

SHREE VASISHTHA VIDHYALAYA

(CBSE affiliated, Member-NPSC, Recipient-International School Award, Eco Schools Award, Duke of Edinburgh & RIDS)

Assignment for Term - I: 2026 27

Class-XII Science

DATE OF SUBMISSION: 01-09-2026 (Tuesday)

1.	ENGLISH
	1. Why does Franz's attitude towards the French language change so dramatically within a single day? Is his transformation psychologically convincing? 2. Analyse the significance of the order, "Vive La France!" at the end of the lesson. Why is silence more powerful than an elaborate speech at that moment? 3. Compare Franz's personal loss with M. Hamel's sense of national loss. Whose grief is more profound, and why? 4. "Poverty in Lost Spring is not merely an economic condition; it becomes a psychological prison." Discuss. 5. Compare Saheb's and Mukesh's ideas of freedom. What does freedom mean differently to each of them? 6. "The greatest tragedy in Lost Spring is not child labour but the destruction of aspiration." Do you agree? 7. Douglas's fear of water originates in childhood, but his final victory requires much more than physical training. Analyse the psychological dimensions of his struggle. 8. "The real enemy in Deep Water is not water but the mind's memory of terror." Critically evaluate. 9. Compare the crofter's treatment of the peddler with Edla's treatment of him. What do these contrasting approaches reveal about human nature? 10. Is the peddler's final act of returning the money a complete transformation, or merely a temporary moral awakening? 11. Explain the symbolic importance of the name "Edla" in relation to the peddler's transformation, even though the story never presents her as a conventional heroic figure. 12. "The world becomes a rattrap only when individuals allow greed and temptation to control them." Evaluate this interpretation. 13. Is the third level a genuine supernatural phenomenon, or is it Charley's psychological escape from the pressures of modern life? Give a reasoned interpretation. 14. Why is the idea of Galesburg, 1894 so attractive to Charley? What does it represent psychologically? 15. Analyse the role of Sam in making the story deliberately ambiguous. 16. "The Third Level is less about time travel and more about the human desire to escape an unbearable present." Discuss. 17. Examine the significance of the first-class ticket, the old currency, and the clothing of the people at the third level. 18. Compare Charley's desire for escape with Sam's eventual decision to remain in the past. Are their motivations fundamentally different? 19. "The Tiger King is a satire on the arrogance of power rather than merely a humorous story about hunting." Discuss. 20. How does Kalki use exaggeration and irony to undermine the authority of the Maharaja? 21. The Maharaja attempts to defeat fate by killing tigers. Why does every step he takes to control destiny actually bring him closer to it? 22. Analyse the significance of the astrologer's prediction. Is the prophecy actually fulfilled, or does the story manipulate coincidence to expose human arrogance? 23. "The Maharaja is powerful enough to control people but powerless to control fate." Examine. 24. Discuss the role of irony in the ending. Why is the death of the Maharaja simultaneously tragic, absurd, and comic? 25. Why does the author describe Antarctica as a place that helps humanity understand its own past and future? 26. Explain the significance of the Gondwana theory in understanding the interconnectedness of continents and life. 27. "Antarctica is presented as both a geographical location and a warning system for humanity." Discuss. 28. How does the chapter connect climate change with the fragility of human civilisation? 29. Why is the phytoplankton discussed in such detail? What larger ecological lesson does it represent? 30. Dr Sadao's greatest conflict is not between Japan and America but between professional duty, humanity,

	and patriotism. Discuss. 31. Why does Sadao save the American soldier even though doing so puts his own life and family at risk? 32. Compare Sadao's attitude towards the wounded soldier with that of the servants. What does this contrast reveal? 33. “The Enemy demonstrates that humanity can transcend political identities.” Critically examine. 34. Why does the poet repeatedly shift her attention from her mother to the outside world? What does this reveal about her emotional state? 35. Explain the contrast between the “young trees” and the mother's ageing face. 36. “The poem is less about death itself and more about the fear of separation.” Discuss. 37. Why does the poet smile and say goodbye despite experiencing intense anxiety? 38. Analyse the significance of the repeated expression of farewell at the end of the poem. 39. “The poet's childhood fear of losing her mother returns in adulthood.” How is this idea conveyed? 40. Does Neruda's call for stillness imply inactivity? Explain the distinction between silence, stillness, and passivity in the poem. 41. Why does the poet ask humanity to count to twelve? What symbolic possibilities does the number suggest? 42. “Keeping Quiet is not a poem about stopping life; it is a poem about stopping destructive behaviour.” Discuss. 43. How does the poem criticise war, exploitation, and humanity's obsession with productivity? 44. “Beauty provides not temporary pleasure but permanent psychological nourishment.” Discuss with reference to the poem. 45. Why does Keats describe beauty as a source of “never-ending” joy despite the suffering present in human life? 46. What is the significance of the “endless fountain of immortal drink”? 47. Why does Keats include both natural objects and human-made stories/legends among things of beauty? 48. “A Thing of Beauty is fundamentally a poem about resilience.” Evaluate. 49. How does the imagery of the “flowery band” suggest a connection between beauty and human survival? 50. Compare Keats's understanding of beauty with Neruda's understanding of stillness in <i>Keeping Quiet</i>. How do both poets imagine ways of escaping human suffering?
2.	PHYSICS
	SECTION A — Multiple Choice Questions (<i>1 mark each, 10 × 1 = 10 marks</i>) <i>Chapter: Ray Optics and Optical Instruments</i> Q1. The power of a convex lens of focal length 50 cm is: (a) +0.5 D (b) +2 D (c) –2 D (d) +5 D <i>Chapter: Ray Optics and Optical Instruments</i> Q2. A ray of light passing through a prism suffers minimum deviation when: (a) the ray is incident normally on one refracting face (b) the angle of incidence equals the angle of emergence (c) the refracted ray inside the prism grazes the second face (d) the angle of prism is 90° <i>Chapter: Wave Optics</i> Q3. In Young's double slit experiment, if the slit separation is halved and the slit-to-screen distance is doubled, the fringe width becomes: (a) same as before (b) doubled (c) 4 times the original (d) one-fourth of the original <i>Chapter: Wave Optics</i> Q4. The bending of light around the edges of an obstacle or aperture is called: (a) reflection (b) refraction (c) diffraction (d) dispersion

