24 Chapter-wise BITSAT

SOLVED PAPERS 2025 - 2005

WITH

English and Logical Reasoning Preparation Notes

SUBJECTS

- PHYSICS
- CHEMISTRY
- MATHEMATICS
- ENGLISH PROFICIENCY
- LOGICAL REASONING

Features:

- Contains 3000+ Questions of Past 21 Years (2025 to 2005)
- Includes Solved Papers of 2023, 2024 and 2025 Session I & Session II
- Detailed Solutions

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**This chapter is not in the latest BITSAT syllabus but questions have appeared in previous exams.*

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SCAN ME FOR DETAILED BITSAT SYLLABUS

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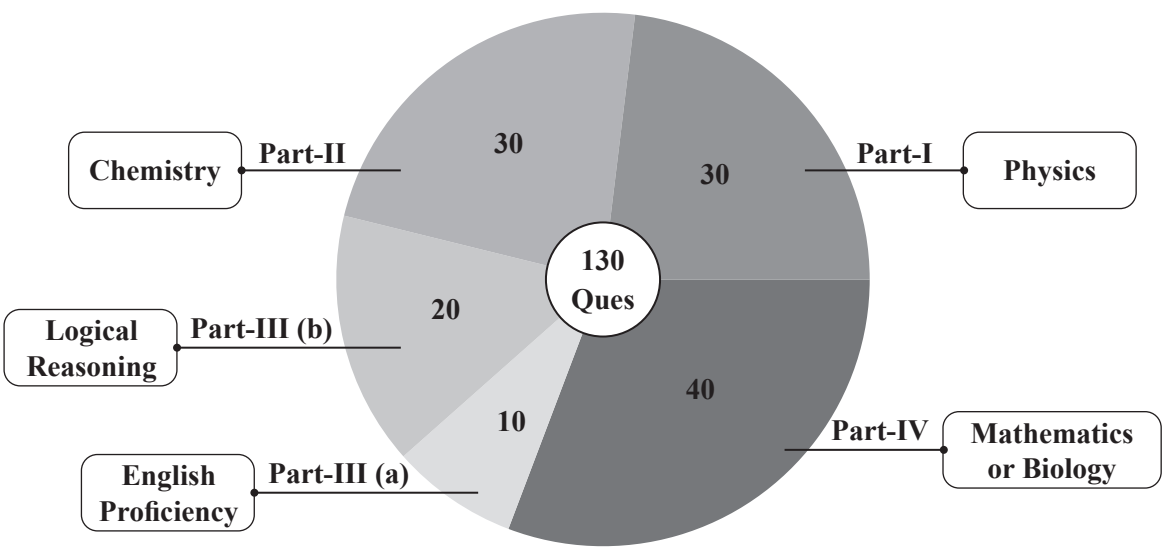
BITSAT is an online computer-based test (CBT), conducted by BITS Pilani for admission to the Integrated First Degree programs in engineering, sciences, and other courses at its campuses in Pilani, Goa, and Hyderabad. The BITSAT test is based on **NCERT syllabus** for the 11th and 12th class.

BITSAT EXAM PATTERN

Particulars	Details
Examination Name	BITSAT
Examination Mode	Computer Based Test (CBT)
Medium of Examination	English
Parts	**Part I :** Physics **Part II :** Chemistry **Part III :** (a) English Proficiency and (b) Logical Reasoning **Part IV :** Mathematics or Biology (For B. Pharm. candidates)
Type of Questions	Multiple Choice Questions (Objective Type)
Total Questions	130 Questions
Marking Scheme	❑ Correct Answer: +3 marks ❑ Incorrect Answer: –1 mark ❑ Unattempted Questions: 0 marks
Exam Duration	180 minutes (without break)

PART-WISE QUESTIONS DISTRIBUTION



Chapter

1

Class-XI

UNITS AND MEASUREMENTS

1. The dimensions of 'resistance' are same as those of _____ where h is the Planck's constant, e is the charge. *[2024, II]*

(*a*) $\frac{h^2}{e^2}$ (*b*) $\frac{h^2}{e}$

(*c*) $\frac{h}{e^2}$ (*d*) $\frac{h}{e}$

2. Which one of the following is NOT correct? *[2024, II]*

(*a*) Dimensional formula of thermal conductivity (K) is $[M^1L^1T^{-3}K^{-1}]$

(*b*) Dimensional formula of potential (V) is $[M^1L^2T^{-3}A^{-1}]$

(*c*) Dimensional formula of permeability of free space (μ_0) is $[M^1L^1T^{-2}A^{-2}]$

(*d*) Dimensional formula of RC is $[M^0L^0T^{-1}]$

3. The ratio of the dimensions of Planck's constant and that of moment of inertia has the dimensions of *[2024, I]*

(*a*) frequency (*b*) velocity

(*c*) time (*d*) angular momentum

4. If A = (1.0 ± 0.2) m and B = (2.0 ± 0.2) m , then $\sqrt{AB}$ is: *[2023,II]*

(*a*) 1.4 m ± 0.4 m (*b*) 1.41 m ± 0.15 m

(*c*) 1.4 m ± 0.3 m (*d*) 1.4 m ± 0.2 m

5. The frequency (v) of an oscillating liquid drop is determined by its radius (r) of the drop, density (ρ) of liquid and the surface tension (s) of the liquid as :

$v = r^a \rho^b s^c$. The values of a, b and c respectvely are *[2023,II]*

(*a*) $\left(-\frac{3}{2},\frac{1}{2},\frac{1}{2}\right)$ (*b*) $\left(\frac{3}{2},-\frac{1}{2},\frac{3}{2}\right)$

(*c*) $\left(\frac{3}{2},\frac{1}{2},-\frac{1}{2}\right)$ (*d*) $\left(-\frac{3}{2},-\frac{1}{2},\frac{1}{2}\right)$

6. If C be the capacitance and V be the electric potential, then the dimensional formula of CV^2 is *[2022]*

(*a*) $[M^1L^2T^{-2}A^0]$ (*b*) $[M^1L^1T^{-2}A^{-1}]$

(*c*) $[M^0L^1T^{-2}A^0]$ (*d*) $[M^1L^{-3}T^1A^{-1}]$

7. If force (F), length (L) and time (T) are taken as fundamental units, then the dimensional formula of the mass will be *[2021]*

(*a*) $[FL^{-1}T^2]$ (*b*) $[FL^{-1}T^{-1}]$

(*c*) $[FL^{-1}T^{-2}]$ (*d*) $[FL^2T^2]$

8. The percentage error in the measurement of mass and speed are 2% and 3% respectively. The error in the estimation of kinetic energy obtained by measuring mass and speed will be: *[2020]*

(*a*) 12% (*b*) 10%

(*c*) 2% (*d*) 8%

9. Number of significant figures in expression $\frac{4.327\text{g}}{2.51\text{cm}^3}$ is *[2019]*

(*a*) 5 (*b*) 7

(*c*) 3 (*d*) 2

10. If P, Q and R are physical quantities having different dimensions, which of the following combinations can never be a meaningful quantity? *[2018]*

(*a*) $\frac{PQ}{R}$ (*b*) $\frac{P-Q}{R}$

(*c*) $\frac{PR-Q^2}{R}$ (*d*) $PQ - R$

11. In the formula $X = 3\ YZ^2$, where X and Z have dimensions of capacitance and magnetic induction respectively. Determine the dimensional formula of Y in MKS system. *[2017]*

(*a*) $[M^{-3}\ L^{-2}\ T^{-2}A^{-4}]$ (*b*) $[ML^{-2}]$

(*c*) $[M^{-3}L^{-2}A^4T^8]$ (*d*) $[M^{-3}L^2\ A^4T^4]$

12. In the following dimensionally correct equations, we have $F = \frac{X}{\text{Linear density}} + Y$, where F = force. The dimensional formula of X are Y are: *[2016]*

(*a*) $[M\ L\ T^{-2}]$, $[M^2\ L^0\ T^{-2}]$

(*b*) $[M^2\ L^0\ T^{-2}]$, $[M\ L\ T^{-2}]$

(*c*) $[M\ L^2\ T^{-4}]$, $[M^2\ L^{-2}\ T^{-2}]$

(*d*) $[M\ L\ T^{-2}]$, $[M^2\ L^0\ T^{-2}]$

13. For the equation $F = A^a v^b d^c$, where F represents the force, A represents the area, v represents velocity and d represents the density, the values of a, b and c are respectively *[2014]*

(*a*) 1, 2, 1 (*b*) 1, 1, 2

(*c*) 2, 1, 1 (*d*) 0, 1, 2

14. The respective number of significant figure for the number 23.023, 0.0003 and 2.1×10^{-3} are: *[2014]*

(*a*) 5, 1, 2 (*b*) 5, 1, 5

(*c*) 5, 5, 2 (*d*) 4, 4, 2

15. The unit of specific resistance is *[2013]*

(*a*) *ohm/m* (*b*) *ohm* m^2

(*c*) *ohm m* (*d*) *ohm*/m^2

16. If E, m, L and G denote energy, mass, angular momentum and gravitational constant respectively, the quantity $\left(\frac{EL^2}{m^5G^2}\right)$ has the dimensions of: *[2013]*

(*a*) Mass (*b*) Length

(*c*) Time (*d*) Angle

17. For the equation $F = at + bt^2$, where F represents force and t is time. Determine the dimensions of a and b. *[2012]*

(*a*) $[ML^2T^{-3}$ and $[ML^3T^{-4}]$

(*b*) $[MLT^{-3}]$ and $[MLT^{-4}]$

(*c*) $[ML^2T^{-3}]$ and $[ML^2T^{-1}]$

(*d*) $[MLT^{-4}]$ and $[MLT^{-2}]$

18. The dimensional formula of physical quantity is $M^aL^bT^c$. Then that physical quantity is *[2011]*

(*a*) surface tension if $a = 1, b = 1, c = -2$

(*b*) force if $a = 1, b = 1, c = 2$

(*c*) angular frequency if $a = 0, b = 0, c = -1$

(*d*) spring constant if $a = 1, b = -1, c = -2$

19. If P represents radiation pressure, c represents speed of light and Q represents radiation energy incident on a unit area per second, the non-zero integers x,y and z such that $P^xQ^yc^z$ is dimensionless are. *[2010]*

(*a*) $x = 1, y = 1, z = 1$

(*b*) $x = 1, y = -1, z = 1$

(*c*) $x = -1, y = -1, z = -1$

(*d*) $x = 1, y = 1, z = -1$

20. By what percentage should the pressure of a given mass of gas be increased so as the decrease in its volume is 10% at a constant temperature? *[2010]*

(*a*) 5 % (*b*) 7.2 %

(*c*) 12.5 % (*d*) 11.1 %

21. In the equation: $P = \frac{\alpha}{\beta}e^{-\frac{\alpha Z}{k\theta}}$

P is pressure, Z is distance, k is Boltzmann constant and is θ the temperature. The dimensional formula of β will be *[2009]*

