

UNIT TEST ANSWERS

PHYSICS

SOUND WAVES

- Hz
 - Transverse wave
- Persistence of audibility
The sensation of hearing produced by a sound is retained for a period of $1/10 = 0.1$ second. This characteristic of the ear is persistence of audibility.
 - Acoustics of buildings
Acoustics of buildings is the branch of science that deals with the condition to be fulfilled in the construction of a building for clear audibility.
- During monsoon, atmosphere is filled with water molecules. Thus density of air increases and speed increases.
 - On hot days, the density of air decreases and speed of sound increases. Speed of sound also increases with increase in temperature.
- Pendulum C will oscillate with maximum amplitude. As A and C has same length, they have same frequency. Thus they are in resonance and amplitude increases to the maximum.
- Natural Vibration** - Vibrations of a tuning

fork when it is hit with the hammer.

Forced Vibration -

- The vibrations produced in a steel spoon when it falls on the floor.
 - Vibration of air column inside drum when the drum is played.
- Resonance** - The paper rider in a sonometer wire is thrown off when a tuning fork is placed on the sonometer board.
- Due to the vibrations produced by thunder, window panes undergo forced vibration. If the frequency of thunder waves become equal to the natural frequency of the window pane, the amplitude of vibration increase to maximum due to resonance. Thus loud sound is produced.
 - If soldiers march, the bridge will undergo forced vibration. In case the frequency of the march becomes equal to the natural frequency of the bridge, the amplitude of vibration increases to maximum due to resonance. Thus the bridge may collapse.

LENSES

- Virtual image
- Convex lens
 - Concave lens
 - Convex lens. Object will be at $2F$.
- Power is a term related to the focal length of a lens. Power of a lens is the reciprocal of focal length expressed in metres. Power

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

Unit of power is dioptre.

It is represented by D.

$$f = +25 \text{ cm} = \frac{+25}{100} = +0.25 \text{ m}$$

$$p = \frac{1}{f} = \frac{1}{+0.25} = +4 \text{ D}$$

- $f = -10 \text{ cm}$
 - $u = -40 \text{ cm}$
 - $f = -10 \text{ cm}$

$$v = \frac{uv}{u+v} = \frac{-40 \times -10}{-10 + -10} = \frac{+400}{-20} = -20 \text{ cm}$$

THE WORLD OF COLOURS AND VISION

- Convex lens
 - Rainbow - Dispersion
 - Red colour of setting sun - Scattering
 - When a person views an object, its image remains in the retina of the eye for a time interval of 0.0625 s (1/16 s). This phenomenon is called Persistence of vision.
 - A torch rotated rapidly appears as an illuminated circle.
 - Sparkler's trail effect.
 - Color - top
 - On retina
 - This can be rectified by using a convex lens of suitable power.
 - Hypermetropia or Long - sightedness
- Thaumatrope.
 - Kaleidoscopic colour-top.
 - Rubber pencil trick.
 - LED POV displays
 - Revolving wheels.
 - Rotation of fan leaves

MAGNETIC EFFECTS OF ELECTRIC CURRENT

- Split ring commutator
 - A magnetic field is created which repels the magnetic needle. It is due to the current flow through the conductor. A magnetic field is created around a conductor when current flows through it.
 - When the direction of current flow across the conductor changes these will be variation in the deflection of the magnetic needle.
 - Magnetic effect of electricity
 - The end of the solenoid through which current flows in the clockwise direction is the south pole and the end through which current flows in the anticlockwise direction is north pole.
- When the current flow in the coil is in the clockwise direction, the direction of magnetic field lines will be from outside to inside of the coil. When the current flows in the anticlockwise direction, the direction of magnetic field lines will be from inside the coil to outside.
 - Number of turns, Intensity of electric current
 - Increase the number of turns
 - Increase the strength of current flow.
 - Use soft iron as the core.
 - Increase the area of cross section of the solenoid.

ELECTRIC ENERGY : CONSUMPTION AND CONSERVATION

- Both A and R are true and R is the correct explanation of A.
 - 3,600,000 J
- An induction cooker works on the principle that a continuously varying magnetic field produces heat in a magnetic substance placed upon it. works by converting microwaves into heat energy within the water molecules of the food.
- Given: $V = 230 \text{ V}$, $I = 2 \text{ A}$.
From Ohm's Law,
$$R = \frac{V}{I} = \frac{230 \text{ V}}{2 \text{ A}} = 115 \Omega.$$
 - Time $t = 5 \text{ minutes} = 300 \text{ s}$.
Heat produced

$$H = VIt = 230 \times 2 \times 300$$

$$= 138,000 \text{ J.}$$

5. Yes — both the statement and reason are scientifically valid and logically connected.

a) Yes, both are correct. Reducing personal carbon footprint is an important environmental responsibility, and greenhouse gases from individual activities do contribute to global warming.

b) Yes. The reason correctly explains the statement because individual greenhouse gas emissions increase global warming, which causes climate change. Therefore, reducing personal emissions helps protect the environment.

c) Use public transport, cycling, or walking instead of using private vehicles.

6. a) Power of Heater A (PA)

$$= V \times I = 230 \text{ V} \times 2 \text{ A} = 460 \text{ W.}$$

Power of Heater B (PB)

$$= V \times I = 230 \text{ V} \times 2.5 \text{ A} = 575 \text{ W.}$$

b) Heater A has the higher resistance. We can find resistance using Ohm's law,

$$R = \frac{V}{I}$$

Resistance of A (R_A)

$$= \frac{V}{I} = \frac{230 \text{ V}}{2 \text{ A}} = 115 \Omega.$$

Resistance of B (R_B)

$$= \frac{230 \text{ V}}{2.5 \text{ A}} = 92 \Omega.$$

Since $115 \Omega > 92 \Omega$, Heater A has a higher resistance.

c) Heater B will produce more heat. According to the equation $H = P \times t$, the heat produced is directly proportional to the power when the time is constant. Since Heater B has a higher power (575 W) than Heater A (460 W), it will generate more heat in the same amount of time.

7. Energy from iron = Power \times Time

$$= 500 \text{ W} \times 1 \text{ h} = 500 \text{ Wh.}$$

Energy from bulbs = $5 \times 12 \text{ W} \times 10 \text{ h}$

$$= 600 \text{ Wh.}$$

Total Energy = 500 Wh + 600 Wh

$$= 1100 \text{ Wh.}$$

Total Energy in units = $1000 \div 1000 = 1.1 \text{ kWh}$ or 1.1 units.

8. If 7500 J of heat is produced in 30 s in a conductor with a resistance of 250Ω , calculate the current that flowed through it.

Answer:

Given: $H = 7500 \text{ J}$, $t = 30 \text{ s}$, $R = 250 \Omega$.

Using Joule's Law, $H = I^2 Rt$.

$$I^2 = \frac{H}{Rt} = \frac{7500 \text{ J}}{(250 \Omega)(30 \text{ s})} = \frac{7500}{7500} = 1$$

Therefore, the current $I = 1 = 1 \text{ A}$.

ELECTRO MAGNETIC INDUCTION IN DAILY LIFE

- (b) From South to North
- (b) Electrical to Mechanical*
- (a) Both (A) and (R) are true, and (R) is the correct explanation of (A).
- AC** is a current that continuously changes its magnitude and periodically reverses its direction.
DC is a current that flows in only one direction.
- 1) Voice coil. 2) Field magnet.
- Electromagnetic induction is the phenomenon of producing an EMF (and hence a current) in a conductor due to a change in the magnetic flux linked with it.
- Magnetic field strength is directly proportional to both current and the number of turns.
 - If the current is doubled (10A to 20A), the magnetic field strength will *double*.
 - If the number of turns is halved (500 to 250), the magnetic field strength will be

halved.

8. a) Electromagnetic induction.
 b) 1. By moving the bar magnet into or out of the stationary coil.
 2. By moving the coil towards or away from the stationary magnet.
 c) 1. The number of turns in the coil.
 2. The strength of the magnet. (Also: The speed of relative motion).
 d) The direction of the relative motion between the coil and the magnet.
9. a. $\frac{V_s}{V_p} = \frac{N_s}{N_p}$

$$V_s \times N_p = N_s \times N_p$$

$$V_s = 12 \text{ V} \quad N_p = 1000$$

$$V_p = 240 \text{ V}$$

$$N_s = V_s \times \frac{N_p}{V_p} = 12 \text{ V} \times \frac{1000}{240 \text{ V}}$$

$$= 50 \text{ turns}$$

- b. For maintaining same power
 Power = Voltage x Current
 Therefore if voltage is lower, thickness of the coil must be increased. Therefore thick wire is used in the secondary coil (2)

MECHANICAL ADVANTAGE IN ACTION

1. c) Tongs
2. a) Statement and reason are correct; the reason explains the statement.
3. Mechanical Advantage
4. inclined plane
5. In a second-order lever, the load is between the fulcrum and the effort.
 This arrangement ensures that the effort arm is always longer than the load arm.
 Since Mechanical Advantage = Effort arm/Load arm, the value will always be greater than one.
6. Given: Load (L) = 250 N, Effort (E) = 50 N
 Mechanical Advantage (MA) = Load/Effort
 MA = 250 N/50 N = 5
 The mechanical advantage is 5.
7. The main advantage of using an inclined plane is that it reduces the amount of effort required to lift an object to a certain height.
 Its mechanical advantage can be increased by increasing the length of the plane (l) or decreasing its height (h), as MA = l/h
8. a) It is a first-order lever because the fulcrum is between the load (stone) and the effort.
 b) Total Length = 1.5 m = 150 cm
 Load Arm (LA) = 30 cm
 Effort Arm (EA) = Total Length - Load Arm
 = 150 cm - 30 cm = 120 cm
 Mechanical Advantage (MA) = Effort arm/

Load arm MA = 120 cm/30 cm = 4

9.



