure metals increases with a rise in temperature

KWh – (Kilo watt hour) – The commercial unit of electric energy 1 kwh = 3.6×10^6 J

Magnetic Effects of Electric Current

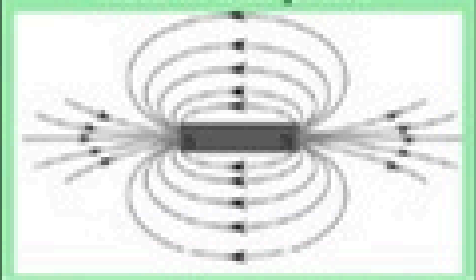
An electric current flowing in a conductor produces magnetism

PROPERTIES OF MAGNETS

- Attractive property Magnets attract magnetic materials like-iron, cobalt, nickel, etc.
- Directive property A freely suspended magnet always aligns in the north-south direction
- Opposite poles attract and like poles repel.
- Poles exist in pairs North and South
- Repulsion is a sure test of magnet

MAGNETIC FIELD
Space around a magnet in which magnetic effect is experienced

MAGNETIC FIELD LINES
A line such that the tangent at any point on it gives the direction of the magnetic field at that point.



PROPERTIES OF MAGNETIC FIELD LINES

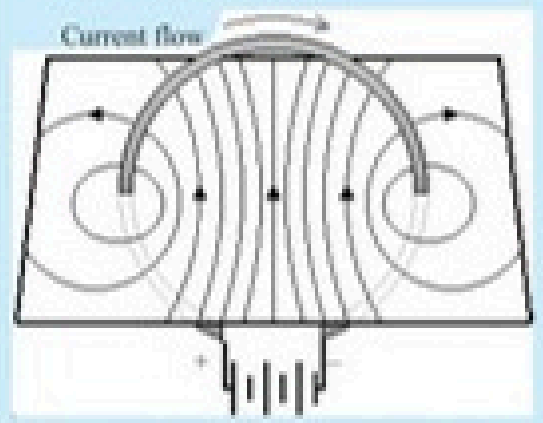
- All field lines are closed curves.
- Field lines are close together near the poles.
- Two field lines never intersect each other

MAGNETIC FIELD DUE TO A CURRENT CARRYING CONDUCTOR

The magnetic field around a straight conductor carrying current is in the form of closed circular loops, in a plane perpendicular to the conductor.

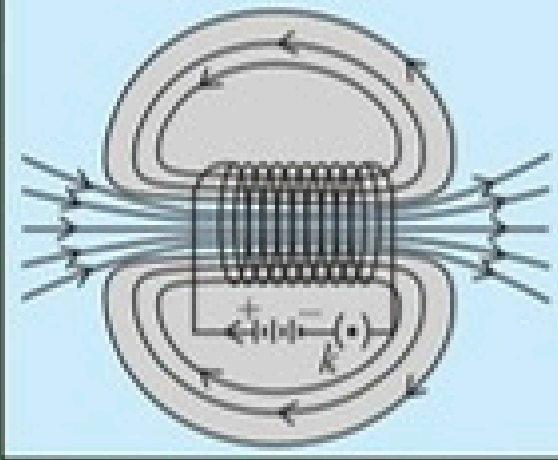
At every point of a current carrying loop, the concentric circles representing the magnetic field around it would become larger as we move away.

Magnetic field due to current through a circular loop



FORCE ON A CURRENT CARRYING CONDUCTOR
Direction of force can be determined by Fleming's left hand rule, right hand palm or screw rule.

Magnetic field due to a current in a solenoid



DOMESTIC ELECTRIC CIRCUIT

- Electricity used in home at 220 V AC
- A cable containing three coloured wires-red (live wire), black (neutral wire) & green (earthed wire)

TYPES OF CURRENT

DIRECT CURRENT
Current whose magnitude and direction does not vary with time.

ALTERNATING CURRENT
Current whose magnitude and direction periodically changes with time.

Our Environment

OUR ENVIRONMENT : It includes - Ecosystem, Food chain, Food web, Ecological pyramids, Ozone depletion & Waste management

ECOSYSTEM
It is a self sustaining structural and functional unit of the biosphere.

- **Natural Ecosystem**
  This ecosystem develops in nature without human support.
  It is of two types - aquatic and terrestrial.
- **Artificial Ecosystem**
  It is created by human beings. e.g., gardens, agricultural farms.