Chapter: Electric Charges and Fields

Q5. Two electric field lines can never intersect each other because:

- (a) field lines are always parallel
- (b) at the point of intersection the field would have two directions, which is not possible
- (c) field lines are purely imaginary and carry no physical meaning
- (d) field lines always meet at infinity

Chapter: Electric Potential and Capacitance

Q6. The capacitance of a parallel plate capacitor increases when:

- (a) the area of the plates is decreased
- (b) the separation between plates is increased
- (c) a dielectric medium is introduced between the plates
- (d) the charge on the plates is reduced

Chapter: Current Electricity

Q7. The order of magnitude of drift velocity of free electrons in a typical metallic conductor carrying current is:

- (a) 10^2 m/s
- (b) 10^{-2} m/s
- (c) 10^{-4} m/s
- (d) 10^4 m/s

Chapter: Current Electricity

Q8. Kirchhoff's junction (current) rule at any node of a circuit is a statement of conservation of:

- (a) energy
- (b) electric charge
- (c) linear momentum
- (d) mass

Chapter: Moving Charges and Magnetism

Q9. A straight current-carrying conductor placed in a uniform magnetic field experiences the maximum force when the angle between the current direction and the field is:

- (a) 0°
- (b) 45°
- (c) 90°
- (d) 180°

Chapter: Moving Charges and Magnetism

Q10. The magnetic field at the centre of a circular coil of radius r carrying current I is given by:

- (a) $\mu_0 I / 2r$
- (b) $\mu_0 I / 2\pi r$
- (c) $\mu_0 I r / 2$
- (d) $\mu_0 I / 4\pi r$

SECTION B — Short Answer Questions (2 marks each, $8 \times 2 = 16$ marks)

Chapter: Ray Optics and Optical Instruments

Q1. Define the power of a lens. Write its SI unit, and state how the sign of power differs for a convex and a concave lens. [2 marks]

Chapter: Ray Optics and Optical Instruments

Q2. Two thin lenses of focal lengths f_1 and f_2 are placed in contact coaxially. Write the expression for the power and the focal length of the combination. [2 marks]

Chapter: Wave Optics

Q3. State Huygens' principle of wave propagation. [2 marks]

Chapter: Wave Optics

Q4. What happens to the interference pattern in Young's double slit experiment if the monochromatic source is replaced by a source of white light? Explain briefly. [2 marks]

Chapter: Electric Charges and Fields

Q5. Define electric flux and write its SI unit. How does electric flux through a closed surface depend on the

charge enclosed? [2 marks]

Chapter: Electric Potential and Capacitance

Q6. Two point charges of $+4\ \mu\text{C}$ and $-2\ \mu\text{C}$ are placed 1 m apart in air. Find the point on the line joining them (outside the segment) where the electric potential is zero. [2 marks]

Chapter: Current Electricity

Q7. Define drift velocity of free electrons in a conductor. Derive the relation between electric current and drift velocity. [2 marks]

Chapter: Moving Charges and Magnetism

Q8. State Fleming's left-hand rule. What is it used for? [2 marks]

SECTION C — Short Answer Questions (3 marks each, $7 \times 3 = 21$ marks)

Chapter: Ray Optics and Optical Instruments

Q1. Derive the lens maker's formula for a thin convex lens, stating the assumptions and sign convention used. [3 marks]

Chapter: Ray Optics and Optical Instruments

Q2. With the help of a labelled ray diagram, explain the formation of the final image in a simple microscope (magnifying glass) and write the expression for its magnifying power. [3 marks]

Chapter: Wave Optics

Q3. Describe Young's double slit experiment with a neat diagram and derive an expression for the fringe width of the interference pattern obtained. [3 marks]

Chapter: Electric Charges and Fields

Q4. State Gauss's law in electrostatics. Use it to derive the expression for the electric field due to an infinite plane sheet of charge. [3 marks]

Chapter: Electric Potential and Capacitance

Q5. Derive an expression for the energy stored in a charged parallel plate capacitor. Hence define energy density of the electric field between its plates. [3 marks]

Chapter: Current Electricity

Q6. Derive expressions for the equivalent resistance of (a) three resistors connected in series and (b) three resistors connected in parallel. [3 marks]

Chapter: Moving Charges and Magnetism

Q7. Derive an expression for the force per unit length between two long, straight, parallel current-carrying conductors placed in air. Hence define the SI unit of current, the ampere. [3 marks]

SECTION D — Long Answer / Numerical Questions (4 marks each, $4 \times 4 = 16$ marks)

Chapter: Ray Optics and Optical Instruments

Q1. An astronomical telescope (in normal adjustment) is made using an objective lens of focal length 100 cm and an eyepiece of focal length 5 cm. [4 marks]

(a) Find the magnifying power of the telescope.

(b) Find the length of the telescope tube.

(c) State one limitation of a refracting astronomical telescope.

(d) How does the magnifying power change if an eyepiece of smaller focal length is used?

Chapter: Wave Optics

Q2. Light of wavelength 600 nm falls normally on a single slit of width 0.3 mm, and the diffraction pattern is observed on a screen 1.5 m away. [4 marks]

(a) Find the distance of the first secondary minimum from the centre of the central maximum.

(b) Find the width of the central maximum.

(c) How does the width of the central maximum change if the slit width is doubled?

(d) Compare the intensity of the central maximum with that of the first secondary maximum (qualitatively).