(*a*) $[M^0L^2T^0]$ (*b*) $[M^1L^2T^1]$

(*c*) $[M^1L^0T^{-1}]$ (*d*) $[M^0L^2T^0]$

22. $S_t = u + \frac{1}{2}a(2t-1)$ is: *[2009]*

(*a*) Only numerically correct

(*b*) Only dimensionally correct

(*c*) Both numerically and dimensionally correct

(*d*) Neither numerically nor dimensionally correct

23. The dimensional formula for strain is same as that of *[2008]*

(*a*) modulus of elasticity (*b*) angle

(*c*) thrust (*d*) pressure

24. The dimensional formula for impulse is *[2008]*

(*a*) $[MLT^{-1}]$ (*b*) $[ML^{-1}T]$

(*c*) $[M^{-1}LT^{-1}]$ (*d*) $[ML^{-1}T^{-1}]$

25. Calculate the value of $\frac{1.53 \times 0.9995}{1.592}$ with due regard for significant figers. [*2007*]

(*a*) 0.961 (*b*) 0.921 (*c*) 0.123 (*d*) 0.913

26. The number of significant figures in the numbers 4.8000×10^4 and and 48000.50 are respectively *[2006]*

(*a*) 5 and 6 (*b*) 5 and 7

(*c*) 2 and 7 (*d*) 2 and 6

27. Identify which of the following group have quantities with different dimension? [*2005*]

(*a*) Potential difference, *EMF*, voltage

(*b*) Heat, energy, work done

(*c*) Pressure, stress, Young's modulus

(*d*) Dipole moment, electric flux, electric field

28. The physical quantity which is measured in the unit of Wb A^{-1} is *[2005]*

(*a*) Self inductance (*b*) Mutual inductance

(*c*) Magnetic flux (*d*) Both (*a*) and (*b*)

Answer Key

1. (*c*)	**2.** (*d*)	**3.** (*a*)	**4.** (*d*)	**5.** (*d*)	**6.** (*a*)	**7.** (*a*)	**8.** (*d*)	**9.** (*c*)	**10.** (*b*)
11. (*c*)	**12.** (*b*)	**13.** (*a*)	**14.** (*a*)	**15.** (*c*)	**16.** (*d*)	**17.** (*b*)	**18.** (*c*)	**19.** (*b*)	**20.** (*d*)
21. (*a*)	**22.** (*c*)	**23.** (*b*)	**24.** (*a*)	**25.** (*a*)	**26.** (*b*)	**27.** (*d*)	**28.** (*d*)		

Explanations

1. (*c*) $R = \frac{V}{I}$

$[R] = \frac{[ML^2T^{-2}A^{-1}]}{[A]} = [ML^2T^{-3}A^{-2}]$

also $\left[\frac{h}{e^2}\right] = \frac{[ML^2T^{-1}]}{[AT]^2} = [ML^2T^{-3}A^{-2}]$

2. (*d*) RC is the time constant of RC circuit.

$[RC] = [M^0L^0T^1]$

3. (*a*) As Planck's constant (h) = $\frac{\text{energy}}{\text{frequency}}$

$[h] = \frac{[ML^2T^{-2}]}{[ML^0T^{-1}]} = [ML^2T^{-1}]$

and $[I] = [M][L^2] = [ML^2T^0]$

$\therefore = \frac{[ML^2T^{-1}]}{[ML^2T^0]} = [T^{-1}] = [\text{frequency}]$

4. (*d*) $x = \sqrt{AB} = \sqrt{1.0 \times 2.0} = 1.414$ m

Rounding off x = 1.4 m

$\frac{\Delta x}{x} = \frac{1}{2}\left(\frac{\Delta A}{A} + \frac{\Delta B}{B}\right) = \frac{1}{2}\left(\frac{0.2}{1.0} + \frac{0.2}{2.0}\right)$m

(in rounded figure)

$\Delta x = x\left(\frac{1}{2}\right)(0.3)$

$\Delta x = \frac{1.4 \times 0.3}{2} = 0.21$

$\therefore \sqrt{AB} = (1.4 \pm 0.2)$ m $\Delta x = 0.2$ (after one decimal)

Therefore, option (*d*) is the correct answer.

5. (*d*) $v = r^a\rho^b s^c$

$[M^0L^0T^{-1}] = [L^a][ML^{-3}]^b\,[MT^{-2}]^c$

Therefore, $b + c = 0$ ...(i)

$a - 3b = 0$ ...(ii)

$-2c = -1$ ...(iii)

Solving (i), (ii) and (iii), we get

$a = -3/2$, $b = -1/2$ and $c = 1/2$

6. (*a*) Energy stored in a capacitor is given by

$U = \frac{1}{2}CV^2$

$\therefore [CV^2] = [U] = [M^1L^2T^{-2}A^0]$

7. (*a*) [Force] = $[MLT^{-2}]$

$\Rightarrow [F] = [M]\,[L]\,[T^{-2}]$

$\Rightarrow [M] = [FL^{-1}T^{-2}]$

8. (*d*) $K = \frac{1}{2}mv^2$

$\frac{\Delta K}{K} \times 100 = \frac{\Delta m}{m} \times 100 + \frac{2\Delta v}{v} \times 100$

$\frac{\Delta K}{K} \times 100 = 2\% + 2 \times 3\% = 8\%$

9. (*c*) When performing multiplication or division, the final result should retain the same number of significant figures as the number in the calculation that has the fewest significant figures. This ensures that the precision of the result matches the precision of the least precise measurement.

10. (*b*) Substraction cannot be operated between physical quantities of different dimensions.

11. (*c*) $X = 3YZ^2$

$[M^{-1}L^4TA^2] = [Y]\,[M^1L^0T^{-2}A^{-1}]^2$

$[Y] = [M^{-3}L^{-2}T^8A^4]$

12. (*b*) $[F] = \left[\frac{X}{L.D}\right] + [Y]$

$\therefore [Y] = [F] = [MLT^{-2}]$

$\left[MLT^{-2}\right] = \left[\frac{X}{ML^{-1}}\right] \Rightarrow X = \left[M^2L^0T^{-2}\right]$

13. (*a*) $F = A^a v^b d^c$

$[MLT^{-2}] = [L^2]^a\,[LT^{-1}]^b\,[ML^{-3}]^c$

$[MLT^{-2}] = [M^c]\,[L^{2a+b-3c}][T^{-b}]$

$\Rightarrow a = 1, b = 2, c = 1$

14. (*a*) $23.023 \rightarrow 5$, $0.0003 = 1$, $2.1 \times 10^{-3} = 2$

15. (*c*) $R = \rho\frac{l}{A}$ $\rho = \frac{RA}{l}$

if all quantities are expressed in SI units then

unit of $\rho = \frac{Ohm\ m^2}{m}$

unit of $\rho = Ohm\ m$

16. (*d*) $\left(\frac{EL^2}{m^5G^2}\right) = \frac{[M^1L^2T^{-2}][ML^2T^{-1}]^2}{[M^5][M^{-2}L^6T^{-4}]}$

$= \frac{\left[M^3L^6T^{-4}\right]}{\left[M^3L^6T^{-4}\right]} = \left[M^0L^0T^0\right]$

= Dimensionless

17. (*b*) $[F] = [at] = [bt^2]$

18. (*c*) Angular frequency (ω)= $2\pi \times$ Frequency

$= [T^{-1}] = [M^0L^0T^{-1}]$

$\therefore a = 0, b = 0, c = -1$

19. (*b*)

- P is radiatoin pressure with dimensions $[P] = [M\,L^{-1}\,T{-}2]$,
- c is speed of ligth with dimensions $[c] = [L\,T^{-1}]$,
- Q is radiatoin energy striking a unit area per second with dimensions $[Q] = [M\,L^0\,T^{-3}]$.

Set up the dimensional equation:

$[M\,L^{-1}\,T^{-2}]^x\,[M\,L^0\,T^{-3}]^y\,[L\,T^{-1}]^z = [M^0\,L^0\,T^0]$

1. For M: $x + y = 0$
2. For L: $-x + z = 0$
3. For T: $-2x - 3y - z = 0$

Using $x = 1$, $y = -1$, and $z = 1$, all equations are satisfied.

20. (*d*) PV = constant

$P'\left(V - \frac{10V}{100}\right) = PV$

$P'\left(\frac{100V - 10V}{100}\right) = PV$

$P'\left(\frac{90V}{100}\right) = PV \rightarrow P' = \frac{10}{9}P$

Percentage increase in pressure

$= \left(\frac{P^1 - P}{P}\right) \times 100\%$

$= \left(\frac{10}{9}P - P\right) \times 100\%$

P = 11.1 %

21. (*a*)

22. (*c*) Displacement in t^{th} second = Displacement in t sec – Displacement in $(t-1)$ sec

$= \left(ut + \frac{1}{2}at^2\right) - \left[u(t-1) + \frac{1}{2}a(t-1)^2\right]$

$= ut + \frac{1}{2}at^2 - ut + u(1) - \frac{1}{2}a\left[t^2 - 2t(1) + (1)^2\right]$

$= ut + \frac{1}{2}at^2 - ut + u(1) - \frac{1}{2}at^2 + at(1) - \frac{a}{2}(1)^2$

$= u(1) + at(1) - \frac{a}{2}(1)^2$

$= u(1) + \frac{a}{2}(1)\,(2t - (1))$

This (*a*) also have dimension of time

$u(t) = LT^{-1} \times T = L$

$= \frac{a}{2}(1)\,(2t - a) = LT^{-2} \times T \times T = L$

23. (*b*) Strain is dimensionless.

Chapter

1

Class-XI

SOME BASIC CONCEPTS OF CHEMISTRY

1. 1 molal concentration of a solution represents: *[2024, II]*

(*a*) 1 mole of solute in 1 L of solution.

(*b*) 1 mole of solute in 1 kg of solvent

(*c*) 1 mole of solvent in 1 L of solution.

(*d*) 1 mole of solvent in 1 kg of solution.