FOOD CHAIN
The sequence of living organism in an ecosystem in which organism transfer food energy is called food chain. It **describes who eats whom in the wild.**

FOOD WEB
It is a network of food chains operating in an ecosystem which get connected at various trophic levels so as to form a number of feeding connections amongst different organisms of biotic community.

ECOLOGICAL PYRAMIDS
It is a graphical representation of ecological parameters like number of individuals or the amount of biomass or the amount of energy present in various trophic levels of a food chain with producer forming the base and top carnivore at the apex.

OZONE DEPLETION
Scientists found, a hole in the ozone layer over Antarctica in 1985. Ozone in stratosphere protects life on earth by absorbing UV light.

WASTE MANAGEMENT
It is concerned with proper disposal of wastes. The wastes are of two types -
(i) Biodegradable
(ii) Non-biodegradable

- Preventing and reducing amount of wastes
- Biological reprocessing
- Sanitary landfill
- Incineration (burning of substance at high temperature to form ash.)
- Sewage treatment
- Bioremediation (cleaning the environment with biological options - microbe and plants)

Biodegradable wastes
These are broken down naturally by saprophytes or decomposers. These include livestock wastes, papers, cotton, leather, etc.

Non-biodegradable wastes
They are not decomposed by decomposers, such materials (wastes) are plastic, crockery, metallic cans, glass articles, etc.

MATHEMATICS

Real Numbers

Fundamental Theorem of Arithmetic

Every composite number can be expressed as product of primes, and this factorisation is unique apart from the order in which the prime factors occur.

LCM = Product of greatest power of each prime factors involved in the numbers

HCF = Product of smallest power of each common prime factors in the numbers.

Irrational Numbers

Number which is not a rational number and whose decimal expansion is non-terminating and non-repeating or Which cannot be written in the form $\frac{p}{q}$ where p and q are integers and $q \neq 0$.

Important Consequence of Fundamental Theorem

(i) For two positive integers a, b
$\text{HCF}(a, b) \times \text{LCM}(a, b) = a \times b$

(ii) For three positive integers a, b and c
$\text{HCF}(a, b, c) \times \text{LCM}(a, b, c) \neq a \times b \times c$

(iii) If p is a prime number and it divides a^2, then p also, divides a where 'a' is the positive integer.

Arithmetic Progressions

Arithmetic Progression (AP)

(i) An arithmetic progression (AP) is a sequence of numbers in which each term is obtained by adding a fixed number 'd' to the preceeding term, except the first term.
The fixed number is called the common difference.

(ii) A sequence of numbers $a_1, a_2, a_3, \ldots$ is an AP if the difference $a_2 - a_1, a_3 - a_2, a_4 - a_3, \ldots$ gives the same value, i.e. if $a_{k+1} - a_k$ is the same for different values of k

Consideration of Terms in A.P

(i) Three terms a-d, a, a+d

(ii) Four terms a-3d, a-d, a+d, a+3d

nth Term (or General Term) of an Arithmetic Progressions

In an AP; with first term 'a' and common difference d, the n^{th} term (or the general term) is given by,

$$a_n = a + (n-1)d$$

Note: that an AP can be finite or infinite according to as the number of terms are finite or infinite.

Sum of the FIRST 'n' Terms of an A.P.

(i) The sum of the first n terms of an A.P. is given by

$$S_n = \frac{n}{2}[2a + (n-1)d]$$

(ii) If l is the last term of the finite A.P. say the n^{th} term, then the sum of all terms of the A.P. is given by,

$$S_n = \frac{n}{2}[a + l]$$

Note: that sum of first n positive integers is given by

$$S_n = \frac{n(n+1)}{2}$$

Polynomials

1 Polynomial

An algebraic expression $f(x)$ of the form $f(x) = a_0 + a_1x + a_2x^2 + ... + a_nx^n$, where $a_0, a_1, ...a_n$ are real numbers and all indices of variable x are non-negative integers is called polynomial in variable x.

(i) The highest indices of x is called degree of the polynomial.

(ii) $a_0, a_1x, ... a_nx^n$ are terms of the polynomial.

(iii) $a_0, a_1, ... a_n$ are co-efficients of the polynomial.