In a movable pulley, the load is supported by two segments of the rope.

Thus, the effort required is only half of the load (ideally).

The effort arm (diameter of the pulley) is twice the load arm (radius of the pulley).
 MA = Effort arm/Load arm = Diameter/Radius = 2r/r = 2

10. a) MA = Length of inclined plane (l)/Height (h) = 12 m/2 m = 6
 b) MA = Load/Effort => 6 = 600 N/Effort
 Effort = 600 N/6 = 100 N
 c) Work Done = Load x Height = 600 N x 2 m = 1200 J
 d) No, there is no gain in work.
 The work done using the inclined plane is
 Effort x Length of plane
 = 100 N x 12 m = 1200 J.

This is equal to the work done in lifting the load directly. Simple machines reduce the effort but do not reduce the work done.

CHEMISTRY

NOMENCLATURE OF ORGANIC COMPOUNDS AND ISOMERISM

- | | |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. Alcohol
2. a. Isomers
b. C_3H_{10}
3. a. 8
b. Methyl (-CH ₃)
Ethyl (-CH ₂ -CH ₃)
c. 6-ethyl-3-methyl octane
4. a. Position isomerism | b. Structure
$CH_3-CH_2-CH_2-CH_2-OH$
$CH_3-CH_2-CH-CH_3$

OH
OR
a. Functional Isomerism
b. $CH_3-CH_2-CH_2-CH_2-OH$
$CH_3-O-CH_2-CH_2-CH_3$ |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|

CHEMICAL REACTIONS OF ORGANIC COMPOUNDS

- | | |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. Grape Spirit
2. a. Compounds needed for the production of ester
. CH ₃ -OH
. CH ₃ -COOH
b. Chemical Reaction
$CH_3-COOH + OH-CH_3$
$\rightarrow CH_3COOCH_3 + H_2O$
3. The organic compounds formed by the reaction between Alcohol and Carboxylic acid | are known as Esters. Such reactions are called as esterification.
$CH_3COOH + HOCH_2CH_3$
$\rightarrow CH_3COOCH_2CH_3 + H_2O$
4. a. (i) Substitution Reaction
(ii) Polymerisation
(iii) Esterification
b. Ethyl ethanoate
c. $CH_3COOH + HOCH_2CH_2CH_3$
$\rightarrow CH_3COOCH_2CH_2CH_3$ |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

PERIODIC TABLE AND ELECTRON CONFIGURATION

- | | |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. a. 8
b. Representative elements
2. a. $Cr^x O_3^{2-}$
$x + 3 \times (-2) = 0$
$x + (-6) = 0$
$x = +6$
Oxidation state of chromium = +6
b. ${}_{24}Cr - 1s^2 2s^2 2p^6 3s^2 3p^6 3d^5 4s^1$
$Cr^{3+} - 1s^2 2s^2 2p^6 3s^2 3p^6 3d^3 (Cr_2O_3)$ | $Cr^{6+} - 1s^2 2s^2 2p^6 3s^2 3p^6 (CrO_3)$
3. a. $1s^2 2s^2 2p^6 3s^2 3p^6 3d^{10} 4s^1$
b. Oxidation: Cu_2O - (Oxidation +1)
CuO_2 - (Oxidation +2)
c. $Cu^{1+} : 1s^2 2s^2 2p^6 3s^2 3p^6 3d^{10}$
$Cu^{2+} 1s^2 2s^2 2p^6 3s^2 3p^6 3d^9$
4. a. $1s^2 2s^2 2p^6 3s^2 3p^6 3d^3 4s^2$
b. Group : 5 |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

GAE LAWS AND MOLE CONCEPT

- 16g
 - 2g
- H_2O, HNO_3, H_2SO_4

$H=1u, O=16u, S=32u, C=12u, N=14u$

$= H_2O = 2 \times 1u + 1 \times 16u = 2u + 16u = 18u$

$HNO_3 = 1 \times 1u + 1 \times 14u + 3 \times 16u$

$= 1u + 14u + 48u = 63u$

$H_2SO_4 = 2 \times 1u + 1 \times 32u + 4 \times 16u = 2u + 32u + 64u$

$= 98u$
- Molecules in 1g hydrogen

$= \frac{1}{2} \times 6.022 \times 10^{23}$
 - Hydrogen molecules in 1 litre
- Molecules in 1 mole hydrogen gas

$= 1 \times 6.022 \times 10^{23}$

1 litre hydrogen < 1 gram hydrogen < 1 mole hydrogen
 - $H_2 + Cl_2 \rightarrow 2HCl$

$H_2 : Cl_2 : HCl = 1 : 1 : 2$

$H_2 : Cl_2 : HCl = 4 : 4 : 8 = 1 : 1 : 8$

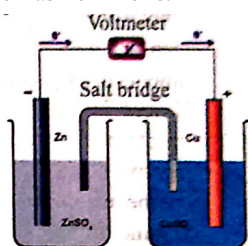
8 mole hydrogen is obtained

ELECTROCHEMISTRY

- (b) Negative
- (b) Electroplating
- (a) Both (A) and (R) are true, and (R) is the correct explanation of (A).
- (b) Only (ii) is correct. (Primary cells are non-rechargeable).
- At the cathode (negative electrode), molten sodium metal (Na) is formed. At the anode (positive electrode), chlorine gas (Cl₂) is liberated.
- Oxidation is the process where a substance loses electrons. Reduction is the process where a substance gains electrons.
- In the reactivity series, iron (Fe) is more reactive than copper (Cu). Therefore, iron will displace copper from the copper sulphate solution. The iron strip acts as the anode, gets oxidized (corrodes), and dissolves into the solution as Fe²⁺ ions.
- An external wire connects the Zn and Cu rods, with an arrow indicating electron flow from Zinc to Copper.
- In the electrolytic refining of copper, a block of impure copper is made the anode, a thin sheet of pure copper is the cathode, and an acidified solution of copper sulphate is the electrolyte. When current is passed, pure copper from the impure anode dissolves and deposits onto the pure cathode, leaving impurities behind.
- Magnesium (Mg) will act as the anode. Justification: According to the reactivity series, magnesium is much more reactive than silver, so it has a greater tendency to lose electrons (get oxidized).
 - The cathode is the silver electrode, where reduction occurs.

The reaction is: $Ag^+(aq) + e^- \rightarrow Ag(s)$.
 - The oxidizing agent is the substance that gets reduced, which is the silver ion (Ag⁺).

The reducing agent is the substance that gets oxidized, which is magnesium (Mg).



METALS

- (c) Bauxite
- (a) Both Statement and Reason are correct, and the Reason explains the Statement.
- (a) (iii) (b) (i) (c) (ii)
- Gangue
- mineral : A naturally occurring substance containing a metal in either its free or combined state is called a mineral.
Ore: A mineral from which a metal can be extracted easily, economically, and in large quantities is called an ore. All ores are minerals, but not all minerals are ores.
- Roasting is the process of heating a concentrated ore (usually sulphide ores) to a high temperature below its melting point in the presence of excess air.
Calcination is the process of heating a concentrated ore (usually carbonate or hydroxide ores) to a high temperature in the absence or limited supply of air.
- Limestone acts as a flux. At high temperatures, it decomposes to form calcium oxide (CaO), which is basic in nature. This calcium oxide then combines with the acidic impurity silica (SiO₂, gangue) to form molten calcium silicate (CaSiO₃), which is called slag. Equation: $\text{CaO(s)} + \text{SiO}_2\text{(s)} \rightarrow \text{CaSiO}_3\text{(l)}$
- (a) Anode: A thick block of impure copper.
(b) Cathode: A thin strip of pure copper.
(c) Electrolyte: A salt solution of the same metal, such as copper sulphate (CuSO₄) solution mixed with dilute sulphuric acid.
- When aluminium is exposed to air, it reacts with oxygen to form a thin, non-porous, and strongly adherent layer of aluminium oxide (Al₂O₃) on its surface. This stable oxide layer acts as a protective coating, preventing the metal underneath from coming into further contact with air and moisture, thus protecting it from corrosion.
- (a) Haematite (Fe₂O₃) and Magnetite (Fe₃O₄).
(b) The main reducing agent is Carbon Monoxide (CO).
(c) $\text{Fe}_2\text{O}_3 + 3\text{CO} \rightarrow 2\text{Fe} + 3\text{CO}_2$
(d) Pig iron is not suitable for hammering into various shapes or for drawing into wires. It is converted to steel, an alloy with a lower carbon content (0.05% to 1.5%), which has superior properties like strength, hardness, and elasticity, making it useful for various industrial purposes.