2. Which of the following concentration term is dependent on the temperature? *[2024, I]*

(*a*) Molality (*b*) Molarity

(*c*) Mole fraction (*d*) None of the above

3. H_2 evolved at STP on complete reaction of 27 g of aluminium with excess of aqueous NaOH would be: *[2022]*

$$Al + H_2O + NaOH \rightarrow NaAlO_2 + \frac{3}{2}H_2$$

(*a*) 22.4 litres (*b*) 44.8 litres

(*c*) 67.2 litres (*d*) 33.6 litres

4. Ethane (C_2H_6) and ethene (C_2H_4), an ideal gaseous mixture occupies 28 litre at 273 K and 1 atm. The mixture reacts wholly with 128 g O_2 to produce H_2O and CO_2. Calculate the mole fraction of C_2H_6 in the mixture. *[2020]*

(*a*) 0.5 (*b*) 0.4

(*c*) 0.8 (*d*) 1.0

5. Dalton's law of partial pressures is applicable to which one of the following systems? *[2019]*

(*a*) $NH_3 + HCl$ (*b*) $NO + O_2$

(*c*) $H_2 + Cl_2$ (*d*) $CO + H_2$

6. If m_A gram of metal A displaces m_B gram of another metal *B* from its salt solution and if E_A and E_B are the equivalent mass respectively, then calculate equivalent mass of A. *[2019]*

(*a*) $E_A = \frac{m_A}{m_B} \times E_B$ (*b*) $E_A = \frac{m_A \times m_B}{E_B}$

(*c*) $E_A = \left(\frac{m_A}{m_B} \times E_B\right)^{1/2}$ (*d*) $E_A = \frac{m_B}{m_A} \times E_B$

7. 25 cm^3 of oxalic acid completely neutralised 0.064 g of sodium hydroxide. Molarity of the oxalic acid solution is *[2018]*

(*a*) 0.064 (*b*) 0.045

(*c*) 0.015 (*d*) 0.032

8. 100 ml H_2 and O_2 kept at same pressure and temperature. Identify the true expression about their number of molecules. *[2018]*

(*a*) $N_{O_2} > N_{H_2}$ (*b*) $N_{O_2} < N_{H_2}$

(*c*) $N_{O_2} = N_{H_2}$ (*d*) $N_{O_2} + N_{H_2} = 1\,\text{mole}$

9. An aqueous solution containing 6.5 g of NaCl of 90% purity was subjected to electrolysis. After the complete electrolysis, the solution was evaporated to get solid NaOH. The volume of 1 M acetic acid required to neutralise NaOH obtained above is *[2017]*

(*a*) 2000 cm^3 (*b*) 100 cm^3

(*c*) 200 cm^3 (*d*) 1000 cm^3

10. 4g of Cu was dissolved in conc. HNO_3. The $Cu(NO_3)_2$ thus obtained gave 5g of its oxide on strong heating. Calculate the equivalent weight of Cu. *[2017]*

(*a*) 21 (*b*) 32

(*c*) 10 (*d*) 20

11. Molarity of a given orthophosphoric acid solution is 3 M. Its normality is *[2016]*

(*a*) 9 N (*b*) 0.3 N

(*c*) 3 N (*d*) 1 N

12. The 1.25 g sample of Na_2SO_4 and Na_2CO_3 is dissolved in 250 mL solution. 25 mL of this solution neutralises 20 mL of 0.1 N H_2SO_4. Calculate % of Na_2CO_3 in this sample. *[2016]*

(*a*) 84.8% (*b*) 42.4%

(*c*) 75.2% (*d*) 8.48%

13. The simplest formula of a compound containing 50% of element X (atomic mass 10) and 50% of element *Y* (atomic mass 20) is: *[2016]*

(*a*) XY (*b*) X_2Y

(*c*) XY_3 (*d*) X_2Y_3

14. Provide the prefix of 10^{18}. *[2015, 2006]*

(*a*) giga (*b*) kilo

(*c*) exa (*d*) nano

15. Hydrogen and oxygen combine to form H_2O_2 and H_2O containing 5.93% and 11.2% hydrogen respectively, the data illustrates: *[2014]*

(*a*) Law of conservation of mass

(*b*) Law of Constant proportions

(*c*) Law of reciprocal proportions

(*d*) Law of multiple proportions

16. Hb contains 0.33% of Fe by weight. The molecular weight of Hb is approximately 67200 g. Calculate the number of Fe atoms (At. wt. of Fe = 56) present in one molecule of Hb. *[2013]*

(*a*) 4 (*b*) 6

(*c*) 2 (*d*) 5

17. What is the molarity of NaOH solution if 250 mL of it contains 1 mg of NaOH? *[2013]*

(*a*) 10^{-1} M (*b*) 10^{-2} M

(*c*) 10^{-4} M (*d*) 10^{-3} M

18. Calculate the number of atoms of He (Helium) in 100 amu of He (Helium) (atomic wt. of He is 4). *[2012]*

(*a*) 25 (*b*) 10

(*c*) 12 (*d*) $10 \times 6 \times 10^{-23}$

19. If the product of specific heat and atomic weight is constant and is approximately 6.4. What is it called? *[2011]*

(*a*) Avogadro's law (*b*) Dalton's law

(*c*) Dulong Pettit law (*d*) Newto's law

20. 0.995g of oxide is produced when 1.520 g of hydroxide of a metal gets ignited. Calculate the equivalent weight of metal. *[2011]*

(*a*) 190 (*b*) 0.995

(*c*) 1.52 (*d*) 9

21. Find the vapour density of N_2O_5. *[2010]*

(*a*) 44 (*b*) 54

(*c*) 63 (*d*) 69

22. 1 g-eq of reducing agent requires P gm-eq. of oxidising agent. Find the value of P. *[2010]*

(*a*) 1 (*b*) Depends on reaction

(*c*) 3 (*d*) 2

23. Which of the following have same number of significant figures? *[2009]*

A. 0.00253 B. 1.0003

C. 15.0 D. 163

Choose the correct answer from the options given below

(*a*) A, B and C only (*b*) C and D only

(*c*) A, C and D only (*d*) B and C only

24. Which of the following number have all zeros as significant? *[2008]*

(*a*) 0.0005 (*b*) 0.0050

(*c*) 50.000 (*d*) 0.0500

25. The total number of protons in 10 *g* of calcium carbonate is: ($N_A = 6.022 \times 10^{23}$) *[2008]*

(*a*) 1.5057×10^{24} (*b*) 2.0478×10^{24}

(*c*) 3.0115×10^{24} (*d*) 4.0956×10^{24}

26. When 30 litre of N_2 and 30 litres of H_2 are reacted, then ammonia is formed and the yield is only 50%. Find the composition of the gaseous mixture. *[2007]*

(*a*) 5L of N_2, 5L of H_2 and 5 L of NH_3.

(*b*) 10L of N_2, 15L of H_2 and 5 L of NH_3.

(*c*) 5L of N_2, 10 L of H_2 and 10L of NH_3.

(*d*) 5L of N_2, 15L of H_2 and 10L of NH_3.

27. The equivalent mass of a certain bivalent metal is 20. The molecular mass of its anhydrous chloride is *[2007]*

(*a*) 91 (*b*) 111

(*c*) 55.5 (*d*) 75.5

28. If the formula of the gas is found to be $[CO]_x$ and it's vapour density is 70, then find x. *[2006]*

(*a*) 4.0 (*b*) 3.0

(*c*) 5.0 (*d*) 6.0

29. How much Cl_2 at STP is liberated when 1 mole $KMnO_4$ reacts with HCl? *[2006]*

(*a*) 11.2 L (*b*) 22.4 L (*c*) 44.8 L (*d*) 56 L

30. Calculate the no. of Na atoms in 2 moles of sodium ferrocyanide. *[2005]*

(*a*) 34×10^{23} (*b*) 26×10^{23}

(*c*) 42×10^{23} (*d*) 48×10^{23}

Answer Key

1. (*b*)	**2.** (*b*)	**3.** (*d*)	**4.** (*b*)	**5.** (*d*)	**6.** (*a*)	**7.** (*d*)	**8.** (*c*)	**9.** (*b*)	**10.** (*b*)
11. (*a*)	**12.** (*a*)	**13.** (*b*)	**14.** (*c*)	**15.** (*d*)	**16.** (*a*)	**17.** (*c*)	**18.** (*a*)	**19.** (*c*)	**20.** (*d*)
21. (*b*)	**22.** (*a*)	**23.** (*c*)	**24.** (*c*)	**25.** (*c*)	**26.** (*d*)	**27.** (*b*)	**28.** (*c*)	**29.** (*d*)	**30.** (*d*)

Explanations

1. (*b*) 1 molal concentration of a solution represents 1 mole of solute in 1 kg of solvent.

2. (*b*) Molarity involves the volume term, which is affected by changes in temperature, hence it is the temperature dependent concentration term.

3. (*d*) $\underset{27gm}{Al} + H_2O + NaOH \rightarrow NaAlO_2 + \frac{3}{2}H_2$

$\frac{3}{2} \times 22.4 = 33.6L$

4. (*b*) The combustion reactions of ethane and ethene are repectively:

$C_2H_6 + 3.5\ O_2 \longrightarrow 2CO_2 + 3H_2O$;

$C_2H_4 + 3O_2 \longrightarrow 2CO_2 + 2H_2O$

Let the volume of ethane (C_2H_6) is x litre,

$22.4 \times 4 = 3.5x + 3(28 - x)$

$\Rightarrow x = 11.2$ litre

At constant P and T, $V \propto n$;

Hence, Mole fraction of C_2H_6 (ethane) in mixture $= \frac{11.2}{28} = 0.4$

5. (*d*) Among the given options, $CO + H_2$ are non-reacting gases, as a result, Dalton's law will be applicable to this system.

6. (*a*) Equivalent mass of A = Equivalent mass of B

$\Rightarrow \frac{m_A}{E_A} = \frac{m_B}{E_B}$

On solving,

$E_A = \frac{m_A}{m_B} \times E_B$

7. (*d*) The reaction between oxalic acid and NaOH is:

$\underset{1\ mole}{(COOH)_2} + \underset{2\ moles}{2NaOH} \rightarrow (COONa)_2 + 2H_2O$

Moles of NaOH = Mass/molar mass

$= \frac{0.064}{40} = 0.0016$

According to the above reaction,

1 mol of Oxalic acid= 2 moles of NaOH

So, number of moles of oxalic acid

$= \frac{0.0016}{2} = 8 \times 10^{-4}$

Volume of solution (in L) $= \frac{25}{1000}$

$\text{Molarity} = \frac{\text{Moles of solute}}{\text{volume of solution in L}}$

$= 8 \times 10^{-4} \times \frac{1000}{25}$

$= 0.032$ M

8. (*c*) According to (Avogardro's hypothesis), equal volume of all gases contains equal number of molecules under similar condition of T and P.

9. (*b*) Weight of NaCl having 90% purity

$= 6.5 \times \frac{90}{100} = 5.85$ g

Number of equivalents of NaCl

$= \frac{\text{wt. of NaCl}}{\text{mol. mass of NaCl}} = \frac{5.85}{58.5} = 0.1$

Number of equivalent of NaOH obtained = 0.1

Apply Normality equation: $N_1V_1 = N_2V_2$

In terms of acid and base,

$\therefore N_{NaOH} \times V_{NaOH}$

$= N_{CH_3COOH} \times V_{CH_3COOH}$

$\Rightarrow 0.1 \times 1000 = 1 \times V_{CH_3COOH}$

On solving, $V_{CH_3COOH} = 100\ cm^3$

10. (*b*) Molar mass of CuO = 63.5 + 16=79.5 g/mol

Moles of CuO = 5/79.5 ≈ 0.0629 mol.