Chapter: Electric Charges and Fields / Electric Potential and Capacitance

Q3. Three point charges q , $2q$ and $-3q$ are placed at the vertices of an equilateral triangle of side a . [4 marks]

(a) Write the expression for the net electric potential energy of the system.

(b) Find the electric potential at the centroid of the triangle due to the three charges.

(c) State the work done in assembling the charges from infinity.

(d) How would the potential energy change if the side of the triangle is doubled?

	<i>Chapter: Current Electricity / Moving Charges and Magnetism</i> Q4. A moving-coil galvanometer of resistance $50\ \Omega$ shows full-scale deflection for a current of 4 mA. It is to be converted into an ammeter reading up to 2 A. [4 marks] (a) Calculate the value of shunt resistance required. (b) Explain why the shunt resistance must be very small compared to the galvanometer resistance. (c) State one change you would make to convert the same galvanometer into a voltmeter instead. (d) State the basic principle on which a moving-coil galvanometer works. SECTION E — Long Answer / Derivation Questions (5 marks each, $4 \times 5 = 20$ marks) <i>Chapter: Ray Optics and Optical Instruments</i> Q1. Describe, with the help of a labelled ray diagram, the construction and working of a compound microscope. Derive the expression for its magnifying power when the final image is formed at the near point. [5 marks] <i>Chapter: Wave Optics</i> Q2. (a) Using Huygens' principle, derive the laws of refraction of light at a plane interface. (b) Describe how a plane wavefront gets modified after passing through (i) a thin convex lens and (ii) a thin prism, giving reasons. [5 marks] <i>Chapter: Electric Charges and Fields / Electric Potential and Capacitance</i> Q3. (a) Derive an expression for the electric field at a point on the axial line of an electric dipole at a distance r from its centre (r much greater than dipole length). (b) Derive an expression for the capacitance of a parallel plate capacitor with a dielectric slab of thickness t ($t < d$) inserted between its plates. [5 marks] <i>Chapter: Current Electricity / Moving Charges and Magnetism</i> Q4. (a) State the Biot–Savart law and use it to derive an expression for the magnetic field at the centre of a circular current-carrying coil of radius r and N turns. (b) Derive the condition for balance of a Wheatstone bridge. [5 marks]
3.	CHEMISTRY
	- What is a coordination compound? Give one example. - Define coordination number and oxidation state with an example. - Write the IUPAC name of $[\text{Cu}(\text{NH}_3)_6]\text{Cl}_3$. - Write the formula of tetraamminecopper(II) sulphate. - Find the oxidation state of the metal in. - What are ligands? Explain monodentate and bidentate ligands with examples. - What is meant by ambidentate ligand? Give two examples. - Explain ionisation isomerism with a suitable example. - Draw the geometrical isomers of $[\text{Co}(\text{C}_2\text{O}_4)_3]^{3-}$. - What is linkage isomerism? Give an example. - Explain the bonding in coordination compounds according to Valence Bond Theory (VBT). - Predict the geometry and magnetic nature of $[\text{Ni}(\text{CN})_4]^{2-}$. - Why is $[\text{Fe}(\text{CN})_6]^{4-}$ diamagnetic whereas $[\text{FeF}_6]^{4-}$ is paramagnetic? - What is crystal field splitting in an octahedral complex? Explain using a diagram. - Explain the importance of coordination compounds in qualitative analysis, metallurgy, and biological systems. - What are haloalkanes and haloarenes? Give two examples of each. - Explain the difference between alkyl halides and aryl halides. - Write the IUPAC name of $\text{CH}_3\text{CH}_2(\text{Cl})\text{CH}_2\text{CH}_3$. - What happens when bromoethane reacts with aqueous KOH? Write the equation. - Explain the $\text{S}_\text{N}1$ mechanism using tert-butyl bromide as an example. - Explain the $\text{S}_\text{N}2$ mechanism using methyl bromide as an example. - What factors affect the rate of an $\text{S}_\text{N}1$ reaction? - What factors affect the rate of an $\text{S}_\text{N}2$ reaction? - Why do tertiary alkyl halides generally undergo $\text{S}_\text{N}1$ reactions more readily than primary alkyl halides? - What is the Wurtz reaction? Write its chemical equation. - What is the Finkelstein reaction? Why is acetone used in this reaction?

