NEW STANDARD ACADEMY

Time : 3 Hours | Maximum Marks : 300

Test Type : Unit Test # 04

Do not open this Test Booklet until you are asked to do so. 11-09-2023

JEE(MAIN): 12th Undergoing/Pass Students

Read carefully the Instructions on the Back Cover of this Test Booklet.

Important Instructions :

1. Immediately fill in the form number on this page of the Test Booklet with Blue/Black Ball Point Pen. Use of pencil is strictly prohibited.
2. The candidates should not write their Form Number anywhere else (except in the specified space) on the Test Booklet/Answer Sheet.
3. The Test Booklet consists of 90 questions.
4. There are three parts in the question paper 1,2,3 consisting of Physics, Chemistry and Mathematics having 30 questions in each subject and each subject having Two sections. (i) Section-I contains 20 multiple choice questions with only one correct option. Marking scheme : +4 for correct answer, 0 if not attempted and –1 in all other cases. (ii) Section-II contains 10 Numerical Value Type questions. Attempt any 5 questions. First 5 attempted questions will be considered for marking. Marking scheme : +4 for correct answer, 0 if not attempted and –1 in all other cases.
5. Use Blue/Black Ball Point Pen only for writting particulars/marking responses on Side –1 and Side–2 of the Answer Sheet. Use of pencil is strictly prohibited.
6. No candidate is allowed to carry any textual material, printed or written, bits of papers, mobile phone any electronic device etc, except the Identity Card inside the examination hall/room.
7. Rough work is to be done on the space provided for this purpose in the Test Booklet only.
8. On completion of the test, the candidate must hand over the Answer Sheet to the invigilator on duty in the Room/ Hall. However, the candidate are allowed to take away this Test Booklet with them.

Name of the Candidate(In Capitals) _____

Date of Examintation _____

Candidate`s Signature:_____ Invigilator`s Signature: _____

PART-1 : PHYSICS

SECTION-I : (Maximum Marks: 80)

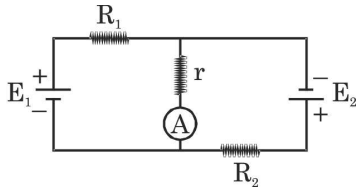
This section contains **20 questions**. Each question has 4 options for correct answer. Multiple-Choice Questions (MCQs) **Only one option is correct**. For each question, marks will be awarded as follows:

Full Marks : +4 If correct answer is selected.

Zero Marks : 0 If none of the option is selected.

Negative Marks : –1 If wrong option is selected.

1. If the reading of ideal ammeter A in circuit shown here is zero, then the ratio $\frac{E_1}{E_2}$ of the emf's of the two batteries must be



(A) 1 (B) $\frac{R_1}{R_2}$

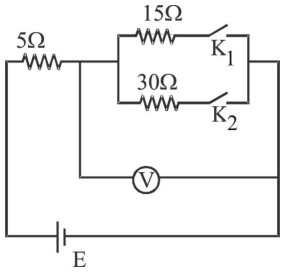
(C) $\frac{R_2}{R_1}$ (D) None of these

2. A copper wire of length ' ℓ ' and radius 'r' is nickel plated till its final radius is 2r. If the resistivity of the copper and nickle are ρ_c and ρ_n, then find the equivalent resistance of wire between its ends?

(A) $\frac{\rho_c \rho_n \ell}{\pi r^2 (\rho_n + 3\rho_c)}$ (B) $\frac{\rho_c \rho_n \ell}{\pi r^2 (\rho_n + 4\rho_c)}$

(C) $\frac{\rho_c \rho_n \ell}{4\pi r^2 (\rho_n + 3\rho_c)}$ (D) None of these

3. In the circuit shown in figure reading of voltmeter is V_1 when only K_1 is closed, reading of voltmeter is V_2 when only K_2 is closed and reading of voltmeter is V_3 when both K_1 and K_2 are closed. Then :-



(A) $V_3 > V_2 > V_1$ (B) $V_2 > V_1 > V_3$

(C) $V_3 > V_1 > V_2$ (D) $V_1 > V_2 > V_3$

4. Three copper wires are there with lengths and cross-sectional areas as (ℓ, A); $\left(2\ell, \frac{A}{2}\right)$ and $\left(\frac{\ell}{2}, 2A\right)$. Resistance :-

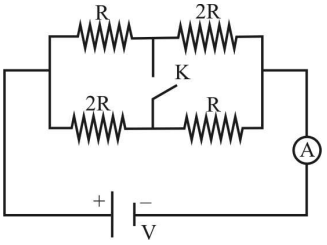
(A) minimum for the wire of cross-sectional area $\frac{A}{2}$

(B) minimum for the wire of cross-sectional area A

(C) minimum for the wire of cross-sectional area 2A

(D) same for all the three cases.