From the reaction stoichiometry, 1 mole of CuO is formed from 1 mole of Cu.

Thus, moles of Cu used = moles of CuO

Moles of Cu = 0.0629 mol

The equivalent weight of Cu = (4/0.0629) /2 = 63.6 /2 = 32

11. (*a*) Molarity of H_3PO_4 = 3 M

It contains three replaceable H^+ ions, so, basicity of H_3PO_4 = 3

$\therefore$ Normality of H_3PO_4 = Molarity × basicity

= 3 M × 3 = 9 N

12. (*a*) Let x g amount of Na_2CO_3 be present in the mixture. Na_2SO_4 will not react with H_2SO_4. Then

$\frac{x}{53} = \frac{20 \times 0.1 \times 10}{1000}$

$\therefore x = 1.06$ g

$\therefore$ % of Na_2CO_3

$= \frac{1.06 \times 100}{1.25} = 84.8\%$

13. (*b*)

Element	%	At.wt.	Mole	Ratio
X	50	10	5	2
Y	50	20	2.5	1
Simplest formula = X_2Y				

14. (*c*) 10^{18} = exa

15. (*d*)

H_2O_2	H_2O
H : O	H : O
5.93 : 94.07	11.2 : 88.8
	or 5.93 : 47.0

Ratio of different masses of O which combines with fixed mass of H is 94.07 : 47.0 or 2 : 1 This illustrates law of multiple proportions.

16. (*a*) ∵ 100 g Haemoglobin contains

= 0.33 g Fe

$\therefore$ 67200 g Haemoglobin

$= \frac{67200 \times 0.33}{100}$ g Fe

g-atom of Fe $= \frac{672 \times 0.33}{56} = 4$

17. (*c*) Number of moles of NaOH

$= \frac{\text{given mass of NaOH}}{\text{molar mass}} = \frac{10^{-3}}{40}$

Molarity

$= \frac{\text{number of moles of solute}}{\text{volume of solution in mL}} \times 1000$

$\text{Molarity} = \frac{\frac{10^{-3}}{40} \times 1000}{250} = 10^{-4}\ M$

18. (*a*) 1 a.m.u. = mass of one proton (approx imately).

100 amu of He $= \frac{100}{4}$ atoms of He = 25 atoms of He.

Chapter

3

TRIGONOMETRIC FUNCTIONS

1. What is $\cos 20° + \cos 100° + \cos 140°$ equal to? *[2024, I]*

(*a*) 2 (*b*) 1

(*c*) 1/2 (*d*) 0

2. If $f(\theta) = \sin^4\theta + \cos^2\theta$, then range of $f(\theta)$ is *[2024, I]*

(*a*) $\left[\frac{1}{2}, 1\right]$ (*b*) $\left[\frac{1}{2}, \frac{3}{4}\right]$

(*c*) $\left[\frac{3}{4}, 1\right]$ (*d*) None of these

3. Find general value of θ when $\tan\theta = \tan\alpha$ *[2023, II]*

(*a*) $n\pi - \alpha$ (*b*) $n\pi + \alpha$

(*c*) $\frac{n\pi}{2} + \alpha$ (*d*) All of the above

4. If $\sec^2\theta = \frac{4}{3}$, then the general value of θ is *[2023, I]*

(*a*) $2n\pi \pm \frac{\pi}{6}$ (*b*) $n\pi \pm \frac{\pi}{6}$

(*c*) $2n\pi \pm \frac{\pi}{3}$ (*d*) $n\pi \pm \frac{\pi}{3}$

5. The trigonometric function $y = \tan x$ in the II quadrant *[2022]*

(*a*) decreases from 0 to ∞

(*b*) increases from 0 to ∞

(*c*) decreases from $-\infty$ to 0

(*d*) increases from $-\infty$ to 0

6. If $A + B + C = \frac{\pi}{2}$ then *[2021]*

(*a*) $\tan A \tan B + \tan B \tan C + \tan C \tan A = 1$

(*b*) $\cot A + \cot B + \cot C = \cot A \cot B \cot C$

(*c*) $\cos 2A + \cos 2B + \cos 2C = 1 + 4 \sin A \sin B \sin C$

(*d*) All three are correct

7. What is the value of $\frac{1+\sin A}{1-\sin A} - \frac{1-\sin A}{1+\sin A}$? *[2021]*

(*a*) $\sec A - \tan A$ (*b*) $2\sec A \cdot \tan A$

(*c*) $4\sec A \cdot \tan A$ (*d*) $4\,\text{cosec}\, A \cdot \cot A$

8. The equation
$\sin^4 x - (k+2)\sin^2 x - (k+3) = 0$
possesses a solution if *[2020]*

(*a*) $k > -3$ (*b*) $k < -2$

(*c*) $-3 \le k \le -2$ (*d*) k is any positive integer

9. The value of $\sin 1° + \sin 2° + \ldots + \sin 359°$ is equal to *[2016]*

(*a*) 0 (*b*) 1

(*c*) –1 (*d*) 180

10. Let $x + y = 3 - \cos 4\theta$ and $x - y = 4 \sin 2\theta$ then the greatest of xy is *[2020]*

(*a*) $\frac{3}{4}$ (*b*) 1

(*c*) $\frac{1}{2}$ (*d*) 2

11. If $\frac{(x+1)^2}{x^3+x} = \frac{A}{x} + \frac{Bx+C}{x^2+1}$, then $\sin^{-1} A + \tan^{-1} B + \sec^{-1} C =$ *[2020]*

(*a*) $\frac{\pi}{2}$ (*b*) $\frac{\pi}{6}$

(*c*) 0 (*d*) $\frac{5\pi}{6}$

12. What is $\frac{\cos\theta}{1-\tan\theta} + \frac{\sin\theta}{1-\cot\theta}$ equal to? *[2019]*

(*a*) $\sin\theta - \cos\theta$ (*b*) $\sin\theta + \cos\theta$

(*c*) $2\sin\theta$ (*d*) $2\cos\theta$

13. If $2\cos^2 x + 3\sin x - 3 = 0$, $0 \le x \le 180°$, then $x =$ *[2018]*

(*a*) 30°, 90°, 150° (*b*) 60°, 120°, 180°

(*c*) 0°, 30°, 150° (*d*) 45°, 90°, 135°

14. If $\frac{\sin(x+y)}{\sin(x-y)} = \frac{a+b}{a-b}$, then what is $\frac{\tan x}{\tan y}$ equal to? *[2018]*

(*a*) $\frac{b}{a}$ (*b*) $\frac{a}{b}$ (*c*) $a\,b$ (*d*) 1

15. Number of solutions of equation $\sin 9\theta = \sin\theta$ in the interval $[0, 2\pi]$ is *[2018]*

(*a*) 16 (*b*) 17

(*c*) 18 (*d*) 15

16. Consider the following statements

I. If ABC is an equilateral triangle, then
$3\tan(A+B)\tan C = 1$

II. If ABC is a triangle in which $A = 78°$, $B = 66°$, then
$\tan\left(\frac{A}{2} + C\right) < \tan A$.

34. If $y=\frac{2\sin\alpha}{1+\cos\alpha+\sin\alpha}$, then value of $\frac{1-\cos\alpha+\sin\alpha}{1+\sin\alpha}$ is *[2009]*

(*a*) $\frac{y}{3}$ (*b*) y

(*c*) $2y$ (*d*) $\frac{3}{2}y$

35. What is the value of $\frac{\sin\theta}{\text{cosec}\,\theta}+\frac{\cos\theta}{\sec\theta}$? *[2009]*

(*a*) 1 (*b*) 1/2

(*c*) 1/3 (*d*) 2

36. The general solution of $8\tan^2\frac{x}{2}=1+\sec x$ is *[2009]*

(*a*) $2n\pi\pm\cos^{-1}\left(\frac{-1}{3}\right)$ (*b*) $2n\pi\pm\frac{\pi}{6}$

(*c*) $2n\pi\pm\cos^{-1}\left(\frac{1}{3}\right)$ (*d*) None of these

37. Which of the following is the correct value of cot 10° . cot20° . cot 60° . cot 70° . cot 80°? *2008]*

(*a*) $\frac{1}{\sqrt{3}}$ (*b*) $\sqrt{3}$

(*c*) –1 (*d*) 1

38. The value of $\tan A+\tan(60°+A)-\tan(60°-A)$ is *[2008]*

(*a*) tan 3*A* (*b*) 2 tan 3*A*

(*c*) 3 tan 3*A* (*d*) None of these

39. Find general solution of $\tan x=\sqrt{3}$ *[2008]*

(*a*) $n\pi+\frac{\pi}{3}, n\in Z$ (*b*) $n\pi-\frac{\pi}{3}, n\in Z$

(*c*) $n\pi+\frac{\pi}{6}, n\in Z$ (*d*) $n\pi\pm\frac{\pi}{3}, n\in Z$

40. The number of solution of $\cos 2\theta=\sin\theta$ in $(0, 2\pi)$ is *[2007]*

(*a*) 1 (*b*) 2

(*c*) 3 (*d*) 4

41. The value of cot 70°+ 4 cos 70° is *[2007]*

(*a*) $\frac{1}{\sqrt{3}}$ (*b*) $\sqrt{3}$

(*c*) $2\sqrt{3}$ (*d*) $\frac{1}{2}$

42. If $\sin\theta+\text{cosec}\,\theta=2$, then $\sin^2\theta+\text{cosec}^2\theta$ is equal to *[2006]*

(*a*) 1 (*b*) 4

(*c*) 2 (*d*) None of these

43. Find the general solution of the equation $\cot x=-\sqrt{3}$? *[2006]*

(*a*) $n\pi+(\pi/6)$ where $n\in Z$.

(*b*) $n\pi+(5\pi/6)$ where $n\in Z$.

(*c*) $n\pi+(7\pi/6)$ where $n\in Z$.