SOME COMPOUNDS OF INDUSTRIAL IMPORTANCE

- (c) Acidic
- (b) Statement 1 is correct, but statement 2 is incorrect. (Reason: Fertilizers must be soluble in water to be absorbed by plants).
- (a) Both A and R are true and R is the correct explanation of A.
- Ammonia gas is highly soluble in water. The aqueous solution of ammonia (ammonium hydroxide) is basic in nature.
- (a) Chlorine gas (Cl₂) is produced at the anode.
(b) Hydrogen gas (H₂) is produced at the cathode.
- A drying agent absorbs physical moisture from a substance (e.g., water vapour from a gas). A dehydrating agent removes chemically combined water or the elements of water (H and O) from a compound's molecular structure.
- (a) Increasing the pressure has no effect on the equilibrium. This is because the total number of moles of gaseous reactants (1+1 = 2) is equal to the total number of moles of the gaseous product (2).
(b) The equilibrium will shift to the right (forward direction) to consume the added reactant, and the amount of HI will increase.
- The rates of the forward and backward reactions are equal.
Both reactants and products coexist in the system.
It is dynamic at the molecular level, meaning reactions continue to occur in both directions. It can only be attained in a closed system.

BIOLOGY

GENETICS OF LIFE

- a. $ttrr$
- a. Uracil b. tRr or tRR
- a. Yellow seed is the dominant character
b. 3 Yellow seed : 1 green seed
- a. (i) $44 + XX$ female (ii) $44 + XY$ male
(iii) $44 + XX$ female (iv) $44 + XY$ male
b. Sex chromosomes in males play major role in sex determination. The ratio of male and female is 1:1. The XY chromosomes of the father determine whether the child is male or female.

PATHS OF EVOLUTION

- a. Ampulla. Others are parts of the neuron
b. Glaucoma. Others are diseases affecting the nervous system.
- a. Cerebrum : Numerous fissures and folds are seen.
b. Thalamus : Analyses impulses from various parts of the body and sends the important ones to the cerebrum.
c. Medulla oblongata : Controls involuntary actions like heart beat, breathing etc.
d. Hypothalamus: Plays a major role in maintenance of homeostasis.
e. Cerebellum : Coordinates muscular activities.
- (a) (i) Spinal reflex
(ii) Cerebral reflex.
(b) Reflex action is the accidental and involuntary responses of the body, in response to a stimulus
- b. Heartbeat increases

BEHIND SENSATIONS

- a. Blind spot
b. Retina
- a. Pinna, Others are parts of the middle ear.
b. Lens, Others are parts of the Ear.
- Pinna → Auditory canal → Tympanum → Ear ossicles → Oval Window → Cochlea → Hair Cells → Impulse → Auditory Nerve → Cerebrum → Sense of Hearing
- External eye muscles - Fixes the eye ball in the orbit.
Eyebrow - Prevents dust particles from the eyes.
Eyelashes - Prevents dust particles from the eyes.
Eyelids - Cover and protect the eyes
Conjunctiva - Secretes mucus which protect the anterior portion of the eye ball except the cornea from being dry.
Tears - Clean and lubricate the anterior part of the eye ball. Lysozyme, the enzyme present in tears, destroys the germs that enter the eyes.

CHEMORECEPTION IN ORGANISMS

- (d) Abscisic acid
- (b) Leptin
- A hormone acts only on its specific target cell. This target cell has a receptor that perfectly matches the shape of the hormone. The hormone binds to this receptor to form a hormone-receptor complex. The formation of this complex is what initiates the chemical changes inside the cell.
- When the blood glucose level decreases, the alpha cells in the Islets of Langerhans of the pancreas are stimulated. These cells secrete the hormone glucagon. Glucagon acts on the liver, stimulating the conversion of stored glycogen back into glucose, which is then released into the blood, raising the glucose level back to normal.
- Pheromone traps are a method of pest control used in agriculture. The principle is to use synthetic versions of the sex pheromones of harmful insects. These chemicals attract the male insects into the trap, preventing them from mating. This helps to control the insect population without using harmful chemical pesticides.
- The two hormones are epinephrine and norepinephrine. Their general function is to prepare the body to overcome emergency situations (the "fight-or-flight" response) by increasing heart rate, blood pressure, and blood flow to the muscles.
- When blood calcium increases, the thyroid gland secretes calcitonin, which lowers the level by preventing its release from bones. When blood calcium decreases, the parathyroid gland secretes parathormone, which raises the level by releasing calcium from bones and increasing its reabsorption in the kidneys.
- When the level of thyroxine in the blood is low, a negative feedback mechanism is activated:
 - The hypothalamus detects the low level and secretes more Thyrotropin-releasing hormone (TRH).
 - TRH travels to the anterior lobe of the pituitary gland and stimulates it to secrete more Thyroid-stimulating hormone (TSH).
 - TSH travels through the blood to the thyroid gland and stimulates it to produce and secrete more thyroxine.
 - The increased level of thyroxine in the blood restores the normal level and also signals the hypothalamus and pituitary to reduce their secretions.

IMMUNITY AND HEALTH CARE

- (c) Inflammatory Response
- (d) Foot and Mouth Disease
- (c) Both (i) and (ii) are correct.
- Eosinophils neutralize chemicals released during an allergic reaction and destroy parasites. Basophils produce heparin (prevents blood clotting) and histamine (causes inflammation).
- Two guidelines are:
 - * A minimum weight of 50kg is required.
 - * The haemoglobin level in the blood should be above 12.5 g/dL.
- They are considered non-specific because they act against all types of pathogens in the same way. The skin provides a general barrier, and lysozyme destroys bacteria without targeting a specific type.
- Antibodies are proteins that act against specific antigens. They are produced by B lymphocytes. Their primary function is to bind to pathogens and either neutralize them directly or mark them for destruction by

other immune cells.

8. The disease Bunchy top of Banana is caused by a virus. Its main symptoms are that the leaves become short, narrow and stand upright, and the overall growth of the plant becomes stunted.
9. a) When the finger is cut, the cells at the injured part release chemical substances like histamine. Histamine dilates (widens) the blood vessels in that area. This increases blood flow, allowing more white blood cells (phagocytes) to reach the site to fight any entering pathogens.

b) The process of blood clotting occurs as follows:

The damaged tissues and platelets at the wound produce an enzyme called thromboplastin.

Thromboplastin converts the inactive protein prothrombin into the active enzyme thrombin.

Thrombin then converts the soluble protein fibrinogen into a network of insoluble fibrin fibers.

This fibrin network traps blood cells, forming a clot that seals the wound.

BIOLOGY AND TECHNOLOGY

1. (c) Plasmid
2. (b) Golden rice
3. Personalised medicine is an approach that analyses an individual's genetic makeup and health information to recommend the most suitable treatment for them. AI helps by rapidly analyzing this complex genetic data to identify patterns and predict which treatments will be most effective for that specific person.
4. A DNA sample (e.g., from hair or blood) is collected from the crime scene. A DNA fingerprint, which is a unique pattern of bands, is created from this sample. This pattern is then compared with the DNA fingerprints of the suspects. A perfect match between the crime scene sample's pattern and a suspect's pattern conclusively identifies the culprit.
5. Gene therapy is the method of treating diseases by removing defective genes and replacing them with functional genes. The steps in stem cell therapy are:
 1. Stem cells are collected from the patient.
 2. A functional gene is incorporated into these stem cells using a vector (like a virus).
 3. The genetically modified stem cells are injected back into the patient's body.
6. a) The technology is Recombinant DNA Technology.
b) The four essential components are:
 - Restriction Endonuclease enzyme (to cut the gene and plasmid).
 - Ligase enzyme (to join the gene and plasmid).
 - A vector (like a plasmid, to carry the gene).
 - A host cell (the bacterium, to produce the protein).
c) The recombinant DNA (plasmid with the human gene) is inserted into the host cell. As the host cell becomes active and multiplies, it reads the inserted gene and its cellular machinery begins to produce the desired human protein.
7. Three uses of DNA fingerprinting are:
 1. To identify culprits in criminal cases.
 2. To determine the biological relationship between parents and offspring.
 3. To identify victims of accidents or disasters.
8. Vectors (like plasmids) are used to carry the desired gene into the host cell. The host cell (like a bacterium) acts as a living factory, replicating the recombinant DNA and using the inserted gene to produce the desired product in large quantities.