5. How will the reading of ammeter change if the key k is closed ?



(A) Increase

(B) Decrease

(C) Remains same

(D) Information insufficient

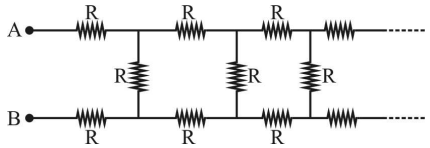
Space for Rough Work /

6. In a potentiometer experiment when terminals of the cell are connected at distance of 52 cm on the wire, then no current flows through it. When 5 Ω shunt resistance is connected across the cell the balancing length is 40 cm. The internal resistance of the cell (in Ω) is :–

(A) 5 (B) $\frac{200}{52}$

(C) $\frac{52}{8}$ (D) 1.5

7. The value of effective resistance between A and B is ? (R = 2 kΩ)



(A) $(1+\sqrt{3})$ kΩ

(B) $2(1+\sqrt{3})$ kΩ

(C) $(1-\sqrt{3})$ kΩ

(D) $2(1-\sqrt{3})$ kΩ

8. A heater takes 40 minutes to boil a given amount of water. Its coil is cut and $\frac{1}{4}$ th of its length is used in the heater now. How much time will it take now to boil the same amount of water using the same source ?

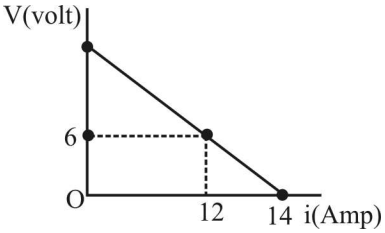
(A) 10 minutes

(B) 12 minutes

(C) 15 minutes

(D) 8 minutes

9. 10 Cells, each of emf 'E' and internal resistance 'r', are connected in series to a variable external resistance. Figure shows the variation of terminal potential difference of their combination with the current drawn from the combination.Emf of each cell is



(A) 1.6 V (B) 3.6 V

(C) 1.4 V (D) 4.2 V

10. Carbon resistor has resistance specified by three bands having colours red, yellow and black. If the resistor is remolded to make a resistor twice of previous length, the new colour code will be

(A) White, Blue, Black

(B) Red, Orange, Black

(C) Brown, Red, Black

(D) Yellow, Gray, Black

11. A particle is moving with a velocity of $\vec{v} = \left(3\hat{i} + 4t\hat{j}\right)$ m/s. Find the ratio of tangential acceleration to that of normal acceleration at t = 1 sec.

(A) 4/3

(B) 3/4

(C) 5/3

(D) 3/5

Space for Rough Work /

12. An insect trapped in a circular groove of some radius moves along the groove steadily and completes 10 revolutions in 100s. Choose the correct statement:-

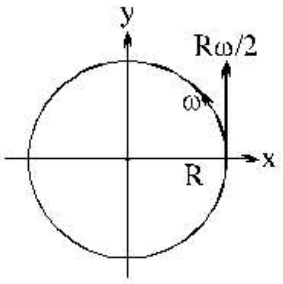
(A) The angular velocity of the insect is 10 rad/s

(B) The angular velocity of the insect is $\frac{\pi}{5}$ rad/s

(C) The angular velocity of the insect is $\frac{2\pi}{5}$ rad/s

(D) The angular velocity of the insect can't be defined as radius is unknown.

13. A body moves in a circle of radius R having centre at origin, with an angular velocity ω in the x-y plane as shown in the figure. Another body moves parallel to y-axis with constant velocity ($R\omega/2$). At time t = 0, both particles are at (R, 0). The value of time t, when first body has velocity only along positive x-axis w.r.t. the second body is



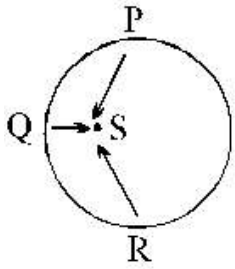
(A) $\pi/6\omega$

(B) $5\pi/3\omega$

(C) $5\pi/6\omega$

(D) None of these

14. An object moves counter-clockwise along the circular path shown below. As it moves along the path its acceleration vector continuously points towards point S. The object



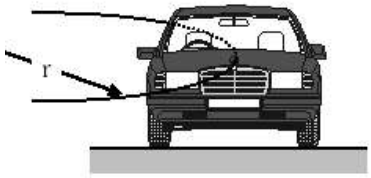
(A) speeds up at P, Q and R

(B) slows down at P, Q and R

(C) speeds up at P and slows down at R.

(D) slows down at P and speeds up at R.