(*d*) None of these

44. If $\sec\theta=1\frac{1}{4}$, then $\tan\frac{\theta}{2}=$ *[2005]*

(*a*) $\frac{1}{3}$ (*b*) $\frac{3}{4}$

(*c*) $\frac{1}{4}$ (*d*) $\frac{5}{4}$

45. If cosec *A* + cot *A* = $\frac{11}{2}$, then tan *A* is *[2005]*

(*a*) $\frac{21}{22}$ (*b*) $\frac{15}{16}$

(*c*) $\frac{44}{117}$ (*d*) $\frac{117}{43}$

46. If $\tan\theta=-\frac{1}{\sqrt{3}}$, then general solution of the equation is *[2005]*

(*a*) $2n\pi+\frac{\pi}{6}, n\in I$ (*b*) $n\pi+\frac{\pi}{6}, n\in I$

(*c*) $2n\pi-\frac{\pi}{6}, n\in I$ (*d*) $n\pi-\frac{\pi}{6}, n\in I$

Answer Key

1. (*d*)	**2.** (*c*)	**3.** (*b*)	**4.** (*b*)	**5.** (*d*)	**6.** (*d*)	**7.** (*c*)	**8.** (*c*)	**9.** (*a*)	**10.** (*b*)
11. (*d*)	**12.** (*b*)	**13.** (*a*)	**14.** (*b*)	**15.** (*b*)	**16.** (*b*)	**17.** (*b*)	**18.** (*c*)	**19.** (*b*)	**20.** (*b*)
21. (*d*)	**22.** (*a*)	**23.** (*d*)	**24.** (*a*)	**25.** (*b*)	**26.** (*a*)	**27.** (*c*)	**28.** (*b*)	**29.** (*d*)	**30.** (*c*)
31. (*d*)	**32.** (*c*)	**33.** (*d*)	**34.** (*b*)	**35.** (*a*)	**36.** (*c*)	**37.** (*a*)	**38.** (*c*)	**39.** (*a*)	**40.** (*c*)
41. (*b*)	**42.** (*c*)	**43.** (*b*)	**44.** (*a*)	**45.** (*c*)	**46.** (*d*)				

Explanations

1. (*d*) $\cos 20° + \cos 100° + \cos 140°$
$= (\cos 140° + \cos 20°) + \cos 100°$
$= 2 \cos 80°. \cos 60° + \cos 100°$
$= 2\cos 80° \cdot \frac{1}{2} + \cos 100°$
$= 2 \cos 90° . \cos 10° = 2 \times 0 \times \cos 10° = 0$

2. (*c*) $f(\theta) = \sin^4\theta + \cos^2\theta$
$= \sin^2\theta (1 - \cos^2\theta) + \cos^2\theta$
$= \sin^2\theta + \cos^2\theta - \sin^2\theta \cos^2\theta$
$f(\theta) = 1 - \frac{1}{4} \sin^2 2\theta \Rightarrow 0 \le \sin^2 2\theta \le 1$
$f(\theta)\max = 1$
$f(\theta)\min = 1 - \frac{1}{4} = 3/4$
$\therefore$ Range is $\left[\frac{3}{4}, 1\right]$.

3. (*b*) Given that, $\tan\theta = \tan\alpha \Rightarrow \theta = n\pi + \alpha$

4. (*b*) Given equation
$\sec^2\theta = \frac{4}{3} \Rightarrow \cos^2\theta = \frac{3}{4} \Rightarrow \cos^2\theta = \left(\frac{\sqrt{3}}{2}\right)^2$
$\Rightarrow \cos^2\theta = \cos^2\left(\frac{\pi}{6}\right) \Rightarrow \theta = n\pi \pm \frac{\pi}{6}$

5. (*d*) By graph of $y = \tan x$ in II quadrant, we obtained its increase from $-\infty$ to 0.

6. (*d*) $B + C = \frac{\pi}{2} - A \Rightarrow \tan(B + C) = \cot A$
$\Rightarrow \frac{\tan B + \tan C}{1 - \tan B \tan C} = \cot A$
$\Rightarrow \frac{\tan B + \tan C}{1 - \tan B \cdot \tan C} = \frac{1}{\tan A}$
$\Rightarrow \tan A \cdot \tan B + \tan C \tan A$
$= 1 - \tan B . \tan C$
$\Rightarrow \tan A \tan B + \tan B \tan C + \tan C \tan A = 1$
$\Rightarrow \frac{1}{\cot A}.\frac{1}{\cot B} + \frac{1}{\cot B}.\frac{1}{\cot C} + \frac{1}{\cot C}.\frac{1}{\cot A} = 1$
$\Rightarrow \frac{\cot C + \cot A + \cot B}{\cot A.\cot B.\cot C} = 1$
$\Rightarrow \cot A + \cot B + \cot C = \cot A. \cot B. \cot C$
Again $\cos 2A + \cos 2B + \cos 2C$
$= 2\cos(A + B) \cos(A - B) + \cos 2C$
$= 2\cos\left(\frac{\pi}{2} - C\right)\cos(A - B) + 1 - 2\sin^2 C$
$= 2 \sin C[\cos (A - B) - \sin C] + 1$
$= 2\sin C\left[\cos(A - B) - \sin\left\{\frac{\pi}{2} - (A + B)\right\}\right] + 1$
$= 2 \sin C [\cos(A - B) - \cos(A + B)] + 1$
$= 4 \sin A \sin B \sin C + 1$

7. (*c*) $\frac{1 + \sin A}{1 - \sin A} - \frac{1 - \sin A}{1 + \sin A}$
$= \frac{(1 + \sin A)^2 - (1 - \sin A)^2}{1 - \sin^2 A} = \frac{4 \sin A}{\cos^2 A}$
$= 4 \tan A \sec A$

8. (*c*) Given equation is
$\sin^4 x - (k + 2) \sin^2 x - (k + 3) = 0$
$\therefore \sin^2 x = \frac{(k + 2) \pm \sqrt{(k + 2)^2 + 4(k + 3)}}{2}$
$= \frac{(k + 2) \pm (k + 4)}{2}$
$\Rightarrow \sin^2 x = k + 3$
($\because \sin^2 x = -1$ is not possible)
Since $0 \le \sin^2 x \le 1$,
$\therefore 0 \le k + 3 \le 1$ or $-3 \le k \le -2$

9. (*a*) $\because \sin 1° + \sin 2° + ... + \sin 359°$
$= \sin 1° + \sin 2° + ...+ \sin 180° + ...$
$+ \sin(360° - 2°) + \sin (360° - 1°)$
$= \sin 1° + \sin 2° + ... + \sin 180° + ... - \sin 2°$
$- \sin 1° = 0$

10. (*b*) Given $x + y = 3 - \cos 4\theta$
and $x - y = 4 \sin 2\theta$
$x = \frac{3 - \cos 4\theta + 4 \sin 2\theta}{2}$
$= \frac{3 - (1 - 2\sin^2 2\theta) + 4 \sin 2\theta}{2}$
$= \frac{2 + 2\sin^2 2\theta + 4 \sin 2\theta}{2}$
$= (1 + \sin 2\theta)^2$
and $y = \frac{3 - \cos 4\theta - 4 \sin 2\theta}{2}$
$= \frac{3 - (1 - 2\sin^2 2\theta) - 4 \sin 2\theta}{2}$
$= \frac{2 + 2\sin^2 2\theta - 4 \sin 2\theta}{2} = (1 - \sin 2\theta)^2$
$\therefore xy = (1 + \sin 2\theta)^2 (1 - \sin 2\theta)^2$
$xy = (1 - \sin^2 2\theta)^2 = \cos^4 2\theta \Rightarrow xy = 1$

11. (*d*) We have, $(x + 1)^2 = A(x^2 + 1) + (Bx + C)x$
$\Rightarrow x^2 + 1 + 2x = Ax^2 + A + Bx^2 + Cx$
Comparing the like terms, we have
$1 = A + B, A = 1, C = 2 \Rightarrow A = 1, B = 0, C = 2$
$\therefore \sin^{-1}A + \tan^{-1}B + \sec^{-1}C$
$= \sin^{-1} 1 + \tan^{-1} 0 + \sec^{-1} 2$
$= \sin^{-1}\left(\sin\frac{\pi}{2}\right) + 0 + \sec^{-1}\left(\sec\frac{\pi}{3}\right) = \frac{5\pi}{6}$

12. (*b*) $\frac{\cos\theta}{1 - \tan\theta} + \frac{\sin\theta}{1 - \cot\theta}$
$= \frac{\cos^2\theta}{\cos\theta(1 - \tan\theta)} + \frac{\sin^2\theta}{\sin\theta(1 - \cot\theta)}$
$= \frac{\cos^2\theta}{\cos\theta - \sin\theta} + \frac{\sin^2\theta}{\sin\theta - \cos\theta}$
$= \frac{\cos^2\theta}{\cos\theta - \sin\theta} - \frac{\sin^2\theta}{\cos\theta - \sin\theta}$
$= \frac{\cos^2\theta - \sin^2\theta}{\cos\theta - \sin\theta}$
$= \frac{(\cos\theta - \sin\theta)(\cos\theta + \sin\theta)}{\cos\theta - \sin\theta}$
$= \cos\theta + \sin\theta$

13. (*a*) Given equation
$2 \cos^2 x + 3 \sin x - 3 = 0$
$\Rightarrow 2 - 2 \sin^2 x + 3 \sin x - 3 = 0$
$\Rightarrow (2 \sin x - 1) (\sin x - 1) = 0$
$\Rightarrow x = \frac{\pi}{6}, \frac{5\pi}{6}, \frac{\pi}{2}$, i.e., 30°,150°,90°

14. (*b*) $\frac{\sin(x + y)}{\sin(x - y)} = \frac{a + b}{a - b}$
Applying componendo and dividendo, we get
$\frac{\sin(x + y) + \sin(x - y)}{\sin(x + y) - \sin(x - y)}$
$= \frac{(a + b) + (a - b)}{(a + b) - (a - b)}$
$\Rightarrow \frac{2 \sin x \cdot \cos y}{2 \cos x \cdot \sin y} = \frac{2a}{2b}$
$\Rightarrow \tan x \cdot \cot y = \frac{a}{b}$
$\therefore \frac{\tan x}{\tan y} = \frac{a}{b}$

15. (*b*) Given equation
$\sin 9\theta = \sin\theta \Rightarrow 9\theta = n\pi + (-1)^n \theta$
If $n = 2m$ then $9\theta = 2m\pi + \theta \Rightarrow 8\theta = 2m\pi$
$\Rightarrow \theta = \frac{m\pi}{4}$
If $n = 2m + 1$ then $9\theta = (2m + 1)\pi - \theta$
$\Rightarrow 10\theta = (2m + 1)\pi$
$\Rightarrow \theta = (2m + 1)\frac{\pi}{10}$
Then values belonging to $[0, 2\pi]$ are
$\theta = 0, \frac{\pi}{10}, \frac{5\pi}{4}, \frac{3\pi}{10}, \frac{\pi}{2}, \frac{7\pi}{10}, \frac{3\pi}{4}, \frac{9\pi}{10},$
$\pi, \frac{11\pi}{10}, \frac{5\pi}{4}, \frac{13\pi}{10}, \frac{3\pi}{2}, \frac{17\pi}{10}, \frac{7\pi}{4}, \frac{19\pi}{10}, 2\pi$

16. (*b*) Statement-I: As ABC is an equilateral triangle.
$\therefore \angle A = \angle B = \angle C = 60°$

Chapter

3

TRIGONOMETRIC FUNCTIONS

1. What is $\cos 20° + \cos 100° + \cos 140°$ equal to? *[2024, I]*

(*a*) 2 (*b*) 1

(*c*) 1/2 (*d*) 0

2. If $f(\theta) = \sin^4\theta + \cos^2\theta$, then range of $f(\theta)$ is *[2024, I]*

(*a*) $\left[\frac{1}{2}, 1\right]$ (*b*) $\left[\frac{1}{2}, \frac{3}{4}\right]$