2 Types of Polynomial

On the basis of number of terms in the polynomial	On the basis of degree of the polynomial
(i) **Monomial:** If polynomial has one term.	(i) **Linear:** If polynomial has degree one.
(ii) **Binomial:** If polynomial has two terms.	(ii) **Quadratic:** If polynomial has degree two.
(iii) **Trinomial:** If polynomial has three terms.	(iii) **Cubic:** If polynomial has degree three.
	(iv) **Biquadratic:** If polynomial has degree four.

Note that 5, 6, – 9 etc are called constant polynomial as there value is fixed and constant polynomial 0 is called zero polynomial whose degree is not defined.

3 Value of a Polynomial

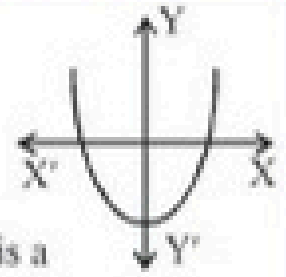
The value of a polynomial $f(x)$ at $x = \alpha$ is obtained by substituting $x = \alpha$ in the given polynomial and is denoted by $f(\alpha)$

4 Zero(es)/Root(s) of Polynomial

$x = r$ is a zero of a polynomial $p(x)$ if $p(r) = 0$

5 Geometrical Meaning of Zeroes of the Polynomial

Zero(es) of a polynomial is/are the x-coordinate of the points where graph $y = f(x)$ intersects the x-axis.



(i) **Linear polynomial :** Graph of linear polynomial is a straight line and has exactly one zero.

(ii) **Quadratic polynomial :** Graph of quadratic polynomial is always a parabola and this polynomial can have atmost two zeroes.

(iii) **Cubic polynomial:** Cubic polynomial can have atmost three zeroes.

6 Relationship between Zeroes and Coefficient of a Polynomial

(i) Zero of a linear polynomial $ax + b$ is $x = -\frac{b}{a}$

(ii) If α and β are the zeroes of the quadratic polynomial $ax^2 + bx + c$, then

$\alpha + \beta = -\frac{b}{a}$

i.e. sum of zeroes $= -\frac{\text{Coefficient of } x}{\text{Coefficient of } x^2}$

and $\alpha\beta = \frac{c}{a}$

i.e. product of zeroes $= \frac{\text{Constant term}}{\text{Coefficient of } x^2}$

(iii) If α, β and γ are zeroes of the cubic polynomial, then $\alpha + \beta + \gamma = -\frac{b}{a}$

i.e. sum of zeroes $= -\frac{\text{Coefficient of } x^2}{\text{Coefficient of } x^3}$

$\alpha\beta + \beta\gamma + \gamma\alpha = \frac{c}{a}$

i.e. sum of product of every two zeroes $= \frac{\text{Coefficient of } x}{\text{Coefficient of } x^3}$, $\alpha\beta\gamma = -\frac{d}{a}$

i.e. product of zeroes $= -\frac{\text{Constant term}}{\text{Coefficient of } x^3}$

(iv) If zeroes α and β of quadratic polynomial are given then

$P(x) = K[x^2 - (\alpha + \beta)x + \alpha\beta]$

Pair of Linear Equations in Two Variables

1 Pair of Linear Equations in Two Variables

An equation of the form $Ax + By + C = 0$ is called a linear equation in two variables x and y where A, B, C are real numbers.

Two linear equations in the same two variables are called a pair of linear equations in two variables. Standard form of linear equations in two variables:

$a_1x + b_1y + c_1 = 0,\ a_2x + b_2y + c_2 = 0$

Where $a_1, a_2, b_1, b_2, c_1, c_2$ are real numbers such that

$a_1^2 + b_1^2 \neq 0,\ a_2^2 + b_2^2 \neq 0$

2 Solution of a Pair of Linear Equations in Two Variables

There are two methods of finding solution of a pair of Linear equations in two variables.

(1) Graphical Method

(2) Algebraic Method: This method is more convenient when point representing the solution has non-integral co-ordinates.

3 Graphical Method

Consider the standard form of linear equations in two variables.

$a_1x + b_1y + c_1 = 0;\ a_2x + b_2y + c_2 = 0$

While solving the above system of equation by this method following three cases arise.