MATHEMATICS

ARITHMETIC SEQUENCES

1. Given sequence = 4, 10, 16, 6
 Common difference = $x_2 - x_1$
 $= 10 - 4 = 6$
2. a. Common difference = $77 - 70 = 7$
 b. $X_{20} - X_{10} = 10d$
 $X_{20} - X_{10} = 10 \times 7 = 70$
 c. $X_1 = 70, X_{11} = 140$
3. a. $X_{11} = f + 10d = 10 + 60 = 70$
 b. $S_{21} = 2 \times X_{11} = 2 \times 70 = 140$
 c. 11, 18, 25 (Any sequence with middle term 71)
4. Given, 5th term of an AP is 20 and 8th term is 32.
 a. Here we know that, term difference is proportional to position difference, and the constant of proportionality is the common difference
 ie.

$$\frac{x_m - x_n}{m - n} = d$$
 ie., $\frac{32 - 20}{8 - 5} = \frac{12}{3} = 4$
- b. Given 5th term = 20
 i.e $f + 4d = 20$
 $f + 4 \times 4 = 20$
 $f = 20 - 16 = 4$.
 Hence 11th term = $f + 10d$
 $= 4 + 10 \times 4 = 44$.
5. a. 4th term = $4a + b$
 We get 16th term by adding 84 with 4th term.
 16th term =
 $4a + b + 84 = 16a + b$
 $12a = 84, \quad a = 7$
 Common difference = 7
 b. 24th term = $24a + b = 168$
 $24 \times 7 + b = 168$
 $b = 0$
 First term = $a + b = 7$
 c. Sum of first 24 terms
 $= \frac{24}{2} (7 + 168) = 2100$
6. Arithmetic sequence : 180, 176, 172,
 i. Common difference
 $a = x_2 - x_1 = 176 - 180 = -4$
 If 0 be a term of the sequence when $(0 - 180) = -180$ be a multiple of common difference -4.
 $-180 / -4 = \frac{180}{4} = 45$
 Remainder = 0
 $\therefore 0$ is a term of the arithmetic sequence.
 ii. 20th term = $an + b$
 $a = -4$
 $= -4 \times 20 + 184 \quad a + b = 180$
 $= -80 + 184 \quad b = 180 + 4 = 184$
 $= 104$
 iii. 0 be a term of the sequence hence $0 + 4 = 4$ be a last positive number of the sequence.
 Number of positive numbers
 $\frac{x_n - x_1}{d} + 1 = \frac{4 - 180}{-4} + 1 = \frac{-176}{-4} + 1 = 45$

CIRCLES

1. $\angle ATB = 180 - 130 = 50^\circ$ (Opposite angles of a cyclic quadrilateral is supplementary)

$$\angle AOB = 50 \times 2 = 100^\circ$$

2. If angle $D = x$, then angle $B = X + 30$.

Let ABCD be a cyclic quadrilateral

$$\angle B + \angle D = 180^\circ \quad x + x + 30 = 180$$

$$2x + 30 = 180, 2x = 150, x = 75$$

$$\angle D = 75^\circ, \angle B = 105^\circ.$$

$\angle D$ is less than 90° , so D is outside the circle having diameter AC.

$\angle B$ is greater than 90° , so B is inside the circle having diameter AC.

3. a. $\angle ACD = 2 \times 30 = 60^\circ$

- b. $\angle CAB = 30^\circ$

In $\triangle AEC$, $\angle AEC = 180 - (60 + 30)$
 $= 180 - 90 = 90^\circ$

$$\angle BED = 90^\circ, \angle ACE = \angle BDE = 60^\circ$$

$\triangle ACE, \triangle BDE$ are equal triangles.

$AB = 6$, hence $AE = 3$

The ratio of the opposite sides of a triangle having angles $30^\circ, 60^\circ, 90^\circ$ is $1:\sqrt{3}:2$.

If $AE = 3$

$$CE = \frac{3}{\sqrt{3}} = \frac{\sqrt{3} \times \sqrt{3}}{\sqrt{3}} = \sqrt{3}$$

Radius, $AC = 2\sqrt{3}$ cm

4. Draw the line AO.

DABC is an equilateral triangle of angle $\angle B = 60^\circ$.

Angle in the same circular arc.

$\angle ADC = \angle ABC = 60^\circ$. In $\triangle AOD$ $OD = OA = \text{Radius}$

$\therefore \angle ADO = \angle DAO$ (Two angles are equal in an isosceles triangle DAOD)

$$\therefore \angle DAO = \angle ADO = 60^\circ$$

$$\therefore \angle AOD = 180 - (60 + 60) = 60^\circ$$

\therefore In $\triangle AOD$ Three angles are equal so this is an equilateral triangle.

$$\therefore AD = OD = OA = \text{Radius}$$

ARITHMETIC SEQUENCES AND ALGEBRA

1. a. Three digit numbers which are multiple of 6 are 102, 108,996

First term = 102

Last term = 996

$$an + b = 996, \quad a = 6 \quad a + b = 102$$

$$b = 102 - 6 = 96$$

$$an + b = 996$$

$$an = 996 - 96 = 900, n = \frac{900}{6} = 150$$

Number of terms = 150

b. Sum of terms = $\frac{150}{2}[102 + 996] = 82350$

2. a. $x_n = 5n + 6$ $a = 5, b = 6$

First term = $a + b = 11$

The Sequence will be 11, 16, 21, 26,

b. Divide the terms in the sequence with 5 we get remainder as 1.

c. Dividing 1000 by 5 we get remainder as 0.

\therefore 1000 will not be a term of the sequence

3. a. Sum of n terms = $pn^2 + qn$

Half of common difference = $p = 8$

$$\therefore \text{Common difference} = 8 \times 2 = 16$$

First term = $p + q = 8 + 5 = 13$

Sum of first 20 terms

$$= 8n^2 + 5n = 8 \times 20^2 + 5 \times 20 = 3300$$

- b. Algebraic expression of the sequence $x_n = an + b$

$$a = 16, a + b = 13, b = 13 - 16 = -3$$

$$x_n = 16n - 3$$

4. i. Sum of first n terms

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

Sum of first 30 terms

$$= \frac{30(30+1)}{2} = \frac{30 \times 31}{2} = 465$$

- ii. Algebraic expression = $8n + 7$

Common difference = 8

First term = $a + b = 8 + 7 = 15$

Sum of first 30 terms

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

$$= \frac{1}{2} \times 8 \times 30 \times 31 + 30 \times 7$$

$$= 4 \times 30 \times 31 + 210 = 3930$$

MATHEMATICS OF CHANCE

1. Outcomes (H H), (H T), (T, H), (T, T)

Number of total outcomes = 4

Probability of getting both head = $\frac{1}{4}$

Probability of getting both tail = $\frac{1}{4}$

Probability of getting one head and one tail = $\frac{2}{4} = \frac{1}{2}$

2. Outcomes

(1, 1), (1, 2), (1, 3), (1, 4), (1, 5), (1, 6)

(2, 1), (2, 2), (2, 3), (2, 4), (2, 5), (2, 6)

(3, 1), (3, 2), (3, 3), (3, 4), (3, 5), (3, 6)

(4, 1), (4, 2), (4, 3), (4, 4), (4, 5), (4, 6)

(5, 1), (5, 2), (5, 3), (5, 4), (5, 5), (5, 6)

(6, 1), (6, 2), (6, 3), (6, 4), (6, 5), (6, 6)

i. Outcomes whose sum of pairs be 10

(4, 6), (5, 5), (6, 4)

Probability of getting sum 10 = $\frac{3}{36} = \frac{1}{12}$

ii. Outcomes whose sum of pairs are odd

(1, 2), (1, 4), (1, 6), (2, 1), (2, 3), (2, 5), (3, 2), (3, 4),

(3, 6), (4, 1), (4, 3), (4, 5), (5, 2), (5, 4), (5, 6),

(6, 1), (6, 3), (6, 5)

Number of outcomes whose sum of pairs are odd = 18

Probability of getting sum odd = $\frac{18}{36} = \frac{1}{2}$

iii. Outcomes whose sum of pairs be even

(1, 1) (1, 3) (1, 5), (2, 2) (2, 4) (2, 6)

(3, 1) (3, 3) (3, 5), (4, 2) (4, 4) (4, 6)

(5, 1) (5, 3) (5, 5), (6, 2) (6, 4) (6, 6)

Number of outcomes whose sum of pairs are even = 18

Probability = $\frac{18}{36} = \frac{1}{2}$

3. 7, 10, 17, 20, 30, 37, 40, 47, 50, 57, 60, 67, 70, 77, 80, 87, 90, 97, 100 are the numbers.