(*c*) $\left[\frac{3}{4}, 1\right]$ (*d*) None of these

3. Find general value of θ when $\tan\theta = \tan\alpha$ *[2023, II]*

(*a*) $n\pi - \alpha$ (*b*) $n\pi + \alpha$

(*c*) $\frac{n\pi}{2} + \alpha$ (*d*) All of the above

4. If $\sec^2\theta = \frac{4}{3}$, then the general value of θ is *[2023, I]*

(*a*) $2n\pi \pm \frac{\pi}{6}$ (*b*) $n\pi \pm \frac{\pi}{6}$

(*c*) $2n\pi \pm \frac{\pi}{3}$ (*d*) $n\pi \pm \frac{\pi}{3}$

5. The trigonometric function $y = \tan x$ in the II quadrant *[2022]*

(*a*) decreases from 0 to ∞

(*b*) increases from 0 to ∞

(*c*) decreases from $-\infty$ to 0

(*d*) increases from $-\infty$ to 0

6. If $A + B + C = \frac{\pi}{2}$ then *[2021]*

(*a*) $\tan A \tan B + \tan B \tan C + \tan C \tan A = 1$

(*b*) $\cot A + \cot B + \cot C = \cot A \cot B \cot C$

(*c*) $\cos 2A + \cos 2B + \cos 2C = 1 + 4 \sin A \sin B \sin C$

(*d*) All three are correct

7. What is the value of $\frac{1+\sin A}{1-\sin A} - \frac{1-\sin A}{1+\sin A}$? *[2021]*

(*a*) $\sec A - \tan A$ (*b*) $2\sec A \cdot \tan A$

(*c*) $4\sec A \cdot \tan A$ (*d*) $4\,\text{cosec}\, A \cdot \cot A$

8. The equation
$\sin^4 x - (k+2)\sin^2 x - (k+3) = 0$
possesses a solution if *[2020]*

(*a*) $k > -3$ (*b*) $k < -2$

(*c*) $-3 \le k \le -2$ (*d*) k is any positive integer

9. The value of $\sin 1° + \sin 2° + \ldots + \sin 359°$ is equal to *[2016]*

(*a*) 0 (*b*) 1

(*c*) –1 (*d*) 180

10. Let $x + y = 3 - \cos 4\theta$ and $x - y = 4 \sin 2\theta$ then the greatest of xy is *[2020]*

(*a*) $\frac{3}{4}$ (*b*) 1

(*c*) $\frac{1}{2}$ (*d*) 2

11. If $\frac{(x+1)^2}{x^3+x} = \frac{A}{x} + \frac{Bx+C}{x^2+1}$, then $\sin^{-1} A + \tan^{-1} B + \sec^{-1} C =$ *[2020]*

(*a*) $\frac{\pi}{2}$ (*b*) $\frac{\pi}{6}$

(*c*) 0 (*d*) $\frac{5\pi}{6}$

12. What is $\frac{\cos\theta}{1-\tan\theta} + \frac{\sin\theta}{1-\cot\theta}$ equal to? *[2019]*

(*a*) $\sin\theta - \cos\theta$ (*b*) $\sin\theta + \cos\theta$

(*c*) $2\sin\theta$ (*d*) $2\cos\theta$

13. If $2\cos^2 x + 3\sin x - 3 = 0$, $0 \le x \le 180°$, then $x =$ *[2018]*

(*a*) 30°, 90°, 150° (*b*) 60°, 120°, 180°

(*c*) 0°, 30°, 150° (*d*) 45°, 90°, 135°

14. If $\frac{\sin(x+y)}{\sin(x-y)} = \frac{a+b}{a-b}$, then what is $\frac{\tan x}{\tan y}$ equal to? *[2018]*

(*a*) $\frac{b}{a}$ (*b*) $\frac{a}{b}$ (*c*) $a\,b$ (*d*) 1

15. Number of solutions of equation $\sin 9\theta = \sin\theta$ in the interval $[0, 2\pi]$ is *[2018]*

(*a*) 16 (*b*) 17

(*c*) 18 (*d*) 15

16. Consider the following statements

I. If ABC is an equilateral triangle, then
$3\tan(A+B)\tan C = 1$

II. If ABC is a triangle in which $A = 78°$, $B = 66°$, then
$\tan\left(\frac{A}{2} + C\right) < \tan A$.

34. If $y=\frac{2\sin\alpha}{1+\cos\alpha+\sin\alpha}$, then value of $\frac{1-\cos\alpha+\sin\alpha}{1+\sin\alpha}$ is *[2009]*

(*a*) $\frac{y}{3}$ (*b*) y

(*c*) $2y$ (*d*) $\frac{3}{2}y$

35. What is the value of $\frac{\sin\theta}{\text{cosec}\,\theta}+\frac{\cos\theta}{\sec\theta}$? *[2009]*

(*a*) 1 (*b*) 1/2

(*c*) 1/3 (*d*) 2

36. The general solution of $8\tan^2\frac{x}{2}=1+\sec x$ is *[2009]*

(*a*) $2n\pi\pm\cos^{-1}\left(\frac{-1}{3}\right)$ (*b*) $2n\pi\pm\frac{\pi}{6}$

(*c*) $2n\pi\pm\cos^{-1}\left(\frac{1}{3}\right)$ (*d*) None of these

37. Which of the following is the correct value of cot 10° . cot20° . cot 60° . cot 70° . cot 80°? *2008]*

(*a*) $\frac{1}{\sqrt{3}}$ (*b*) $\sqrt{3}$

(*c*) –1 (*d*) 1

38. The value of $\tan A+\tan(60°+A)-\tan(60°-A)$ is *[2008]*

(*a*) tan 3*A* (*b*) 2 tan 3*A*

(*c*) 3 tan 3*A* (*d*) None of these

39. Find general solution of $\tan x=\sqrt{3}$ *[2008]*

(*a*) $n\pi+\frac{\pi}{3}, n\in Z$ (*b*) $n\pi-\frac{\pi}{3}, n\in Z$

(*c*) $n\pi+\frac{\pi}{6}, n\in Z$ (*d*) $n\pi\pm\frac{\pi}{3}, n\in Z$

40. The number of solution of $\cos 2\theta=\sin\theta$ in $(0, 2\pi)$ is *[2007]*

(*a*) 1 (*b*) 2

(*c*) 3 (*d*) 4

41. The value of cot 70°+ 4 cos 70° is *[2007]*

(*a*) $\frac{1}{\sqrt{3}}$ (*b*) $\sqrt{3}$

(*c*) $2\sqrt{3}$ (*d*) $\frac{1}{2}$

42. If $\sin\theta+\text{cosec}\,\theta=2$, then $\sin^2\theta+\text{cosec}^2\theta$ is equal to *[2006]*

(*a*) 1 (*b*) 4

(*c*) 2 (*d*) None of these

43. Find the general solution of the equation $\cot x=-\sqrt{3}$? *[2006]*

(*a*) $n\pi+(\pi/6)$ where $n\in Z$.

(*b*) $n\pi+(5\pi/6)$ where $n\in Z$.

(*c*) $n\pi+(7\pi/6)$ where $n\in Z$.

(*d*) None of these

44. If $\sec\theta=1\frac{1}{4}$, then $\tan\frac{\theta}{2}=$ *[2005]*

(*a*) $\frac{1}{3}$ (*b*) $\frac{3}{4}$

(*c*) $\frac{1}{4}$ (*d*) $\frac{5}{4}$

45. If cosec *A* + cot *A* = $\frac{11}{2}$, then tan *A* is *[2005]*

(*a*) $\frac{21}{22}$ (*b*) $\frac{15}{16}$

(*c*) $\frac{44}{117}$ (*d*) $\frac{117}{43}$

46. If $\tan\theta=-\frac{1}{\sqrt{3}}$, then general solution of the equation is *[2005]*

(*a*) $2n\pi+\frac{\pi}{6}, n\in I$ (*b*) $n\pi+\frac{\pi}{6}, n\in I$

(*c*) $2n\pi-\frac{\pi}{6}, n\in I$ (*d*) $n\pi-\frac{\pi}{6}, n\in I$

Answer Key

1. (*d*)	**2.** (*c*)	**3.** (*b*)	**4.** (*b*)	**5.** (*d*)	**6.** (*d*)	**7.** (*c*)	**8.** (*c*)	**9.** (*a*)	**10.** (*b*)
11. (*d*)	**12.** (*b*)	**13.** (*a*)	**14.** (*b*)	**15.** (*b*)	**16.** (*b*)	**17.** (*b*)	**18.** (*c*)	**19.** (*b*)	**20.** (*b*)
21. (*d*)	**22.** (*a*)	**23.** (*d*)	**24.** (*a*)	**25.** (*b*)	**26.** (*a*)	**27.** (*c*)	**28.** (*b*)	**29.** (*d*)	**30.** (*c*)
31. (*d*)	**32.** (*c*)	**33.** (*d*)	**34.** (*b*)	**35.** (*a*)	**36.** (*c*)	**37.** (*a*)	**38.** (*c*)	**39.** (*a*)	**40.** (*c*)
41. (*b*)	**42.** (*c*)	**43.** (*b*)	**44.** (*a*)	**45.** (*c*)	**46.** (*d*)				

Explanations

1. (*d*) $\cos 20° + \cos 100° + \cos 140°$
$= (\cos 140° + \cos 20°) + \cos 100°$
$= 2 \cos 80°. \cos 60° + \cos 100°$
$= 2\cos 80° \cdot \frac{1}{2} + \cos 100°$
$= 2 \cos 90° . \cos 10° = 2 \times 0 \times \cos 10° = 0$

2. (*c*) $f(\theta) = \sin^4\theta + \cos^2\theta$
$= \sin^2\theta (1 - \cos^2\theta) + \cos^2\theta$
$= \sin^2\theta + \cos^2\theta - \sin^2\theta \cos^2\theta$
$f(\theta) = 1 - \frac{1}{4} \sin^2 2\theta \Rightarrow 0 \le \sin^2 2\theta \le 1$
$f(\theta)\max = 1$
$f(\theta)\min = 1 - \frac{1}{4} = 3/4$
$\therefore$ Range is $\left[\frac{3}{4}, 1\right]$.

3. (*b*) Given that, $\tan\theta = \tan\alpha \Rightarrow \theta = n\pi + \alpha$

4. (*b*) Given equation
$\sec^2\theta = \frac{4}{3} \Rightarrow \cos^2\theta = \frac{3}{4} \Rightarrow \cos^2\theta = \left(\frac{\sqrt{3}}{2}\right)^2$
$\Rightarrow \cos^2\theta = \cos^2\left(\frac{\pi}{6}\right) \Rightarrow \theta = n\pi \pm \frac{\pi}{6}$

5. (*d*) By graph of $y = \tan x$ in II quadrant, we obtained its increase from $-\infty$ to 0.