(i) If $\frac{a_1}{a_2} \neq \frac{b_1}{b_2}$; system is called consistent, having one or unique solution and pair of straight lines representing the above equations intersect at one point only.

(ii) If $\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$; system is called dependent and have infinitely many solution. Pair of lines representing the equations coincide.

(iii) If $\frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2}$; system is called inconsistent and has no solution. Pair of lines representing the equations are parallel or do not intersect at any point.

4 Algebraic Method

Consider the following system of equation

$a_1x + b_1y + c_1 = 0;\ a_2x + b_2y + c_2 = 0$

There are following two methods under Algebraic method to solve the above system:

(i) Substitution method

(a) Find the value of one variable, say y in terms of x or x in terms of y from one equation.

(b) Substitute this value in second equation to get equation in one variable and find solution.

(c) Now substitute the value solution so obtained in the equation got in step (a)

(ii) Elimination Method

(a) If coefficient of one variable are not same in both the equation multiply both the equation with suitable non-zero constants to make coefficient of one variable numerically equal.

(b) Add or subtract the equation to get equation in one variable and solve it.

(c) Now substitute the value got in the above step in either of the original equation to get value of the other variable.

Quadratic Equations

Quadratic Equations

A polynomial of degree two in the standard form $ax^2 + bx + c$ $(a \neq 0)$, when equated to zero is called a quadratic equation in standard form.

Thus, $ax^2 + bx + c = 0$, where a, b, c all are real numbers and $a \neq 0$, is the standard form of a quadratic equation.

Nature Of Roots

For quadratic equation

$ax^2 + bx + c = 0$

$(a \neq 0)$, value of $(b^2 - 4ac)$ is called discriminant of the equation and denoted as D.

$$\therefore D = b^2 - 4ac$$

Discriminant is very important in finding nature of the roots.

(i) If $D = 0$, then roots are real and equal.

(ii) If $D > 0$, then roots are real and unequal.

(iii) If $D < 0$, then roots are not real.

(iv) If $D \geq 0$, then roots are real

Zero(es)/Root(s) of Quadratic Equation

A real number α is said to be a root of the quadratic equation $ax^2 + bx + c = 0$, if $a\alpha^2 + b\alpha + c = 0$.

The zeroes of the quadratic polynomial $ax^2 + bx + c$ and the roots of the equation $ax^2 + bx + c = 0$ are same.

Relation Between Zeroes and Co-efficient of Quadratic Equation

If α and β are zeroes of the quadratic equation $ax^2 + bx + c = 0$, where a, b, c are real numbers and $a \neq 0$, then

$$\alpha + \beta = -\frac{b}{a}$$

$$\Rightarrow \text{sum of zeroes} = -\frac{\text{Coefficient of } x}{\text{Coefficient of } x^2}$$

$$\alpha\beta = \frac{c}{a}$$

$$\Rightarrow \text{product of zeroes} = \frac{\text{Constant term}}{\text{Coefficient of } x^2}$$

Quadratic Formula

Roots of quadratic equation $ax^2 + bx + c = 0$ are given by

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

provided $b^2 - 4ac \geq 0$

Methods of Solving Quadratic Equation

(i) Factorisation.

(ii) By using quadratic formula.

Triangles

Similar Figures

Two figures having the same shape but not necessarily the same size are called similar figures.

Note that all congruent figures are similar but the similar figures need not be congruent.

Similarity of Polygons

Two polygons of the same number of sides are similar if (i) their corresponding angles are equal and (ii) their corresponding sides are in the same ratio (or proportion).

Similarity of Traingles

Two triangles are similar if

(i) their corresponding angles are equal and

(ii) their corresponding sides are in the same ratio (or proportion)

Basic Proportionality Theorem (BPT)

If a line is drawn parallel to one side of a triangle to intersect the other two sides in distinct points, then other two sides are divided in the same ratio. Thus in $\triangle ABC$, if $DE \parallel BC$, then

$$\frac{AD}{DB} = \frac{AE}{EC}$$

Converse of BPT

If a line divides any two sides of a triangle in the same ratio, then the line is parallel to the third side.

Criteria for Similarity of Traingles

(i) **AAA Similarity Criterion** : If in two triangles, corresponding angles are equal, then their corresponding sides are in the same ratio and hence the two triangles are similar.