	12. Explain the Swarts reaction with an example. 13. Why are haloarenes less reactive towards nucleophilic substitution than haloalkanes? 14. Explain the Sandmeyer reaction and give one example. 15. What happens when chlorobenzene is treated with NaOH at high temperature and pressure? Name the product and reaction. 16. Calculate the molarity of a solution prepared by dissolving 5.85 g of NaCl in 500 mL of solution. 17. Calculate the molality of a solution containing 18 g glucose dissolved in 200 g water. 18. Calculate the mole fraction of ethanol and water in a solution containing 46 g ethanol and 54 g water. 19. Calculate the elevation in boiling point when 18 g glucose is dissolved in 500 g water. Given. (k_b for water = $0.52 \text{ K kg mol}^{-1}$). 20. Calculate the depression in freezing point of a solution containing 5.85 g NaCl in 500 g water, assuming complete dissociation. Given (k_f for water = $1.86 \text{ K kg mol}^{-1}$). 21. Calculate the osmotic pressure at 300 K of a solution containing 9 g glucose per litre. 22. A solution containing 2 g of an electrolyte in 100 g water has a freezing point depression of 0.372 K. If its molar mass is 100 g mol^{-1}, calculate the Van't Hoff factor. 23. Calculate the EMF of the following cell: $\text{Zn} \mid \text{Zn}^{2+} (0.01 \text{ M}) \parallel \text{Cu}^{2+} (0.005 \text{ M}) \mid \text{Cu}$ (Given $E^\circ_{\text{cell}} = 1.10 \text{ V}$, AT 298 K.) 24. Calculate the standard Gibbs energy change for a cell reaction having $E^\circ_{\text{cell}} = 1.10 \text{ V}$ at 298 K and $n = 2$. 25. A current of 2 A is passed through a CuSO_4 solution for 30 minutes. Calculate the mass of copper deposited. 26. Calculate the quantity of electricity required to deposit 1.08 g of silver from AgNO_3 solution. 27. The resistance of a conductivity cell containing 0.02 M KCl solution is 500 Ω. If the conductivity of the solution is $2.76 \times 10^{-3} \text{ S cm}^{-1}$, calculate the cell constant. 28. The molar conductivity of a 0.01 M KCl solution is $141.2 \text{ S cm}^2 \text{ mol}^{-1}$. Calculate its conductivity. 29. A conductivity cell has a resistance of 100 Ω and a cell constant of 1.25 cm^{-1}. Calculate the conductivity of the solution. 30. A first-order reaction has a rate constant of $k = 2.31 \times 10^{-3} \text{ sec}^{-1}$. Calculate its half-life. 31. The half-life of a first-order reaction is 20 minutes. Calculate its rate constant in per sec. 32. For a first-order reaction, the initial concentration is 0.8 M and after 30 minutes it becomes 0.2 M. Calculate the rate constant. 33. A first-order reaction is 75% complete in 40 minutes. Calculate its half-life. 34. The rate constant of a reaction increases from $2.0 \times 10^{-3} \text{ sec}^{-1}$ to $8.0 \times 10^{-3} \text{ sec}^{-1}$, when the temperature is increased from 300 K to 320 K. Calculate the activation energy using the Arrhenius equation. 35. For a reaction, the rate doubles when the concentration of reactant is doubled. Determine the order of the reaction and write its rate law.
4.	MATHEMATICS 1. If $R = \{(x, y): x+2y=8\}$ is a relation on N, write the range for R. 2. Show that the relation R defined by $(a, b) R (c, d)$ iff $a + d = b + c$ on the $N \times N$ is an equivalence relation. 3. Let $A = \{1, 2, 3, \dots, 9\}$ and R be the relation defined on $A \times A$ by $(a, b) R (c, d)$ iff $a + d = b + c$. Prove that R is an equivalence relation. Also find the equivalence class $[(2, 5)]$. 4. Let N be the set of natural numbers and R be the relation on $N \times N$ defined by $(a, b) R (c, d)$, if $ad = bc$ for all $a, b, c, d \in N$. Show that R is an equivalence relation. 5. Show that a function $f: R \rightarrow R$ defined as $f(x) = x^2 + x + 1$ is neither one one nor onto. Also, find all the values of x for which $f(x) = 3$. 6. Let N be the set of natural numbers and R be the relation on $N \times N$ defined by $(a, b) R (c, d)$, if $a d (b + c) = b c (a + d)$ for all $a, b, c, d \in N$. Show that R is an equivalence relation. 7. Show that the function $f: R \rightarrow R$ defined by $f(x) = x + x$ is neither one-one nor onto. Also find the range of R. 8. Show that the function $f: R \rightarrow \{x: x \in R, -1 < x < 1\}$ given by $f(x) = \frac{x}{1+ x }$ is one-one and onto. Hence find the inverse of f. 9. Prove that: $\tan^{-1} \left(\frac{\sqrt{1+x} - \sqrt{1-x}}{\sqrt{1+x} + \sqrt{1-x}} \right) = \frac{\pi}{4} - \frac{1}{2} \cos^{-1} x, -\frac{1}{\sqrt{2}} \leq x \leq 1$ 10. Find the value of k if $\sin^{-1} [k \tan(2 \cos^{-1} \frac{\sqrt{3}}{2})] = \frac{\pi}{3}$.