6. (*d*) $B + C = \frac{\pi}{2} - A \Rightarrow \tan(B + C) = \cot A$
$\Rightarrow \frac{\tan B + \tan C}{1 - \tan B \tan C} = \cot A$
$\Rightarrow \frac{\tan B + \tan C}{1 - \tan B \cdot \tan C} = \frac{1}{\tan A}$
$\Rightarrow \tan A \cdot \tan B + \tan C \tan A$
$= 1 - \tan B . \tan C$
$\Rightarrow \tan A \tan B + \tan B \tan C + \tan C \tan A = 1$
$\Rightarrow \frac{1}{\cot A}.\frac{1}{\cot B} + \frac{1}{\cot B}.\frac{1}{\cot C} + \frac{1}{\cot C}.\frac{1}{\cot A} = 1$
$\Rightarrow \frac{\cot C + \cot A + \cot B}{\cot A.\cot B.\cot C} = 1$
$\Rightarrow \cot A + \cot B + \cot C = \cot A. \cot B. \cot C$
Again $\cos 2A + \cos 2B + \cos 2C$
$= 2\cos(A + B) \cos(A - B) + \cos 2C$
$= 2\cos\left(\frac{\pi}{2} - C\right)\cos(A - B) + 1 - 2\sin^2 C$
$= 2 \sin C[\cos (A - B) - \sin C] + 1$
$= 2\sin C\left[\cos(A - B) - \sin\left\{\frac{\pi}{2} - (A + B)\right\}\right] + 1$
$= 2 \sin C [\cos(A - B) - \cos(A + B)] + 1$
$= 4 \sin A \sin B \sin C + 1$

7. (*c*) $\frac{1 + \sin A}{1 - \sin A} - \frac{1 - \sin A}{1 + \sin A}$
$= \frac{(1 + \sin A)^2 - (1 - \sin A)^2}{1 - \sin^2 A} = \frac{4 \sin A}{\cos^2 A}$
$= 4 \tan A \sec A$

8. (*c*) Given equation is
$\sin^4 x - (k + 2) \sin^2 x - (k + 3) = 0$
$\therefore \sin^2 x = \frac{(k + 2) \pm \sqrt{(k + 2)^2 + 4(k + 3)}}{2}$
$= \frac{(k + 2) \pm (k + 4)}{2}$
$\Rightarrow \sin^2 x = k + 3$
($\because \sin^2 x = -1$ is not possible)
Since $0 \le \sin^2 x \le 1$,
$\therefore 0 \le k + 3 \le 1$ or $-3 \le k \le -2$

9. (*a*) $\because \sin 1° + \sin 2° + ... + \sin 359°$
$= \sin 1° + \sin 2° + ...+ \sin 180° + ...$
$+ \sin(360° - 2°) + \sin (360° - 1°)$
$= \sin 1° + \sin 2° + ... + \sin 180° + ... - \sin 2°$
$- \sin 1° = 0$

10. (*b*) Given $x + y = 3 - \cos 4\theta$
and $x - y = 4 \sin 2\theta$
$x = \frac{3 - \cos 4\theta + 4 \sin 2\theta}{2}$
$= \frac{3 - (1 - 2\sin^2 2\theta) + 4 \sin 2\theta}{2}$
$= \frac{2 + 2\sin^2 2\theta + 4 \sin 2\theta}{2}$
$= (1 + \sin 2\theta)^2$
and $y = \frac{3 - \cos 4\theta - 4 \sin 2\theta}{2}$
$= \frac{3 - (1 - 2\sin^2 2\theta) - 4 \sin 2\theta}{2}$
$= \frac{2 + 2\sin^2 2\theta - 4 \sin 2\theta}{2} = (1 - \sin 2\theta)^2$
$\therefore xy = (1 + \sin 2\theta)^2 (1 - \sin 2\theta)^2$
$xy = (1 - \sin^2 2\theta)^2 = \cos^4 2\theta \Rightarrow xy = 1$

11. (*d*) We have, $(x + 1)^2 = A(x^2 + 1) + (Bx + C)x$
$\Rightarrow x^2 + 1 + 2x = Ax^2 + A + Bx^2 + Cx$
Comparing the like terms, we have
$1 = A + B, A = 1, C = 2 \Rightarrow A = 1, B = 0, C = 2$
$\therefore \sin^{-1}A + \tan^{-1}B + \sec^{-1}C$
$= \sin^{-1} 1 + \tan^{-1} 0 + \sec^{-1} 2$
$= \sin^{-1}\left(\sin\frac{\pi}{2}\right) + 0 + \sec^{-1}\left(\sec\frac{\pi}{3}\right) = \frac{5\pi}{6}$

12. (*b*) $\frac{\cos\theta}{1 - \tan\theta} + \frac{\sin\theta}{1 - \cot\theta}$
$= \frac{\cos^2\theta}{\cos\theta(1 - \tan\theta)} + \frac{\sin^2\theta}{\sin\theta(1 - \cot\theta)}$
$= \frac{\cos^2\theta}{\cos\theta - \sin\theta} + \frac{\sin^2\theta}{\sin\theta - \cos\theta}$
$= \frac{\cos^2\theta}{\cos\theta - \sin\theta} - \frac{\sin^2\theta}{\cos\theta - \sin\theta}$
$= \frac{\cos^2\theta - \sin^2\theta}{\cos\theta - \sin\theta}$
$= \frac{(\cos\theta - \sin\theta)(\cos\theta + \sin\theta)}{\cos\theta - \sin\theta}$
$= \cos\theta + \sin\theta$

13. (*a*) Given equation
$2 \cos^2 x + 3 \sin x - 3 = 0$
$\Rightarrow 2 - 2 \sin^2 x + 3 \sin x - 3 = 0$
$\Rightarrow (2 \sin x - 1) (\sin x - 1) = 0$
$\Rightarrow x = \frac{\pi}{6}, \frac{5\pi}{6}, \frac{\pi}{2}$, i.e., 30°,150°,90°

14. (*b*) $\frac{\sin(x + y)}{\sin(x - y)} = \frac{a + b}{a - b}$
Applying componendo and dividendo, we get
$\frac{\sin(x + y) + \sin(x - y)}{\sin(x + y) - \sin(x - y)}$
$= \frac{(a + b) + (a - b)}{(a + b) - (a - b)}$
$\Rightarrow \frac{2 \sin x \cdot \cos y}{2 \cos x \cdot \sin y} = \frac{2a}{2b}$
$\Rightarrow \tan x \cdot \cot y = \frac{a}{b}$
$\therefore \frac{\tan x}{\tan y} = \frac{a}{b}$

15. (*b*) Given equation
$\sin 9\theta = \sin\theta \Rightarrow 9\theta = n\pi + (-1)^n \theta$
If $n = 2m$ then $9\theta = 2m\pi + \theta \Rightarrow 8\theta = 2m\pi$
$\Rightarrow \theta = \frac{m\pi}{4}$
If $n = 2m + 1$ then $9\theta = (2m + 1)\pi - \theta$
$\Rightarrow 10\theta = (2m + 1)\pi$
$\Rightarrow \theta = (2m + 1)\frac{\pi}{10}$
Then values belonging to $[0, 2\pi]$ are
$\theta = 0, \frac{\pi}{10}, \frac{5\pi}{4}, \frac{3\pi}{10}, \frac{\pi}{2}, \frac{7\pi}{10}, \frac{3\pi}{4}, \frac{9\pi}{10},$
$\pi, \frac{11\pi}{10}, \frac{5\pi}{4}, \frac{13\pi}{10}, \frac{3\pi}{2}, \frac{17\pi}{10}, \frac{7\pi}{4}, \frac{19\pi}{10}, 2\pi$

16. (*b*) Statement-I: As ABC is an equilateral triangle.
$\therefore \angle A = \angle B = \angle C = 60°$

ENGLISH PROFICIENCY
(PREPARATION NOTES)

Reading Comprehension

Reading Comprehension (RC) is the ability to actively read and assimilate information to answer a set of questions.

So, to answer the reading comprehension questions, you must be able to:

- Recognize the passage's crux
- Answer questions based on the text provided.
- Create an opinion about the tone and tenor of the given path.
- The most important rule in the RC section is comprehending what you read. If you can read quickly, it will come in handy. Nonetheless, speed is always secondary to comprehension.

READING COMPREHENSION – DIFFERENT TYPES OF PASSAGES

Aside from the length, difficulty level, and vocabulary used in the passage, another critical aspect of these questions is the topics on which the course may be asked. The comprehension is usually based on recent news or topics related to the competitive exam, but it can also be from any other area of life. However, it is essential to note that even if the candidate has a broader understanding of the topic, his answers should only be based on the information in the passage.

Current Events: The passage is mainly drawn from a recent event in the world, which may be hype and is in the news.

Economy-Related: A passage about a country's economic growth or development may also be included in the comprehension section.

Social Sciences: This is another field where the passage could be used in the Verbal Ability section.

Philosophy and Psychology: The comprehension may cover topics in philosophy and psychology, making the case moderately difficult for the candidate.

Imaginary Events: It is also possible that the passage is based on fictitious information that is not realistic and is entirely fictional.

ESSENTIAL GUIDELINES FOR ANSWERING

- The author's main point should be understood.
- Identify the key arguments advanced to prove that point.
- Determine the author's tone, which can be mocking, inquisitive, respectful, condescending, etc.
- Look for negative conjunctions; these words will undoubtedly reveal a shift in the author's tone. As a result, the author's implication may differ from the initial statement. Examples include: but despite, and so on.
- Look for negative qualifiers that cast doubt on the statement's veracity. For example, perhaps, appears, somewhat, seems to be, and so on.

HOW TO APPROACH READING COMPREHENSION?

- Reading is the most effective medicine. If you enjoy reading, the ball is in your court.
- For those who do not enjoy reading, it is all about defending.
- Begin reading several things at once (editorials are good).
- This will assist you in tackling various passages in those 60 minutes.
- Attempt it wholeheartedly, as if you were watching a movie or drinking your last cup of coffee.
- Don't slack off, and don't rush.
- Learn to avoid answering questions. Don't attempt to answer the inference-based questions if you can't grasp the main idea.
- It's a game of negative marking, so choose your battles wisely.
- Don't ignore the data-driven questions.
- Develop the ability to jot down the main points, so you don't have to look them up again. This will take much practice.
- Aim to complete at least three to four passages per day.
- It takes time to master reading comprehension.

PRACTICE EXERCISE

Direction (1-5): Read the passage and answer the questions based on it. Select your answers based on the contents of the passage and opinion of the author only.

In what may be the Centre's first strike in response to the rural distress read into the Gujarat Assembly poll outcomes, a 30% customs duty has been slapped on the import of chana dal and masoor dal. The official reasoning is clear. Cheap imports could hit farm incomes especially at a time when domestic production of pulses is at a record high and a bumper rabi crop is expected. With an adequate domestic stockpile of pulses and with international prices remaining low for a prolonged period, the Centre fears that traders may still prefer to import some pulses rather than buy the fresh crop from local farmers at higher prices.