(ii) **AA Similarity Criterion** : If in two triangles, two angles of one triangle are respectively equal to the two angles of the other triangle, then the two triangles are similar.

(iii) **SSS Similarity Criterion** : If in two triangles, corresponding sides are in the same ratio, then their corresponding angles are equal and hence the triangles are similar.

(iv) **SAS Similarity Criterion** : If one angle of a triangle is equal to one angle of another triangle and the sides including these angles are in the same ratio (proportion), then the triangles are similar.

Coordinate Geometry

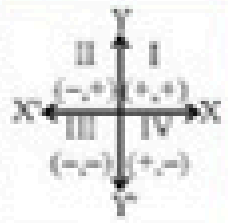
Coordinate of a point in XY- Plane

The perpendicular distance of a point from the y-axis is called its x-coordinate or abscissa. The perpendicular distance of a point from the x-axis is called its y-coordinate or ordinate. The x and y taken together is called coordinate of a point denoted by (x, y).

The coordinate of a point on x-axis are of the form (x, 0) and on the y-axis are of the form (0, y).

Sign-conventions in the XY-Plane

The x and y-axis divide the plane into four parts known as quadrants denoted by I, II, III and IV. The sign of x-and y-coordinate in each of the quadrant is shown.



Distance Formula

The distance between any two points $P(x_1, y_1)$ and $Q(x_2, y_2)$ in the plane is given by,

$$PQ = \sqrt{(x_1 - x_2)^2 + (y_1 - y_2)^2}$$

Also the distance of the point $P(x_1, y_1)$ from the origin is

$$\sqrt{x_1^2 + y_1^2}$$

Mid-point Formula

The coordinates of the mid point P of the line segment joining the points $A(x_1, y_1)$ and $B(x_2, y_2)$ is,

$$\left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right)$$

Section Formula

(i) The coordinates of the point $P(x, y)$ which divides the line segment joining the points $A(x_1, y_1)$ and $B(x_2, y_2)$ internally in the ratio $m_1 : m_2$ are,

$$\left(\frac{m_1x_2 + m_2x_1}{m_1 + m_2}, \frac{m_1y_2 + m_2y_1}{m_1 + m_2}\right)$$

(ii) If the ratio in which P divides AB is $K : 1$, then the coordinates of the point P will be,

$$\left(\frac{Kx_2 + x_1}{K + 1}, \frac{Ky_2 + y_1}{K + 1}\right)$$

Introduction to Trigonometric

Trigonometric Identities

(i) $\sin^2\theta + \cos^2\theta = 1$ [for $0° \le \theta \le 90°$]

(ii) $\sec^2\theta - \tan^2\theta = 1$ [for $0° \le \theta < 90°$]

(iii) $\operatorname{cosec}^2\theta - \cot^2\theta = 1$ [for $0° < \theta \le 90°$]

Trigonometric Ratios

Let ΔABC be a right triangle right angled at B. Then the trigonometric ratios of the angle A in right ΔABC are defined as follows:

$$\text{sine of } \angle A = \frac{\text{Side opposite to } \angle A}{\text{hypotenuse}} = \frac{BC}{AC}$$

$$\text{cosine of } \angle A = \frac{\text{Side adjacent to } \angle A}{\text{hypotenuse}} = \frac{AB}{AC}$$

$$\text{tangent of } \angle A = \frac{\text{Side opposite to } \angle A}{\text{Side adjacent to } \angle A} = \frac{BC}{AB}$$

$$\text{cosecant of } \angle A = \frac{\text{hypotenuse}}{\text{Side opposite to } \angle A} = \frac{AC}{BC}$$

$$\text{secant of } \angle A = \frac{\text{hypotenuse}}{\text{Side adjacent to } \angle A} = \frac{AC}{AB}$$

$$\text{cotangent of } \angle A = \frac{\text{Side adjacent to } \angle A}{\text{Side opposite to } \angle A} = \frac{AB}{BC}$$

(i) $\sin A \cdot \operatorname{cosec} A = 1$ (ii) $\cos A \cdot \sec A = 1$

(iii) $\tan A \cdot \cot A = 1$ (iv) $\tan A = \frac{\sin A}{\cos A}$

Note : The values of the trigonometric ratios of an angle do not vary with the lengths of the sides of the triangle, if the angle remains same.