11. Find the domain of $y = \sin^{-1}(x^2 - 4)$.
12. The value of $\cos\left[\tan^{-1}\left(\tan\frac{15\pi}{4}\right)\right]$ is _____.
13. If $\sin^{-1}(1 - x) - 2\sin^{-1}(x) = \frac{\pi}{2}$, then $x =$ _____.
14. If the matrix $A = \begin{bmatrix} 0 & a & -3 \\ -2 & b & -1 \\ c & 1 & 0 \end{bmatrix}$ is a skew symmetric matrix, then $a + b + c =$ _____.
15. Let $A = \begin{bmatrix} a & b \\ c & d \end{bmatrix}$ be a square matrix such that $\text{adj } A = A$. Then $(a + b + c + d) =$ _____.
16. If A is square matrix of order 2 such that $\det(A) = 4$, then find the value of $\det(4\text{adj } A)$.
17. If A is a square matrix of order 3 such that $\det(A) = 9$, then $\det(9A^{-1})$ is equal to _____.
18. Let A and B be two square matrices of order 3 such that $\det(A) = 3$ and $\det(B) = -4$. Find the value of $|-6AB|$.
19. If $A(\text{adj } A) = \begin{bmatrix} 3 & 0 & 0 \\ 0 & 3 & 0 \\ 0 & 0 & 3 \end{bmatrix}$, then the value of $|A| + |\text{adj } A|$ is equal to _____.
20. If $A = \begin{bmatrix} -2 & 0 & 0 \\ 1 & 2 & 3 \\ 5 & 1 & -1 \end{bmatrix}$, then the value of $|A(\text{adj } A)|$ is _____.
21. If the points with vertices (p_1, q_1) , (p_2, q_2) and $(p_1 + p_2, q_1 + q_2)$ are collinear, show that $p_1 q_2 = p_2 q_1$.
22. A furniture workshop produces three types of furniture - chairs, tables and beds each day. On a particular day the total number of furniture pieces produced is 45. It was also found that production of beds exceeds that of chairs by 8, while the total production of beds and chairs together is twice the production of tables. Determine the units produced of each type of furniture, using matrix method.
23. If A is a 3×3 invertible matrix, show that for any scalar $k \neq 0$, $(KA)^{-1} = \frac{1}{k}A^{-1}$. Hence calculate $(3A)^{-1}$, where $A = \begin{bmatrix} 2 & -1 & 1 \\ -1 & 2 & -1 \\ 1 & -1 & 2 \end{bmatrix}$.
24. Use the product of matrices $\begin{bmatrix} 1 & 2 & -3 \\ 3 & 2 & -2 \\ 2 & -1 & 1 \end{bmatrix} \begin{bmatrix} 0 & 1 & 2 \\ -7 & 7 & -7 \\ -7 & 5 & -4 \end{bmatrix}$ to solve the following system of equations: $x + 2y - 3z = 6$, $3x + 2y - 2z = 3$, $2x - y + z = 2$.
25. Find k for which $f(x) = \begin{cases} \frac{\sqrt{1+kx} - \sqrt{1-kx}}{x}, & \text{if } -1 \leq x < 0 \\ \frac{2x+1}{x-1}, & \text{if } 0 \leq x < 1 \end{cases}$ is continuous at $x=0$.
26. If $f(x) = \begin{cases} \frac{x^3 + x^2 - 16x + 20}{(x-2)^2}, & \text{if } x \neq 2 \\ k, & \text{if } x = 2 \end{cases}$ is continuous at $x=2$, find the value of k .
27. Examine the function $f(t)$ given by $f(t) = \begin{cases} \frac{\cos t}{\frac{\pi}{2} - t}; & t \neq \frac{\pi}{2} \\ 1; & t = \frac{\pi}{2} \end{cases}$ continuity at $t = \frac{\pi}{2}$.
28. Let $f(x) = \begin{cases} \frac{1 - \cos 4x}{x^2}, & \text{if } x < 0 \\ a; & \text{if } x = 0 \\ \frac{\sqrt{x}}{\sqrt{16 + \sqrt{x}} - 4}; & \text{if } x > 0 \end{cases}$ Determine the value of a so that $f(x)$ is continuous at $x=0$.
29. If $f(x) = \frac{\sqrt{2}\cos x - 1}{\cot x - 1}$, $x \neq \frac{\pi}{4}$ find the value of $f\left(\frac{\pi}{4}\right)$ so that $f(x)$ becomes continuous at $x = \frac{\pi}{4}$.
30. Discuss the differentiability of $f(x) = x|x|$ at $x=0$.
31. Differentiate $2^{\cos^2 x}$ w.r.t $\cos^2 x$.
32. If $\sqrt{1-x^2} + \sqrt{1-y^2} = a(x-y)$ then prove that $\frac{dy}{dx} = \sqrt{\frac{1-y^2}{1-x^2}}$.
33. Differentiate $\tan^{-1}\left(1 + \frac{\cos x}{\sin x}\right)$ with respect to x .
34. If $x \cos(p+y) + \cos p \sin(p+y) = 0$, prove that $\cos p \frac{dx}{dy} = -\cos 2(p+y)$, where p is a constant.
35. If $y = \log(\sqrt{x} + \frac{1}{\sqrt{x}})^2$, then show that $x(x+1)^2 y_2 + (x+1)^2 y_1 = 2$.
36. If $x = \alpha \sin 2t(1 + \cos 2t)$ and $y = \beta \cos 2t(1 - \cos 2t)$, show that $\frac{dy}{dx} = \frac{\beta}{\alpha} \tan t$.

	37. If $(x - a)^2 + (y - b)^2 = c^2$, $c > 0$, prove that $\frac{\left[1 + \left(\frac{dy}{dx}\right)^2\right]^{\frac{3}{2}}}{\frac{d^2y}{dx^2}}$ is constant independent of a & b. 38. If $u = \sin^{-1}\left(\frac{2x}{1+x^2}\right)$ and $v = \tan^{-1}\left(\frac{2x}{1-x^2}\right)$, then find $\frac{du}{dv}$. 39. Differentiate $\frac{5^x}{x^5}$ with respect to x. 40. Show that the derivative of $\tan^{-1}(\sec x + \tan x)$, $[-\frac{\pi}{2} < x < \frac{\pi}{2}]$ with respect to x is equal to 2. 41. Differentiate $\tan^{-1}\frac{\sqrt{1-x^2}}{x}$ with respect to $\cos^{-1}(2x\sqrt{1-x^2})$, $x \in (\frac{1}{\sqrt{2}}, 1)$ 42. Find the intervals in which $f(x) = 5x^{\frac{3}{2}} - 3x^{\frac{5}{2}}$ is (i) increasing (ii) decreasing. 43. Find the values of 'a' for which $f(x) = \sin x - ax + b$ is increasing on R. 44. Separate the interval $[0, \frac{\pi}{2}]$ into the subinterval in which $f(x) = \sin^4 x + \cos^4 x$. (a) increasing (b) decreasing. 45. Find the value of 'a' for which $f(x) = \sqrt{3} \sin x - \cos x - 2ax + 6$ is decreasing in R. 46. Let AP and BQ be two vertical poles at points A and B, respectively. If AP = 16 m, BQ = 22 m and AB = 20 m, then find the distance of a point R on AB from the point A such that $RP^2 + RQ^2$ is minimum. 47. Show that the rectangle of maximum perimeter which can be inscribed in a circle of radius r is the square of side $r\sqrt{2}$. 48. A car starts from a point P at time $t = 0$ seconds and stops at point Q. The distance x, in metres, covered by it, in t seconds is given by $x = t^2(2 - \frac{t}{3})$, Find the time taken by it to reach Q and also find distance between P and Q. 49. Manufacturer can sell x items at a price of rupees $(5 - \frac{x}{100})$ each. The cost price of x item is Rs $(\frac{x}{5} + 500)$ Find the number of items he should sell to earn maximum profit. 50. Show that height of the cylinder of greatest volume which can be inscribed in a right circular cone of height h and semi vertical angle α is one-third that of the cone and the greatest volume of cylinder is $\frac{4}{27} \pi h^3 \tan^2 \alpha$.
5.	BIOLOGY SETA - What is the significance of double fertilisation in angiosperms? - Differentiate between autogamy and geitonogamy with one example of each. - Explain the role of the tapetum in the development of pollen grains. - Describe the major changes that occur in the ovary and ovule after fertilisation. - What are the functions of LH and FSH during the menstrual cycle? - State Mendel's Law of Segregation. - Differentiate between genotype and phenotype. - A heterozygous tall pea plant is crossed with a dwarf plant. Write the expected genotypic and phenotypic ratios. - Explain why DNA is considered a better genetic material than RNA. - What is semiconservative replication of DNA? Who experimentally demonstrated it? - What is an antigen? How does it differ from an antibody? - Name the causative organisms of typhoid, malaria and AIDS. - Explain how vaccination provides protection against a particular disease. - Differentiate between innate immunity and acquired immunity. - Explain the role of microbes in the production of antibiotics and organic acids. SET B - Explain the development of a female gametophyte (embryo sac) from a megaspore mother cell. - A pollen grain lands on the stigma but fails to germinate. Give three possible biological reasons for this failure. - Explain the hormonal regulation of the menstrual cycle, mentioning the roles of FSH, LH, estrogen and progesterone. - Differentiate between spermatogenesis and oogenesis with respect to timing, number of functional gametes