Probability of getting one of these numbers

$$= \frac{20}{100} = \frac{1}{5}$$

4. Let r be the radius of small circle, then its area

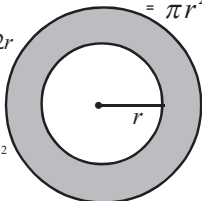
$$= \pi r^2$$

Radius of larger circle = 2r

Area = $\pi(2r)^2 = 4\pi r^2$

Area of shaded portion

$$= 4\pi r^2 - \pi r^2 = 3\pi r^2$$



Probability of the dot to fall within the shaded portion = $\frac{3\pi r^2}{4\pi r^2} = \frac{3}{4}$

5. Pairs :

(0, 1), (0, 2) (0, 9)

(1, 1) (1, 2) (1, 9)

.....

(9, 1) (9, 2) (9, 9)

Such 10 x 9 = 90 pairs are present.

(0, 1) is only one pair having sum 1

Probability = $\frac{1}{90}$

Sum obtained (9, 9), Probability = $\frac{1}{90}$

6. Total beads on A = 9 + 8 = 17

Total beads on B = 7 + 9 = 16

Number of white beads on A = 9

Number of black beads on A = 8

Probability of getting white bead when we take

one bead on A = $\frac{9}{17}$

Probability of getting white bead when we take

one bead on B = $\frac{7}{16}$

If we add a white and one black bead into B, total number of beads on B = 18

Number of White beads = 8

Probability = $\frac{8}{18} = \frac{4}{9}$

7. a. 2, 3, 5, 7, 11, 13, 17, 19, 23 are the prime numbers from 1 to 25.

Number of prime numbers = 9

Total numbers = 25

Probability of getting prime numbers = $\frac{9}{25}$

b. 1, 4, 9, 16, 25 are the complete squares from 1 to 25.

Number of complete squares = 5

Probability of getting complete squares = $\frac{5}{25} = \frac{1}{5}$

8. Total number of balls on the first box = 12

Total number of balls on the second box = 12

a. Probability of getting red balls from the first

box = $\frac{7}{12}$

- b. Probability of getting blue balls from the first box = $\frac{5}{12}$
- c. Probability of getting yellow balls from the second box = $\frac{5}{14}$
- d. Probability of getting green balls from the second box = $\frac{9}{14}$

SECOND DEGREE EQUATIONS

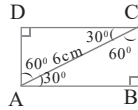
1. Number = x
 $x + x^2 = 42$; $x^2 + x - 42 = 0$
 $(x - 6)(x + 7) = 0$
 $x = 6, x = -7$
2. Let $10y, x$ are the digits of the two digit numbers
 $y \cdot x = 12$
 $10y + x + 36 = 10x + y$
 $xy = 12$
 $xy = 12$ _____(1)
 $9y - 9x + 36 = 0$
 $y - x + 4 = 0$
 $x - y = 4$ _____(2)
 $x(x - 4) = 12$
 $x^2 - 4x = 12$
 $x^2 = 4x - 12 = 0$
 $= 6$ or -2
Number = 26
4. Width = x , Length = $x + 6$,
Area = 135
 $x(x+6) = 135$
 $x^2 + 6x - 135 = 0$
 $(x+15)(x-9) = 0$
 $x+15 = 0$ or $x - 9 = 0$
 $x = -15$ $x = 9$
Width = 9 cm,
Length = $9 + 6 = 15$ cm
5. $(x-4)^2 = 256$
 $x - 4 = 16$
 $x = 16 + 4$ or $-16 + 4$
 $x = 20$, or $x = -12$
6. Let x be the number
 $(x + 3)^2 = 100$
 $x + 3 = 10$ or -10
If $x + 3 = 10$, then $x = 7$
If $x + 3 = -10$, then $x = -13$
Number = 7 or -13
7. 1. $(x+8)^2 = 625$
 $x + 8 = \pm\sqrt{625}$
 $x + 8 = \pm 25$
 $x + 8 = 25$ or $x + 8 = -25$
 $x = 25 - 8$ or $x = -25 - 8$
Numbers are 17 or -33
3. $(x-4)^2 = 200$
 $x - 4 = \pm\sqrt{200}$
 $x - 4 = \pm 10\sqrt{2}$
 $x - 4 = 10\sqrt{2}$ or $x - 4 = -10\sqrt{2}$
Numbers are $4 + 10\sqrt{2}$ or $4 - 10\sqrt{2}$
4. $2x^2 + 18 = 418$
 $2x^2 = 400$
 $x^2 = 200$
 $x = \pm\sqrt{200}$
 $x = \pm 10\sqrt{2}$
Numbers are $10\sqrt{2}$ or $-10\sqrt{2}$

TRIGONOMETRY

1. a. In ΔABC

The sides of the right angle triangle with angles $30^\circ, 60^\circ, 90^\circ$ are proportional to $1 : \sqrt{3} : 2$.

$\therefore AB : BC : AC = 1x : \sqrt{3}x : 2x$
 $2x = 6 ; x = 3, AB = 3$
 $BC = \sqrt{3} \times 3 = 3\sqrt{3}$



\therefore Sides of the rectangle
 $AB = CD = 3, BC = AD = 3\sqrt{3}$

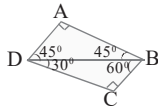
b. In ΔABD , the sides of the triangle with angles $45 : 45 : 90$ will have sides proportional to [opposite to corresponding angles] $1 : 1 : \sqrt{2}$

$\sqrt{2}x = 6 ; x \frac{6}{\sqrt{2}} = 3\sqrt{2} \text{ cm}$
 $\therefore AB = 3\sqrt{2}, AD = 3\sqrt{2}$

In ΔBCD , the sides of the right angle triangle with angles $30^\circ, 60^\circ, 90^\circ$ are proportional to $1 : \sqrt{3} : 2$. $\therefore 2x = 6 \text{ cm} ; x = 3 \text{ cm}$

$BC = 3 \text{ cm} ; DC = 3\sqrt{3} \text{ cm}$

\therefore Sides of a rectangle
 $AB = 3\sqrt{2} \text{ cm} ; BC = 3 \text{ cm}$
 $CD = 3\sqrt{3} \text{ cm} ; AD = 3\sqrt{2} \text{ cm}$



2. The sides of the right angle triangle with angles $30^\circ, 60^\circ, 90^\circ$ are proportional to the number $1 : \sqrt{3} : 2$.

Small side $x = 6 \text{ cm}$

Hypotenuse $2x = 2 \times 6 = 12 \text{ cm}$

3. The sides of the isosceles right angle triangle with angles $45 : 45 : 90$ will have sides proportional to [opposite to corresponding angles] $1 : 1 : \sqrt{2}$

Hence hypotenuse $\sqrt{2}x = 10$

$x = \frac{10}{\sqrt{2}} = 5\sqrt{2} \text{ cm}$

\therefore Other side are $5\sqrt{2} \text{ cm}$ each.

4. Extend PQ to the left, draw a perpendicular to the line RD through R.

The sides of the ΔPDR with angles $45 : 45 : 90$ will have sides proportional to

$1 : 1 : \sqrt{2}$

$\sqrt{2}x = 4$
 $x = \frac{4}{\sqrt{2}} = 2\sqrt{2}$
 $\therefore RD = 2\sqrt{2} = DP$
 Area of $\Delta PQR = \frac{1}{2} \times PQ \times RD$
 $= \frac{1}{2} \times 6 \times 2\sqrt{2}$
 $= 6\sqrt{2} \text{ cm}^2$

5. Draw a perpendicular RS to PQ through R.

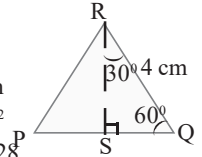
In ΔQRS , The sides of the right angle triangle with angles $30^\circ, 60^\circ, 90^\circ$ are proportional to $1 : \sqrt{3} : 2$.