$\angle A$	$0°$	$30°$	$45°$	$60°$	$90°$
$\sin A$	0	$\frac{1}{2}$	$\frac{1}{\sqrt{2}}$	$\frac{\sqrt{3}}{2}$	1
$\cos A$	1	$\frac{\sqrt{3}}{2}$	$\frac{1}{\sqrt{2}}$	$\frac{1}{2}$	0
$\tan A$	0	$\frac{1}{\sqrt{3}}$	1	$\sqrt{3}$	Not defined
$\operatorname{cosec} A$	Not defined	2	$\sqrt{2}$	$\frac{2}{\sqrt{3}}$	1
$\sec A$	1	$\frac{2}{\sqrt{3}}$	$\sqrt{2}$	2	Not defined
$\cot A$	Not defined	$\sqrt{3}$	1	$\frac{1}{\sqrt{3}}$	0

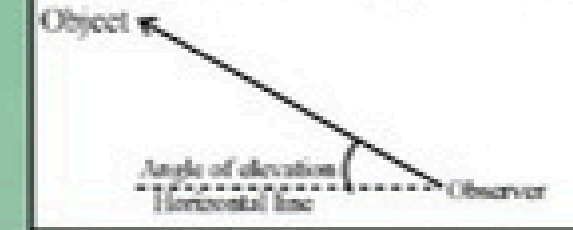
Some Applications of Trigonometric

Introduction

The height or length of an object or the distance between two distant objects can be determined with the help of trigonometric ratios.

Line of Sight

The line drawn from the eye of an observer to the point on the object the object viewed by the observer is called the line of sight.

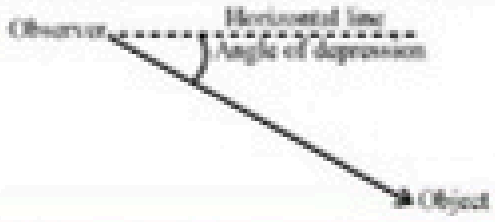


Angle of Elevation

The angle formed by the line of sight with the horizontal when the object is above the horizontal level is called angle of elevation.

Angle of Depression

The angle formed by the line of sight with the horizontal when the object is below the horizontal level is called angle of depression.



Circles

Introduction

A circle is a set of all points in a plane at a fixed distance from a fixed point in a plane. The fixed point is called the centre of the circle. The fixed distance is called the radius of the circle.

Tangent

A tangent to a circle is a straight line which touches the circle at only one point. The point where the tangent touches the circle is called point of contact of the tangent to the circle.

A tangent to a circle is a special case of a secant, when the two ends points of its corresponding chord coincides.

Note that

(i) Tangent at any point of a circle is perpendicular to the radius through the point of contact.

(ii) The line containing the radius through the point of contact is called the normal to the circle at the point.

Number of Tangents from a Point to Circle

(i) Only two tangents can be drawn from an exterior point to a circle.

(ii) One and only one tangent can be drawn from a point lying on the circle.

(iii) No tangent can be drawn from the point lying inside the circle.

Length of a Tangent

The length of the segment of a tangent from an external point to the point of contact with the circle is called the length of the tangent. Lengths of tangents drawn from an external point to a circle are equal.

Areas Related to Circles

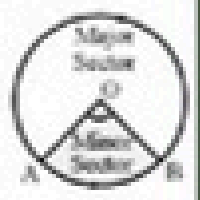
Circle

The set of all points in a plane which are at a fixed distance from a fixed point in the plane is called circle.
The fixed point is called centre and the fixed distance is called radius of the circle.

Terms Related to Circles

(i) **Chord:** A line joining any two points on a circle.

(ii) **Arc:** A piece of a circle between two points on the circle is called an arc.
The arc less than the semi-circular arc is called minor arc and the one greater than the semi-circular arc is called major arc.

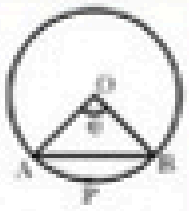


(iii) **Sector:** The portion of a circular region enclosed by two radii and the corresponding arc is called a sector of the circle.

(iv) **Segment:** The portion of a circular region enclosed between a chord and the corresponding arc is called a segment of the circle.