and cytokinesis.

5. A woman has a regular 28-day menstrual cycle. Explain what would happen to the levels of LH, progesterone and estrogen if fertilisation and implantation occur.
6. Explain incomplete dominance with a suitable example and compare it with Mendelian dominance.
7. A carrier woman for haemophilia marries a normal man. Construct a cross and determine the probability of their sons and daughters being affected or carriers.
8. Explain how DNA fingerprinting can be used to establish biological relationships.
9. Describe the process of transcription in bacteria, including the role of promoter, RNA polymerase and terminator.
10. A mutation changes a DNA codon but does not alter the amino acid incorporated into the protein. Explain how this can happen and name the type of mutation.
11. Explain the life cycle of *Plasmodium* in humans and mosquitoes.
12. Why does a person infected with HIV gradually become susceptible to opportunistic infections? Explain the role of helper T lymphocytes.
13. Explain how secondary immune response differs from the primary immune response.
14. Explain the role of microbes in sewage treatment and how they help reduce pollution.
15. A patient is prescribed antibiotics for a bacterial infection. Explain why completing the prescribed course is important and how indiscriminate antibiotic use can contribute to antibiotic resistance.

SET C

1. A farmer notices that a particular hybrid crop produces very few seeds even though pollen grains are viable. Analyse the possible reproductive barrier involved and explain how artificial hybridisation techniques can overcome such problems.
2. In a flowering plant, the pollen tube reaches the embryo sac but fertilisation does not occur. Trace the normal pathway of the pollen tube and identify the cells involved in syngamy and triple fusion.
3. A woman has normal ovulation but does not become pregnant despite repeated fertilisation attempts. Explain how abnormalities in the fallopian tube, uterus or endometrium could prevent successful pregnancy.
4. During assisted reproductive technology, fertilisation occurs outside the female body and the resulting embryo is transferred into the uterus. Identify the technique and explain its major steps.
5. A couple wants to avoid pregnancy but does not want to use hormonal contraceptives. Compare barrier methods, intrauterine devices and natural methods with respect to their mechanisms and effectiveness.
6. In a dihybrid cross, the observed offspring ratio differs significantly from the expected Mendelian ratio. Analyse possible reasons such as linkage, gene interaction or environmental effects.
7. A DNA molecule contains 30% adenine. Calculate the percentage of thymine, guanine and cytosine and explain the principle used.
8. A mutation occurs in the promoter region of a structural gene. Predict how this mutation could affect transcription and protein production.
9. A DNA template has the sequence:
3'–TAC GGA CTT ACT–5'
Determine the corresponding mRNA sequence and explain how the ribosome would use it during translation.
10. A population contains a harmful recessive allele that remains at low frequency for many generations. Explain why natural selection may not completely eliminate the allele from the population.
11. A person develops fever, chills and sweating at regular intervals after returning from a mosquito-infested region. Analyse the symptoms and explain the role of the vector and parasite in the disease cycle.
12. Two individuals are exposed to the same pathogen. One develops severe disease while the other shows only mild symptoms. Explain how immune memory, vaccination history and individual immune response could account for this difference.
13. A bacterial population is exposed repeatedly to an antibiotic. Initially most bacteria die, but after several generations the antibiotic becomes less effective. Explain this observation using natural selection and antibiotic resistance.
14. During sewage treatment, the biological oxygen demand (BOD) of wastewater decreases considerably after