$RQ = 2x = 4 \text{ cm}, x = 2 \text{ cm}$

$QS = 2 \text{ cm}, RS = 2\sqrt{3} \text{ cm}$

In $\Delta PSR, PR^2 = PS^2 + RS^2$
 $= 4^2 + (2\sqrt{3})^2 = 16 + 12 = 28$

$PR = \sqrt{28} \text{ cm}$



6. Let AD be the diameter

$\angle ABD = 90^\circ$ (Angle on the semicircle)

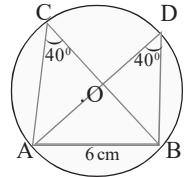
$\angle ADB = 40^\circ$ ($\angle C = 40^\circ$, Hence angle on the same circular arc)

In right angled triangle ABD

$\sin 40 = \frac{6}{AD}$

$AD = \frac{6}{\sin 40} = \frac{6}{0.6428}$

$= 9.34 \text{ cm}$



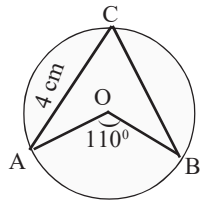
OR

$AB = 2r \sin C^\circ$

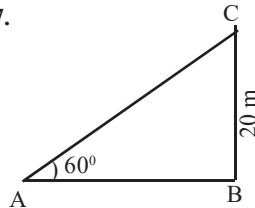
$= 2 \times 4 \times \sin 55^\circ$

$= 8 \times 0.8191$

$= 6.55 \text{ m}$



7.



$$\tan 60 = \frac{20}{AB}$$

$$AB = \frac{20}{\tan 60} = \frac{20}{\sqrt{3}} = \frac{20}{1.73} = 11.56$$

Distance from the building = 11.56 m

8. i) $\angle ACB = 50^\circ$ hence $\angle AOB = 100^\circ$

In right angled triangle ODB

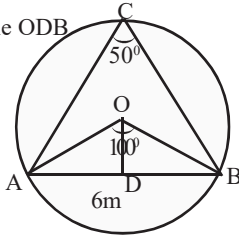
$$DB = \frac{6}{2} = 3 \text{ cm}$$

$$\angle DOB = 50^\circ$$

$$\sin 50 = \frac{DB}{OB} = \frac{3}{OB}$$

$$OB = \frac{3}{\sin 50} = \frac{3}{0.7660}$$

$$= 3.916 \text{ cm}$$

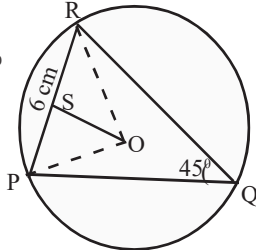


Diameter of circum circle = $2 \times 3.916 = 7.8 \text{ cm}$

- ii) $\angle POR = 90^\circ$

$$\angle ROS = 45^\circ$$

$$\sin 45 = \frac{RS}{OR}$$



$$OR = \frac{RS}{\sin 45} = \left(\frac{6}{\frac{1}{\sqrt{2}}}\right) = 3\sqrt{2} \text{ cm}$$

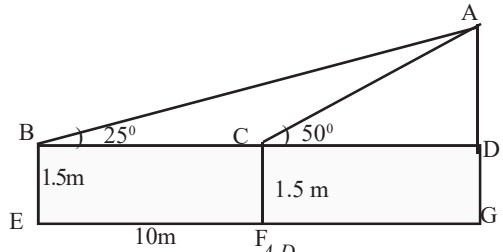
Diameter of circum circle = $2 \times 3\sqrt{2} = 6\sqrt{2} \text{ cm}$

9. $\angle ACB = 180 - 50 = 130^\circ$

$$\therefore \triangle ABC, \angle BAC = 180 - (130 + 25) = 25^\circ$$

$\therefore \triangle ABC$ is an isosceles triangle

$$BC = AC = 10 \text{ m}$$



$$\text{In } \triangle ADC, \sin 50 = \frac{AD}{AC}$$

$$AD = AC \times \sin 50 = 10 \times 0.766 = 7.66$$

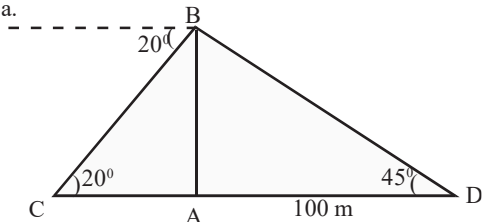
$$\text{In } \triangle ADC, \cos 50 = \frac{CD}{AC}$$

$$CD = AC \times \cos 50 = 10 \times 0.6428 = 6.428$$

Width of the river = $CD = 6.428 \text{ m}$

Height of the tree = $1.5 + 7.66 = 9.16 \text{ m}$

10. a.



b. $\tan 45 = \frac{AB}{AD}$

$$AB = AD \times \tan 45 = 100 \times 1 = 100 \text{ m}$$

Height of the light house = 100m

c. $\tan 20 = \frac{AB}{AC}, AC = \frac{AB}{\tan 20} = \frac{100}{0.3420} = 292 \text{ m}$

Distance of ship from the land = 292m

COORDINATES

1. Let $(x, 0)$ be a term on the x axis.

$$\sqrt{(x-5)^2 + (0-4)^2} = \sqrt{(x-2)^2 + (0-3)^2}$$

$$\sqrt{(x-5)^2 + 16} = \sqrt{(x+2)^2 + 9}$$

$$(x-5)^2 + 16 = (x+2)^2 + 9$$

$$x^2 - 10x + 25 + 16 = x^2 + 4x + 4 + 9$$

$$41 - 13 = 4x + 10x$$

$$28 = 14x$$

$$x = 2$$

Point on the x axis is $(2, 0)$

2. $A(1, 1), B(-1, -1), C(-, -)$

$$AB =$$

$$\sqrt{(-1-1)^2 + (-1-1)^2} = \sqrt{(-2)^2 + (-2)^2} = \sqrt{8} = 2\sqrt{2}$$

$$BC = \sqrt{(-\sqrt{3}-1)^2 + (\sqrt{3}-1)^2} = \sqrt{(-\sqrt{3}+1)^2 + (\sqrt{3}+1)^2}$$

$$= \sqrt{3-2\sqrt{3}+1+3+2\sqrt{3}+1} = \sqrt{8} = 2\sqrt{2}$$

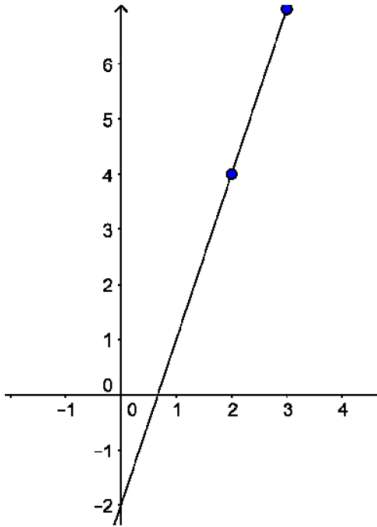
$$AC = \sqrt{(-\sqrt{3}-1)^2 + (\sqrt{3}-1)^2} = \sqrt{(-\sqrt{3}-1)^2 + (\sqrt{3}-1)^2}$$

$$= \sqrt{3+2\sqrt{3}+1+3-2\sqrt{3}+1} = \sqrt{8} = 2\sqrt{2}$$

$$AB = BC = AC$$

3. Point which cut the x axis = $(0.5, 0)$

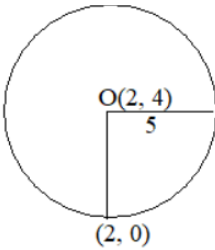
Point which cut the y axis = $(0, -2)$.



4. a. Distance between (2, 4) and (2, 0)
 $= |4 - 0| = 4$

This is less than the radius of the circle, so the circle will not pass through the point (2, 0)

- b. Let (x, 0) be the point on which the circle cut the x axis



The radius of the circle is 5 cm, so the distance between (2, 4) and (x, 0) = 5

$$(x - 2)^2 + 16 = 5^2,$$

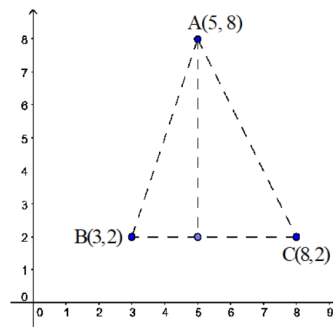
$$x^2 - 4x + 4 + 16 = 25$$

$$x^2 - 4x - 5 = 0$$

$$(x+1)(x-5) = 0$$

∴ The point on which the circle cut the x axis = (5, 0), (-1, 0)

5. a.



- b. Height of $\Delta ABC = 6$ unit
 c. Area of $\Delta ABC = \frac{1}{2} \times 6 \times BC = 15$
 $BC = 5$ unit
 d. Coordinates of C = (8, 2)
6. Diameter is 10 unit and center is (4, 0).