Area of a Segment

(i) Area of segment APB
= Area (sector OAPB)
– Area (ΔOAB)



(ii) If θ is the central angle, then the area of segment APB is given by the formula.
Area (segment APB)

$$= \frac{\theta}{360^\circ} \times \pi r^2 - r^2 \sin\frac{\theta}{2}\cos\frac{\theta}{2}$$

Length of an Arc and Area of Sector

(i) The length of an arc of a sector of an angle θ is given by,

$$l = \frac{\theta}{360^\circ} \times 2\pi r$$

Perimeter of sector

$$AOB = OA + OB + \overset{\frown}{AB} = 2r + \frac{\theta}{360^\circ} \times 2\pi r$$

(ii) The area of the sector of angle θ is given by,

$$\text{Area of sector } AOB = \frac{\theta}{360^\circ} \times \pi r^2$$

Perimeter and Area of a Circle

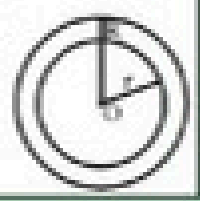
(i) The perimeter or circumference of a circle is given by $C = 2\pi r$

(ii) The Area of a circle of radius r is given by, $A = \pi r^2$

(iii) Area of a circular ring:

The area of the circular path or ring is given by the difference of the area of outer circle and the area of inner circle.

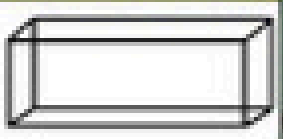
Area of circular ring $= \pi(R^2 - r^2)$



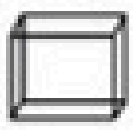
Surface Areas and Volumes

1 Surface Areas and Volumes of Solids

(i) **Cuboid:**
Volume $= l \times b \times h$
Total surface area $= 2[lb + bh + hl]$
Lateral surface area $= 2[bh + hl]$
Diagonal of a cuboid $= \sqrt{l^2 + b^2 + h^2}$

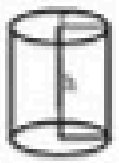


(ii) **Cube:**
Volume $= a^3$
Total surface area $= 6a^2$
Lateral surface area $= 4a^2$
Diagonal of a cube $= \sqrt{3}a$

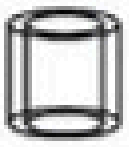


(iii) **Cylinder and cone:**

(a) Right circular cylinder
Volume $= \pi r^2 h$
C.S.A $= 2\pi rh$
T.S.A $= 2\pi rh + 2\pi r^2 = 2\pi r(r + h)$



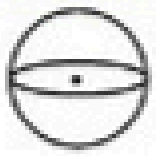
(b) Right circular hollow cylinder: Let r and R be internal & external radii.
Volume $= \pi(R^2 - r^2)h$
C.S.A $= 2\pi(R + r)h$
T.S.A $= 2\pi(R + r)h + 2\pi(R^2 - r^2)$
$= 2\pi(R + r)(h + R - r)$



(c) Right circular cone
Slant height, $l = \sqrt{r^2 + h^2}$
Volume $= \frac{1}{3}\pi r^2 h$
C.S.A $= \pi rl$
T.S.A $= \pi rl + \pi r^2$

2 Surface Areas and Volumes of Sphere and Hemisphere

(i) **Sphere:**
Volume $= \frac{4}{3}\pi r^3$
Surface area $= 4\pi r^2$



(ii) **Hemisphere:**
Volume $= \frac{2}{3}\pi r^3$
C.S.A $= 2\pi r^2$
T.S.A $= 3\pi r^2$

(iii) **Hemispherical shell:**
Volume $= \frac{2}{3}\pi\left(R^3 - r^3\right)$
C.S.A. $= 2\pi(R^2 - r^2)$
T.S.A. $= 2\pi(r^2 + R^2) + \pi(R^2 - r^2)$
$= \pi(r^2 + 3R^2)$

3 Surface Areas of a Combination of Solids

The surface area of a solid which is a combination of other solids, is calculated by adding the curved surface areas of the individual solids.

4 Volume of a Combination of Solids

Whenever solid is formed by combining two or more solids, then the amount of matter present in the new solid is equal to the sum of amounts of matter in the constituting solids.

Volume of new solid = sum of the volumes of the individual solids.