	secondary treatment. Explain why BOD decreases and identify the microorganisms/processes responsible. 15. A village experiences an outbreak of a communicable disease. Health authorities observe that the disease spreads rapidly among people living in crowded conditions. They introduce vaccination, improve sanitation and educate people about personal hygiene. (a) Why does overcrowding favour the spread of communicable diseases? (b) How does vaccination reduce disease transmission? (c) Distinguish between active and passive immunity. (d) Explain why sanitation is an important component of disease prevention.
6.	INFORMATICS PRACTICES Python Questions 1. Consider the following Python code snippet: <code>import pandas as pd S1 = pd.Series([10, 20, 30], index=['a', 'b', 'c']) S2 = pd.Series([5, 2], index=['b', 'a']) S3 = S1 + S2</code> Evaluate the resulting values in the series S3. 2. Predict the output of the scalar multiplication operation <code>S1 * 2</code> given the series <code>S1 = pd.Series([10, 20, 30], index=['a', 'b', 'c'])</code>. 3. Consider the following Python code snippet: <code>import pandas as pd obj1 = pd.Series(5, index=[10, 20, 30]) obj2 = pd.Series([5], index=[10, 20, 30])</code> What will be the value and behavior of <code>obj1</code> versus <code>obj2</code>? 4. What will be the output of the following script? <code>import pandas as pd v1 = [4, 5] vs = pd.Series([10, 20]) result = v1 * vs print(result)</code> 5. Write a Python program snippet to read data from a CSV file named student where the separator character is '@', ensuring that old column names do not appear as data. 6. Complete the missing statements for Anish's script to plot a line chart of temperature fluctuations over four consecutive days (<code>days = ['Day 1', 'Day 2', 'Day 3', 'Day 4']</code>, <code>temp = [32, 35, 28, 30]</code>) where the line must be green with a square marker ('s'). 7. Write independent Python statements to add a new employee row with index label 'E01', named 'Rohan', with a Salary of 48000 and a Bonus of 4500 to a Pandas DataFrame df. 8. Write a Python statement to update the Salary of the employee at index label 'E01' to 55000 in the DataFrame df. 9. Write a statement to rename the column header 'EmpName' to 'Employee_Name' permanently within the same Pandas DataFrame structure. 10. Write a Python statement to remove the entire row belonging to the employee index label 'E02' from a DataFrame. 11. Display all records from a Pandas Series named P_Sales where the sales amount is strictly greater than 40. 12. The company decides to give a 10% incremental growth adjustment to the sales figures of all products in a Pandas Series named P_Sales. Write the vectorized arithmetic operation to achieve this. 13. Write a statement to change the existing index labels of a Series from ['P01', 'P02', 'P03'] to ['Prod_A', 'Prod_B', 'Prod_C']. 14. Write a statement using label-based slicing to display the elements from the modified index label 'Prod_A' up to 'Prod_B' (inclusive) in a Pandas Series. 15. Which function/method is used in Pandas to write a DataFrame back out to a CSV file (complementary to reading CSVs)? MySQL Questions 1. Write an SQL query to increase the price of all items belonging to the 'Electronics' category by a flat 10% in an INVENTORY table. 2. Write an SQL query to display the total stock quantity available in the store grouped by each category, but only for categories where the total stock exceeds 50 items from the INVENTORY table. 3. Write an SQL statement to modify the structural definition of a DOCTORS table by adding a new column named Experience_Years that stores whole integer values. 4. Write an SQL statement to insert a new medical practitioner record into the DOCTORS table with ID 501, Name 'Dr. Kapoor', Department 'Cardiology', and a Fee of 1200 leaving the experience field blank. 5. Write an SQL query to display the names and departments of all doctors from the DOCTORS table whose consultation fees range anywhere from 800 to 1500 inclusive. 6. Based on a STOCK table, write an SQL query to display the company-wise highest quantity available.

	- Based on a STOCK table, write an SQL query to display the year-wise lowest quantity available. - Based on a STOCK table containing a TYPE column, write an SQL query to display the total number of 'SW' (Software) and 'HW' (Hardware) type stocks. - Write an SQL query to display the last five characters from the string "VIDYALAYA". - Write an SQL query to display the UName and Type of all uniforms sorted in alphabetical order by their name from a UNIFORM table. - Write an SQL query to display the UCode and Price from the COST table for all items whose price is more than 500 and size is either 'L' or 'XL'. - Write an SQL query to display the UName, Size, and Price of all uniforms by joining the UNIFORM and COST tables using their common column. - Write an SQL query to display the Size along with the maximum price using MAX(Price) for each size group from the COST table. - Identify the Primary Key column for the UNIFORM table and state the relationship (Foreign Key) column connecting it to the COST table based on the schema. - Write an SQL query to display the names of all items from a table where the name starts with the letter 'M' using the LIKE operator.
7.	PHYSICAL EDUCATION
	Easy Level – 10 Questions - What is meant by a sports tournament? - Name any two types of tournaments. - What is a fixture? - What is meant by balanced diet? - Name any two nutrients required by a sportsperson. - What is obesity? - Name any two lifestyle diseases that can be prevented through Yoga. - What is meant by CWSN? - What is a sports injury? - Name any two common sports injuries. Medium Level – 10 Questions - Explain the importance of proper planning in the management of a sports event. - Differentiate between knock-out and league tournaments. - Explain the importance of physical activity for the health and development of children. - Discuss the importance of regular physical activity for women and explain any two benefits. - Explain how Yoga can help in preventing obesity, diabetes and hypertension. - Explain the importance of inclusive Physical Education for Children with Special Needs (CWSN). - What modifications can be made in sports activities to facilitate the participation of CWSN? - Explain the importance of carbohydrates, proteins and fats in the diet of a sportsperson. - What are the immediate physiological effects of exercise on the cardiovascular and respiratory systems? - Explain any four common sports injuries and their basic preventive measures. Hard Level – 10 Questions Case Study: Your school is organising an inter-house basketball tournament with 8 teams. Explain the major steps you would follow to plan, organise and successfully conduct the event. - Analyse the advantages and disadvantages of knock-out, league and combination tournaments. Suggest which format would be most suitable when a large number of teams participate. - Discuss the physiological and psychological benefits of regular physical activity for women. Also explain the precautions that should be considered during different stages of life. “Participation in sports during childhood contributes to lifelong health.” Critically analyse this statement with reference to physical, psychological and social development. - A student is overweight, stressed and physically inactive. Design a suitable Yoga-based programme to help prevent lifestyle diseases and explain the expected benefits. - Analyse the role of inclusive Physical Education in the physical, psychological and social development of CWSN. Suggest practical strategies for making a school sports programme more inclusive.