PA and PB are the radius of the circle

$$\text{Radius} = \frac{10}{2} = 5$$

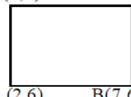
Distance of P from A and B is 5 unit

$$\therefore A(4 + 5, 0) = A(9, 0)$$

$$B(4 - 5, 0) = B(-1, 0)$$

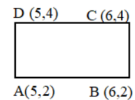
7. i. If A(2, 6), C(7, 8), then
other vertices are D(2,8) C(7,8)

$$B(7, 6), D(2, 8)$$



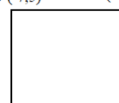
- ii. A(5, 2), C(6, 4), then
other vertices are D(5,4) C(6,4)

$$B(6, 2), D(5, 4)$$



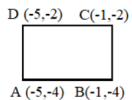
- iii. B(-3, 1), D(-7, 5), then
other vertices are D(-7,5) C(-3,5)

$$A(-7, 1), C(-3, 5)$$



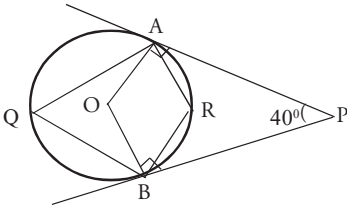
- iv. B(-1, -4), D(-5, -2), then
other vertices are D(-5,-2) C(-1,-2)

$$A(-5, -4), C(-1, -2)$$



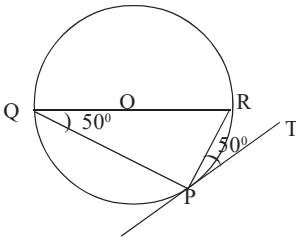
TANGENTS

1. OAPB is a cyclic quadrilateral.



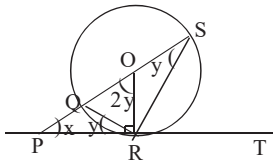
- a. $\angle AOB = 180^\circ - 40^\circ = 140^\circ$
 b. $\angle AQB = 70^\circ$
 (The angle made by any arc on the centre of circle is twice the angle made by alternate arc). $\angle ARB = 180^\circ - 70^\circ = 110^\circ$
 (ARBQ is a cyclic quadrilateral)

2. $\angle PQR = 50^\circ$ (In a circle, the angle which a chord makes with the tangents at its ends on any side are equal to the angle which it makes on the part of the circle on the other side.)



- $\angle QPR = 90^\circ$ (Angle on the semicircle is 90°)
 $\angle PRQ = 180^\circ - (90^\circ + 50^\circ)$
 $= 180^\circ - 140^\circ = 40^\circ$

3. $\angle PRQ = \angle QSR = y$
 (The angle which a chord makes with the tangents re equal to the angle which it makes on the part of the circle on the other side..)



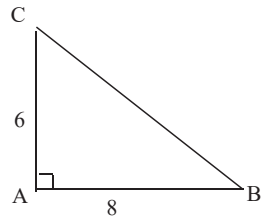
- $\angle QOR = 2y$
 (The angle made by any arc on the centre of circle is twice the angle made by alternate arc)
 $\angle ORP = 90^\circ$
 (Chord and tangents are mutually perpendicular)
 $2y + x + 90 = 180, \quad x + 2y = 90^\circ$

6. $BC^2 = 8^2 + 6^2 = 100$

$BC = \sqrt{100} = 10$

$r = \frac{A}{S}$

$A = \frac{1}{2} \times 6 \times 8 = 24 \text{ cm}$

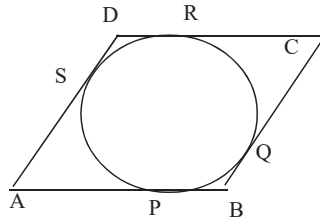


$S = \frac{8+6+10}{2} = \frac{24}{2} = 12$

$r = \frac{A}{S} = \frac{24}{12} = 2 \text{ cm}$

7. ABCD is a parallelogram

Therefore
 $AB = CD,$
 $AD = BC$



Circle can touch the sides of the rectangle, hence

$AB + CD = AD + BC$

$\therefore 2 AB = 2 AD$

$AB = AD$

$AB = AD = BC = CD,$ Therefore

ABCD is a rhombus.

POLYNOMIALS AND EQUATIONS

- To write $x^2 + 8x + 15$ in the form $(x + a)(x + b)$,
we need two numbers whose sum is 8 and product is 15.
 $3 + 5 = 8$
 $3 \times 5 = 15$
Answer: $a = 3, b = 5$
- We look for two numbers that add up to 6 and multiply to -91 .
The numbers are 13 and -7 .
 $13 + (-7) = 6$
 $13 \times (-7) = -91$
Answer: $(x + 13)(x - 7)$
- Number and its Square
(i) Form a second-degree equation:
Let the number be x .
The square of the number is x^2 .
Equation: $x^2 + x = 90$ (or $x^2 + x - 90 = 0$)
(ii) Find the possible values:
 $(x + 10)(x - 9) = 0$
 $x + 10 = 0 \Rightarrow x = -10$
 $x - 9 = 0 \Rightarrow x = 9$
Answer: The possible values are 9 and -10 .
- Quadratic Formula
Equation: $x^2 - 6x + 7 = 0$
Here, $a = 1, b = -6, c = 7$.
Using the quadratic formula:
$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$
$$x = \frac{-(-6) \pm \sqrt{(-6)^2 - 4(1)(7)}}{2(1)}$$
$$x = \frac{6 \pm \sqrt{36 - 28}}{2}$$
$$x = \frac{6 \pm \sqrt{8}}{2}$$

$$x = \frac{6 \pm 2\sqrt{2}}{2}$$

Answer: $x = 3 + \sqrt{2}$ or $x = 3 - \sqrt{2}$

- Rectangle Dimensions
(i) Perimeter
 $= 2(l + b) = 34 \Rightarrow l + b = 17$
Diagonal²
 $= l^2 + b^2 = 13^2 \Rightarrow l^2 + b^2 = 169$
(ii) Second-degree equation and solution:
From the first equation,
 $b = 17 - l$. Substitute this into the second:
$$l^2 + (17 - l)^2 = 169$$
$$l^2 + 289 - 34l + l^2 = 169$$
$$2l^2 - 34l + 120 = 0$$
Divide by 2:
$$l^2 - 17l + 60 = 0$$
Solving this:
$$(l - 12)(l - 5) = 0$$
If $l = 12$, then $b = 5$. If $l = 5$, then $b = 12$.
Answer: Length = 12 cm,
Breadth = 5 cm
- Sum of Even Numbers
(i) n -th even natural number:
The sequence is 2, 4, 6, ...
Answer: $2n$
(ii) Formula for the sum (S_n):
 $S_n = n(n + 1)$ or $n^2 + n$
(iii) Find n :
 $n(n + 1) = 240$
 $n^2 + n - 240 = 0$
 $(n + 16)(n - 15) = 0$
Since n (the number of terms) must be positive, $n = 15$.
Answer: 15 even numbers were added.

CIRCLES AND LINES

1. 6 cm.

Reason: According to the intersecting chords theorem,

$$PA \times PB = PC \times PD. \text{ So, } 9 \times 4 = 6 \times PD$$

$$36 = 6 \times PD$$

$$PD = 6 \text{ cm.}$$

2. (B) Statement 1 is false and statement 2 is true.

Reason: Statement 1 is false because the product of the parts of the secant is equal to the square of the length of the tangent ($PA \times PB = PT^2$). Statement 2 is true.

3. (i) The product of the parts is given by the formula
- $r^2 - d^2$
- .

$$\text{Product} = 10^2 - 6^2 = 100 - 36 = 64.$$

(ii) The shortest chord through P is the one that is perpendicular to the diameter passing through P. Let half its length be 'c'.

$$\text{Then } c^2 = r^2 - d^2 = 64.$$

So, $c = 8$ cm. The length of the shortest chord is $2 \times 8 = 16$ cm.

4. Principle: The square of the length of a perpendicular from a point on a diameter to the semicircle is equal to the product of the parts of the diameter (
- $c^2 = ab$
-).

Construction Steps:

To get a length of 12, we need a product of 12 (e.g., 6×2).

Draw a line segment of length $6 + 2 = 8$ cm.

Draw a semicircle with this 8 cm line as the diameter.

From the point that divides the diameter into 6 cm and 2 cm, draw a perpendicular line up to the semicircle. The length of this perpendicular line is $6 \times 2 = 12$ cm.

5. (i) P is the external point. A is the nearer intersection point and B is the farther one.

$$PB = PA + AB = 4 + 5 = 9 \text{ cm.}$$

(ii) Using the Tangent-Secant theorem,

$$PT^2 = PA \times PB.$$

$$PT^2 = 4 \times 9 = 36.$$

$$PT = \sqrt{36} = 6 \text{ cm.}$$

6. (i) The figure shows the full circle. The diameter is perpendicular to the chord of length 16 ft. The height of the arc (4 ft) is one part of the diameter. The chord is bisected into two parts of 8 ft each.

(ii) Let the parts of the diameter be $a = 4$ and b . Let half the chord be $c = 8$. Using the theorem $ab = c^2$ $4 \times b = 8^2 = 64$.

$$b = 64 / 4 = 16 \text{ ft.}$$

The full diameter is $a + b = 4 + 16 = 20$ ft. The radius of the circle is $20 / 2 = 10$ feet.

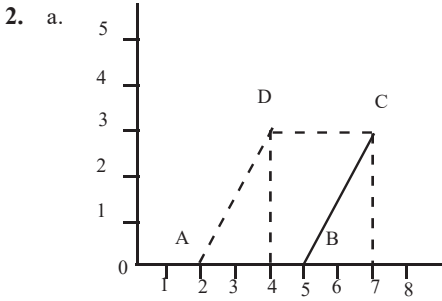
7. Draw the 7 cm x 4 cm rectangle. Extend the 7 cm side by 4 cm, making a total length of 11 cm.