Statistics

1 Basic Terms

Class limits : Suppose marks obtained by all of the students are divided into classes 25 – 35, 35 – 45 and so on.
In class 25 – 35 , 25 is called lower class limit and 35 is called upper class limit.
Class size : The difference between upper and lower class limit.

Class mark : It is given by

$$\frac{\text{Upper class limit} + \text{Lower class limit}}{2}$$

2 Mean of Ungrouped Data

The mean of 'n' observations $x_1, x_2, \ldots, x_n$ is given by $\bar{x} = \frac{\Sigma x_i}{n}$

3 Mean of Grouped Data

(i) **Direct method:** Mean $(\bar{x}) = \frac{\Sigma f_i x_i}{\Sigma f_i}$

(ii) **Assumed mean method :**

$$\text{Mean}(\bar{x}) = A + \frac{\Sigma f_i d_i}{\Sigma f_i}$$

where A is assumed mean, $d_i = x_i - A$

(iii) **Step deviation method :**

$$\text{Mean}(\bar{x}) = A + \left(\frac{\Sigma f_i u_i}{\Sigma f_i}\right) h, \; u_i = \frac{x_i - A}{h}$$

4 Mode

(i) **For ungrouped data:** The mode is that observation which occurs most frequently, i.e. an observation with maximum frequency.

(ii) **For grouped data :**

$$\text{Mode} = l + \frac{f_1 - f_0}{2f_1 - f_0 - f_2} \times h, \text{ where}$$

l = lower limit of the modal class,
f_1 = frequency of the modal class,
f_2 = frequency of the class succeeding the modal class,
h = size of the class interval,
f_0 = frequency of the class preceeding the modal class.

5 Median

(i) **For ungrouped data:** Arrange the data in ascending order.

If n is odd, then the median is $\left(\frac{n+1}{2}\right)^{th}$ observation.

If n is even, then the median is the average of $\left(\frac{n}{2}\right)^{th}$ and, $\left(\frac{n}{2}+1\right)^{th}$ observations.

(ii) **For grouped data:** Median $= l + \left[\frac{\frac{n}{2} - cf}{F}\right] \times h$, where

l = lower limit of the median class,
cf = commutative frequency of the class preceeding the median class,
F = frequency of the median class,
h = class size, n = sum of all frequencies.

6 Relationship Between Mean, Mode and Median

3 Median = Mode + 2 Mean

Probability

1 Probability - An Experimental (Empirical) Approach

Let n be the total number of trials. The empirical probability of an event E happening, is given by

$$P(E) = \frac{\text{Number of trials in which the event happened}}{\text{The total number of trials.}}$$

2 Probability as a Measure of Uncertainity

(i) **Experiment :** An operation which can produce some well defined outcomes is known as experiment.
(ii) **Trial :** Performing of an experiment is called trial.
(iii) **Event :** The outcomes of an experiment are called events.
(iv) **Equally likely event :** Outcomes of trial are equally likely if taking into consideration all the relevant evidences, there is no reason to expect one in preference to the others.
(v) **Elementary event :** An event having only one outcome
Note that the sum of probabilities of all the elementary events of an experiment is 1.
(vi) **Sample space :** The set of all possible outcomes in an experiment is called sample space.

3 Probability - A Theoretical Approach (Classical Probability)

If an event 'A' can happen in 'm' ways and does not happen in 'n' ways, then the probability of occurence of event 'A' denoted by P (A) is given by,

$$P(A) = \frac{\text{Number of favourable outcomes}}{\text{Number of all possible outcomes}} = \frac{m}{m+n}$$

and the probability of not happening of A, denoted by $P(\bar{A})$ is given by

$$P(\bar{A}) = \frac{\text{Number of unfavourable outcomes}}{\text{Number of all possible outcomes}} = \frac{n}{m+n}$$

4 Impossible and Sure Events

The probability of an event which is impossible to occur is 0 and such an event is called impossible event.
The probability of an event which is sure or certain to occur is 1 and such an event is called sure event or certain event.

5 Complementary Events

The event representing 'not E' is called the complement of event 'E' and we say that the events E and $\bar{E}$ are complementary events, $P(E) + P(\bar{E}) = 1$

DNA
NEET+JEE

DNA NEET + JEE

Maya Dental Clinic, Tadoba Rd, Sharda Nagar, Tukum, Chandrapur

9370220183, 8275215238