There has been a significant upsurge in imports, in the range of 30% to 46%, in four out of the first six months of this financial year. Chana and masoor were the key contributors for India's pulses imports rising to over $1.6 billion between April and September, compared to $1.2 billion in the same period last year. The value of chana imports in this period rose 373%, while masoor grew 204% year on year. However, the recent trends suggest that there has been a moderation in imports, especially since October.

Against this backdrop, the government's is too late, but flawed market timing isn't the real issue. Because, reflexively raising or breaking such tariff walls, as the production cycle warrants, doesn't add up to a serious long-term policy, which should be aimed at boosting farm incomes and ensuring food security.

Farmers, like investors, need predictability and coherence in government policies. Just as a duty hike on electronic goods won't directly prop up local manufacturing or curb their consumption, hiking import duties on one dal or another won't make farmers better-off — though traders who accumulated cheaper imports will benefit. The government must devise better means to shore up farm incomes without stirring up inflation.

1. What does 'reflexively raising' refers to in the passage?
(*a*) By not giving much thought into it
(*b*) By consulting with the concerned officials
(*c*) By reflecting on the issues faced by farmers
(*d*) None of the Above

2. The focus of the passage is to_____
(*a*) Suggest measures to boost electronic goods production
(*b*) Emphasize the need to curb imports of pulses
(*c*) Evaluate the long term efficacy of the hike in duties on pulses
(*d*) Suggest measures to investor protection in agriculture infrastructure.

3. Between April and November, imports of chana and masoor
(*a*) Have been rising consistently
(*b*) Have been decreasing consistently
(*c*) Decreased in the initial period and then increased
(*d*) Increased in the initial period and then moderated

4. The appropriate title for the passage can be_____
(*a*) Agricultural Distress – Reasons and Analysis
(*b*) Agriculture EXIM policy: Need for revision
(*c*) Reasons behind farmers suicide
(*d*) Missing the pulse on policies for farmers

5. The government's move to increase import duty on chana and masoor is
(*a*) Too early (*b*) Too late
(*c*) Timely (*d*) Can't be decided

Direction (6-10): Read the passage and answer the questions based on it. Select your answers based on the contents of the passage and opinion of the author only.

Light is fabricated

Electromagnetic waves make up light. These differ in length, and it is because of these differences that we perceive different colors. All of the wavelengths of the light spectrum are mixed together in white light. An object appears colored because light falls on it and only certain parts of the spectrum are reflected. The object absorbs the remainder of the spectrum. A white object reflects all of the light that falls on it. A red object reflects the red part of the spectrum and absorbs the rest. These various reflected waves are detected by our eyes and appear as different colors.

6. Without colours we would consider the world a dull and less beautiful place.
(*a*) True (*b*) False
(*c*) Cannot tell

7. White light is an amalgam of all the wave lengths of light.
(*a*) True (*b*) False
(*c*) Cannot tell

8. The passage states that an object that looks blue absorbs all but the blue wavelengths of light.
(*a*) True (*b*) False
(*c*) Cannot tell

9. The colour we perceive an object to be is determined by the electro-magnetic waves that it absorbs or reflects.
(*a*) True (*b*) False
(*c*) Cannot tell

10. White paint reflects more light than red paint.
(*a*) True (*b*) False
(*c*) Cannot tell

Direction (11-15): Read the passage and answer the questions based on it. Select your answers based on the contents of the passage and opinion of the author only.

NATO allies Germany, the United Kingdom, and France voted in favor of the resolution that "deeply regretted" the United States' decision, as did Asian allies Japan and South Korea; Canada and Mexico chose to abstain. The overwhelming majority ignored Mr. Trump's and UN Ambassador Nikki Haley's threats that any country that defied America would be 'named and shamed,' and that US aid would be withdrawn. The suggestion was that the US would exact its vengeance by refusing to support these countries at the UN when

LOGICAL REASONING
(PREPARATION NOTES)

Analogy

'Analogy' means 'Similarity'. A particular relationship is given and another similar relationship has to be identified from the alternatives provided. Analogy tests are, therefore, meant to test a candidate's overall knowledge, power of reasoning and ability to think concisely and accurately.

Types of Analogy

1. Word based analogy
2. Number based analogy
3. Letter based analogy

Word Based Analogy

These questions can be based on synonyms, antonyms, or other word relationships. To solve these questions, you need to understand the relationship between the first two words, and then find the word that has the same relationship with the third word. Given table will help to understand the relationship between the words.

(a) Study and Topic Relationship:

Botany		Plants	
(Botany means study of Plants)			
Zoology	Animals	Archaeology	Artifacts
Pathology	Diseases	Ecology	Environment
Cardiology	Heart	Anthology	Collection of Poems
Astronomy	Planets	Trigonometry	Triangles
Astrology	Future	Paleography	Writings
Cytology	Cells	Semantics	Language
Geology	Earth	Haematology	Blood
Pedology	Soil	Bryology	Bryophytes
Seismology	Earthquakes	Taxonomy	Classification
Penology	Punishment	Orography	Mountains

(b) Worker and Tool Relationship:

Labourer		Spade	
(Spade is a tool used by a Labourers)			
Carpenter	Saw	Wood cutter	Axe
Blacksmith	Anvil	Soldier	Gun
Tailor	Needle	Chef	Knife
Farmer	Plough	Author	Pen
Warrior	Sword	Sculptor	Chisel
Mason	Plumb line	Jockey	Tack
Gardener	Harrow	Surgeon	Scalpel
Astronomer	Telescope	Lumberjack	Axe
Painter	Brush	Violinist	Bow
Barber	Scissors	Butcher	Chopper
Doctor	Stethoscope	Cobbler	Awl

(c) Tool and Action Relationship:

Needle		Saw	
(A Needle is used for Sewing)			
Knife	Cut	Gun	Shoot
Pen	Write	Microscope	Magnify
Filter	Purify	Sword	Slaughter
Mattock	Dig	Spade	Dig
Spoon	Feed	Steering	Drive
Axe	Grind	Chisel	Carve
Loudspeaker	Amplify	Shield	Guard

(d) Worker and Working place:

Chef		Kitchen	
(Chef works in a Kitchen)			
Farmer	Field	Scientist	Laboratory
Engineer	Site	Warrior	Battle field
Pilot	Cockpit	Sailor	Ship
Actor	Stage	Beautician	Parlour
Painter	Gallery	Mechanic	Garage
Waiter	Restaurant	Gambler	Casino
Servant	House	Worker	Factory
Umpire	Pitch	Teacher	School
Artist	Theatre	Doctor	Hospital
Clerk	Office	Driver	Cabin

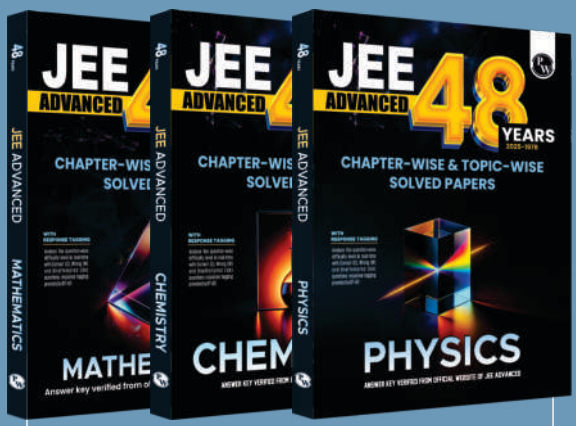
(e) Worker and Product:

Poet		Poem	
(Poet writes Poem)			
Farmer	Crop	Author	Book
Cobbler	Shoes	Mason	Wall
Editor	Newspaper	Hunter	Prey
Carpenter	Furniture	Butcher	Meat
Gold smith	Ornaments	Producer	Film
Architect	Design	Tailor	Clothes
Teacher	Education	Dramatist	Play
Choreographer	Ballet	Judge	Justice

(f) Material and Product:

Cloth	Fibre
(Cloth is made of Fibre)	

Other Helpful Books



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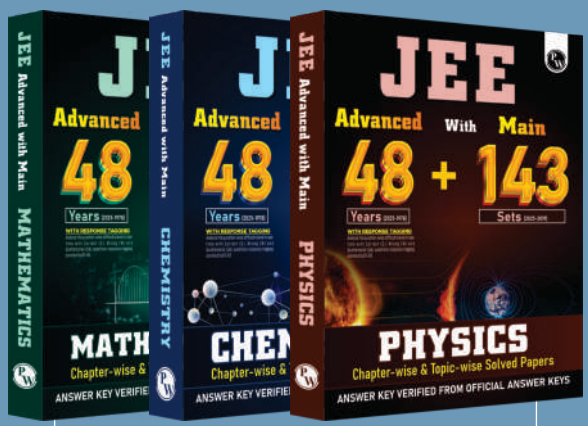

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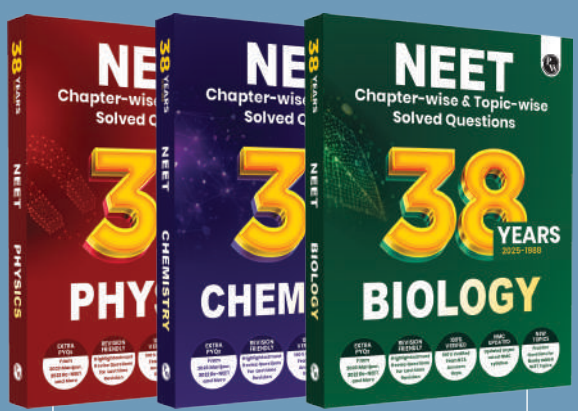

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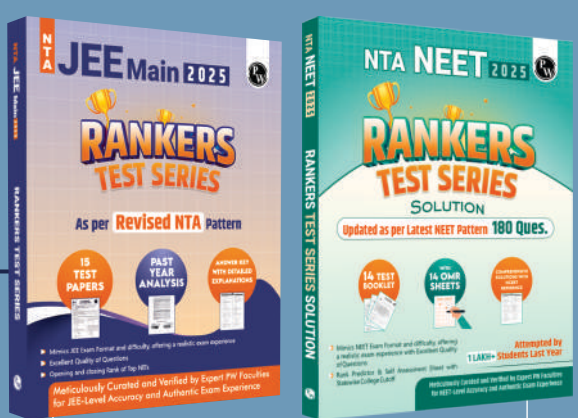

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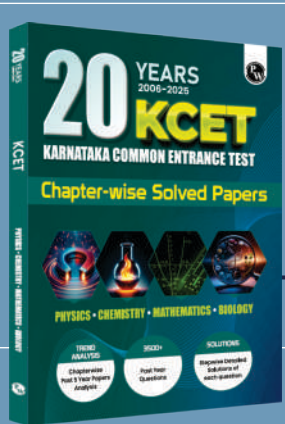

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