	27. A young athlete frequently feels tired during training and performs poorly despite regular practice. Analyse how an imbalanced diet, dehydration and improper nutrient intake could affect performance. Suggest appropriate nutritional strategies. 28. Explain how the body responds physiologically to strenuous exercise. Discuss the role of the cardiovascular, respiratory and muscular systems in maintaining sports performance. 29. Case Study: During a football match, a player suffers an ankle injury. Explain the immediate management of the injury, precautions to prevent further damage and measures that can help reduce the risk of similar injuries in the future. 30. Integrated Question: A school is organising a sports camp for children, including CWSN, with Yoga, physical training and competitive events. Prepare a comprehensive plan covering event management, nutrition, Yoga, inclusion, physiological preparation and injury prevention
8.	ARTIFICIAL INTELLIGENCE
	Short Answer 1. What is communication? Mention two important elements of communication. 2. What is active listening? Why is it important? 3. What are communication barriers? Give two examples. 4. What is self-management? Why is it important? 5. What is positive thinking? Mention two benefits of positive thinking. 6. How can a person develop self-confidence? 7. What is a spreadsheet? Mention one use of a spreadsheet. 8. What is the difference between a worksheet and a workbook? 9. What is sorting in a spreadsheet? Why is it useful? 10. What is presentation software? Give one example. 11. What are Green Skills? Why are they important? 12. What is sustainable development? 13. What are the 3Rs of waste management? Explain them briefly. 14. What is Data Science Methodology? 15. What is problem identification? 16. What is data preparation? 17. Why is model evaluation important? 18. What is a capstone project? 19. What is Big Data? 20. What are the five Vs of Big Data? 21. What is Data Analytics? 22. What is predictive analytics? 23. What is unstructured data? 24. What is Generative AI? 25. What is a prompt? 26. What is prompt engineering? 27. What is AI hallucination? 28. What are the limitations of Generative AI? Long Answer 1. What is Data Science Methodology? Explain its importance. 2. Explain the different stages of a Data Science project. 3. What is problem identification? Why is it important in a capstone project? 4. What is data collection and why is it important? 5. Explain Exploratory Data Analysis and its importance. 6. What is model evaluation? Why is it necessary? 7. What is a Capstone Project? Explain its importance in AI. 8. What is Big Data? Explain its characteristics. 9. Explain the five Vs of Big Data with examples. 10. What is Data Analytics? Explain its importance. 11. Explain the different types of Data Analytics. 12. Differentiate between structured, semi-structured, and unstructured data. 13. Explain the major sources of Big Data. 14. How does Big Data and Data Analytics help organizations? 15. What is Generative AI? Explain its working and applications.

	16. What is a prompt? Explain the importance of effective prompting. 17. What is AI Hallucination? Explain its causes and prevention. 18. Explain the advantages of Generative AI. 19. Explain the limitations and risks of Generative AI. 20. What is responsible use of Generative AI? Why is it important?
9.	PSYCHOLOGY
	Easy Level 1. What is meant by individual differences in psychology? 2. Define intelligence. 3. What is an aptitude? 4. Differentiate between real self and ideal self? 5. What is meant by the self? 6. Define personality. 7. What is self-esteem? 8. What is stress? 9. What is meant by social influence? 10. Define conformity. Intermediate level 11. Explain any three types of intelligence tests used to assess intelligence. 12. Differentiate between self-concept and self-esteem with suitable examples. 13. Explain the Type A and Type B personalities. Which personality is more prone to stress? 14. What are projective techniques? Explain any one projective technique used for personality assessment. 15. Explain the difference between problem-focused coping and emotion-focused coping. 16. Riya performs exceptionally well in music and painting but finds mathematical calculations difficult. Her teacher believes that Riya cannot be called intelligent because her overall academic performance is average. a) Which psychological concept can explain Riya's different abilities? b) Name the theory of intelligence that supports the idea that a person can be intelligent in different areas. c) Do you agree with the teacher? Give a reason. 17. Explain the difference between compliance, obedience, and conformity with one example each. 18. What is prejudice? Explain any two sources of prejudice. 19. A student is preparing for board examinations. Whenever she feels stressed, she makes a study timetable, divides her syllabus into smaller tasks, and seeks help from her teachers. a) Identify the coping strategy being used. b) Explain why this strategy can be effective. c) Mention one more technique that may help her manage stress. 20. Explain social loafing and suggest two ways to reduce it in group activities. Hard level 21. Arjun believes that his success in examinations is completely due to his own hard work. However, when he fails, he believes that the questions were unfair and the teacher did not explain the topic properly. He rarely takes responsibility for his failures. a) Identify the possible locus of control reflected in his explanation of success and failure. b) How does locus of control influence behaviour and personality? c) What psychological bias or inconsistency can be observed in Arjun's thinking? 22. Critically explain Gardner's Theory of Multiple Intelligences. How is it different from the traditional view of intelligence? 23. Explain Jung's typology of personality. Compare introversion and extroversion with suitable examples. 24. During a group project, five students are given the responsibility of preparing a presentation. Initially, everyone is enthusiastic. However, as the deadline approaches, two students stop contributing because they believe that other group members will complete the work. a) Identify the group process shown in this case. b) Explain the psychological reasons behind this behaviour. c) Suggest three strategies the teacher can use to reduce this problem.

- | |
|--|
| <p>25. Explain the General Adaptation Syndrome (GAS) proposed by Hans Selye. Describe all its stages.</p> <p>26. Discuss the relationship between stress, coping, and psychological well-being.</p> <p>27. Meera receives negative comments about her appearance from some classmates. Gradually, she starts believing that she is inferior to others. She avoids participating in activities and becomes highly dependent on others' opinions before making decisions.</p> <p>a) Which aspects of the self are being negatively affected?</p> <p>b) Explain how social feedback can influence self-concept and self-esteem.</p> <p>c) Suggest psychological strategies that can help develop a healthier self-concept.</p> <p>28. Explain group polarisation with an example. How is it different from groupthink?</p> <p>29. Discuss the formation and reduction of prejudice. Explain any four strategies that can help reduce prejudice in society.</p> <p>30. "Personality is influenced by both internal psychological processes and the social environment." Discuss this statement using relevant personality theories and examples.</p> |
|--|