Draw a semicircle with this 11 cm line as the diameter.

Extend the 4 cm side of the rectangle upwards until it meets the semicircle. This perpendicular line is the side of the required square (its length is $7 \times 4 = 28$ cm). Construct a square using this side length.

GEOMETRY AND ALGEBRA

1. a. Radius = $\sqrt{9^2+2^2} = \sqrt{225} = 15$
 b. (15, 0), (-15, 0), (0, 15), (0, -15) are the points by which the circle cuts the x axis.



b. Coordinates of D is (4,3) .

3. Equation of the line which joins the points (1, 3) and (2, 7) are

$$\frac{y-y_1}{x-x_1} = \frac{y_2-y_1}{x_2-x_1}, \quad \frac{y-3}{x-1} = \frac{4}{1}$$

$$\frac{y-3}{x-1} = \frac{7-3}{2-1} \quad y-3=4(x-1)$$

$$y-4x-3+4=0$$

$$y-4x+1=0$$

(a, b) is a point on the line is $b - 4a + 1 = 0$.

If (a + 1, b + 4) is lies on the line, then

$$b + 4 - 4(a + 1) + 1 = b + 4 - 4a - 4 + 1$$

$$= b - 4a + 1 = 0$$

∴ (a + 1, b + 4) is a point on the line.

4. Slope of AB = $\frac{11-7}{3-1} = \frac{4}{2} = 2$

$$\text{Slope of PQ} = \frac{6-2}{4-2} = 2$$

Slope of AB and PQ are same, then the lines are parallel.

5. a. Slope of AB

$$= \frac{(y_2 - y_1)}{(x_2 - x_1)} = \frac{(3 - (-3))}{(6 - 2)} = \frac{(3 + 3)}{(6 - 2)} = \frac{6}{4} = \frac{3}{2}$$

Equation of AB;

$$y - y_1 = m(x - x_1); \quad Y - 3 = \frac{3}{2}(x - 6) \Rightarrow 2(y - 3)$$

$$= 3(x - 6) \Rightarrow 2y - 6 = 3x - 18$$

$$3x - 2y - 12 = 0$$

- b. $y = 0$ for a point which cuts the x axis

$$y = 0; \quad 3x - 12 = 0 \Rightarrow 3x = 12 \Rightarrow x = 4$$

$$C = (4, 0).$$

- c. $AC^2 = (4-2)^2 + (0 - (-3))^2 = (2)^2 + (3)^2 = 4 + 9 = 13$

$$BC^2 = (4-6)^2 + (0-3)^2 = (-2)^2 + (-3)^2 = 4 + 9 = 13$$

$$AC^2 = BC^2 \Rightarrow AC = BC$$

∴ C is the midpoint of AB.

6. $\frac{6-5}{x-1} = \frac{1}{2}$, $x - 1 = 2 \times 1 = 2$, $x = 2 + 1 = 3$

7. Slope of the line which joins the points (0, 0) and (4, 2)

$$= \frac{2-0}{4-0} = \frac{2}{4} = \frac{1}{2}$$

Slope is $\frac{1}{2}$, that is when x coordinates are increased by 2, then y coordinate can be increased by 1 unit.

In another words x coordinate is always twice the y coordinates.

Slope for any point (x, y) on the line

$$\frac{y-0}{x-0} = \frac{1}{2}$$

$$\text{That is } \frac{x}{y} = \frac{1}{2}$$

$$\therefore x = 2y \text{ or } x - 2y = 0$$

i.e., Equation of the line is $x - 2y = 0$

SOLIDS

1. When a semicircle is rolled up to form a cone, the radius of the semicircle becomes the slant height (l) of the resulting cone. This is because the straight edge (the radius) of the semicircle forms the line from the apex of the cone down to the base.

Radius of the semicircle (R) = 15cm

Therefore, Slant height of the cone (l) = 15cm

2. Let r_1, r_2 be the radius of the sphere

Ratio between the area

$$= 4\pi r_1^2 : 4\pi r_2^2 = 4\pi(x)^2 : 4\pi(2x)^2 = 1 : 4$$

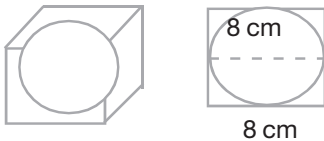
3. Base area = $2^2 = 4 \text{ m}^2$

Slant height = $\sqrt{3^2 - 1^2} = 2\sqrt{2} \text{ m}$

Surface area of the pyramid = $4 + (4 \times 2\sqrt{2})$

$$= 4 + 8\sqrt{2} \text{ m}^2$$

- 4.



From the figure, it is clear that diameter of the sphere is equal to the length of the edge of the cube.

$$\therefore \text{Radius of the sphere} = \frac{1}{2} \times 8 = 4 \text{ cm}$$

Surface area of sphere

$$= 4\pi \times 4^2 = 64\pi \text{ cm}^2$$

8. $a = 8 \text{ cm}, e = 8 \text{ cm}, l = \sqrt{8^2 - 4^2} = \sqrt{48}$

$$h = \sqrt{l^2 - \left(\frac{a}{2}\right)^2} = \sqrt{48 - 16} = 4\sqrt{2}$$

Volume of the toy

$$= \frac{1}{3} a^2 h = \frac{1}{3} \times 4^2 \times 4\sqrt{2}$$

$$= \frac{64\sqrt{2}}{3} \text{ cm}^3$$

9. Surface area of the square pyramid

$$= a^2 + 2al = 3456 \quad l = 30 \text{ cm}$$

$$a^2 + 60a = 3456, \quad a^2 + 60a - 3456 = 0$$

$$a = 36 \text{ cm}$$

$$l^2 = h^2 + \left(\frac{a}{2}\right)^2$$

$$h^2 = l^2 - \left(\frac{a}{2}\right)^2 = 30^2 - \left(\frac{36}{2}\right)^2$$

$$= 900 - 18^2 = 900 - 324 = 576$$

$$h = 24 \text{ cm}$$

$$\text{Volume} = \frac{1}{3} a^2 h = \frac{1}{3} \times 36 \times 36 \times 24 = 10368 \text{ cm}^3$$

STATISTICS

1.

Cost	Number of letters
15	47
20	80
25	136
30	177
35	202

Total number of letters = 202

Mean is the cost of the letters between the letters which are placed at 101 and 102 positions

Cost of the letters from 81 to 136 = 25

∴ Median of the cost = 25

2. Mean = $\frac{470+520+390+445+505}{5}$
 $= \frac{2330}{5} = 466$

Arrange the given number in the ascending order, then find out the middle one

390, 445, 470, 505, 520

Median = 470

3.

Height	Number
less than 135	3
less than 140	12
less than 145	25
less than 150	33
less than 155	38
less than 160	40

Total children = 40

To find the median of the heights calculate the half of the sum of the heights of 20th and 21st children

Height of the 13th child = $(140+140 \times \frac{5}{13}) \div 2 = 140 \times \frac{5}{26}$

There are 7 children to reach the to 20th child from 13th child

∴ Height of the 20th child

$= 140 \times \frac{5}{26} + 7 \times \frac{5}{13} = 140 \times \frac{5}{26} + \frac{35}{13} = 140 \times \frac{75}{26}$

∴ Height of the 21th child = $140 \times \frac{75}{26} + \frac{5}{13} = 140 \times \frac{85}{26}$

Median height = $(140 \times \frac{75}{26} + 140 \times \frac{85}{26}) \div 2 = 140 \times \frac{80}{26} = 143.07$

4.

Daily wage (Rs)	Number of workers	Total wages (Rs)
225	4	900
250	7	1750
270	9	2430
300	5	1500
350	3	1050
400	2	800
Total	30	8430

Median of the daily wages = $\frac{8430}{30} = 281$

5.

Weight	Number
less than 45.5	5
less than 50.5	12
less than 55.5	22
less than 60.5	30
less than 65.5	34

Here the number of children is even number i.e., 34. So to take half of the weight of the children in the position 17 and 18.

According to this 10 persons in between 13 and 22 have weights in between 50.5 and 55.5.

The required 17 and 18th positioned persons are included here.

Divide the 5 years in between 50.5 and 55.5 are into 10 equal parts.

Each part contains one person .

So weight of each part = $\frac{5}{10} = \frac{1}{2}$

According to this weight of the person placed at 17th position is in between 50.5 and 51.

That is 50.75. Continuing each persons weight can be increased by 5.

Weight of 17th placed person

$= 50.75 + (4 \times \frac{1}{2}) = 50.75 + 2 = 52.75$

Weight of 18th placed person

$= 52.75 + \frac{1}{2} = 53.25$

Median = $\frac{52.75 + 53.25}{2} = 53$