15. Two-wheeler can tilt while turning, but four-wheeler cannot. Estimate maximum safe speed of a four-wheeler on turn of radius 10 m assuming coefficient of static friction between tires and the flat road to be 0.64 and acceleration due to gravity to be 10 m/s^2.



(A) 6.4 m/s

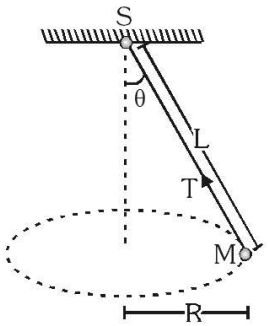
(B) 2.8 m/s

(C) 8 m/s

(D) 10 m/s

Space for Rough Work /

16. A string of length L is fixed at one end and carries a mass M at the other end. The string makes $2/\pi$ revolutions per second around the vertical axis through the fixed end as shown in the figure, then tension in the string is



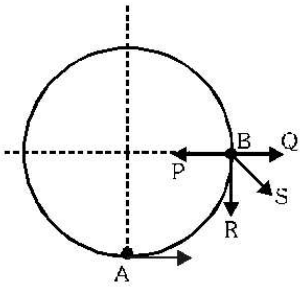
(A) ML (B) 2 ML (C) 4 ML (D) 16 ML

17. A circular curve of a highway is designed for traffic moving at 72 km/h. If the radius of the curved path is 100 m, the correct angle of banking of the road should be given by :

(A) $\tan^{-1}\frac{2}{3}$ (B) $\tan^{-1}\frac{3}{5}$

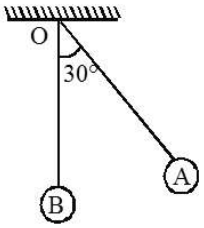
(C) $\tan^{-1}\frac{2}{5}$ (D) $\tan^{-1}\frac{1}{4}$

18. A ball of mass m moves inside a smooth spherical shell of radius R with velocity $\sqrt{2gR}$ at 'A'. What is the direction of force acting on the ball, when it reaches B ?



(A) BP (B) BQ (C) BR (D) BS

19. A pendulum is released from rest from the point A as shown in the figure. The string of the pendulum is taut. OA makes an angle 30° with the vertical. The acceleration of the pendulum bob at this instant would be



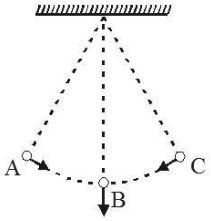
(A) along $\vec{AO}$

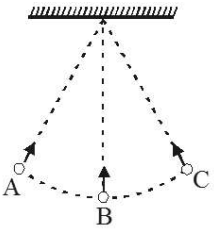
(B) along the vertical

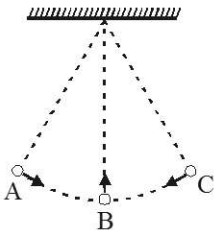
(C) in a direction perpendicular to OA

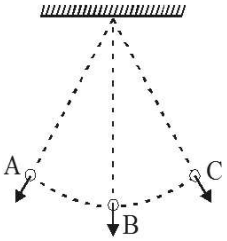
(D) In a direction making an angle less than 30° with the vertical

20. A simple pendulum of mass m swings about point B between extreme positions A and C. Net force acting on the bob at these three points is correctly shown by

(A)


(B)


(C)


(D)


Space for Rough Work /

SECTION-II : (Maximum Marks: 20)

This section contains 10 questions Candidates have to attempt any 5 questions out of 10. If more than 5 questions are attempted, then only first 5 attempted questions will be evaluated.

The answer to each question is a **Numerical Value.**

For each question, enter the correct integer value (In case of non-integer value, the answer should be rounded off to the nearest Integer).

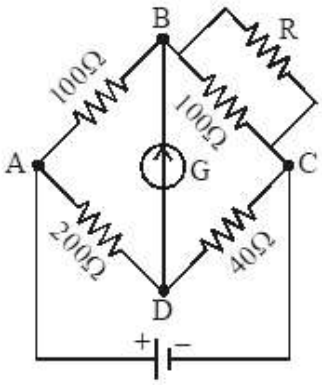
Answer to each question will be evaluated according to the following marking scheme:

Full Marks : +4 If correct answer is entered.

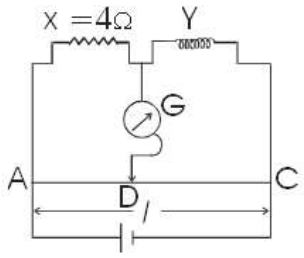
Zero Marks : 0 If the question is unanswered.

Negative Marks : –1 If wrong answer is entered.

1. The given Wheatstone bridge is showing no deflection in the galvanometer joined between the points B and D (figure). Calculate the value of R (in Ω).

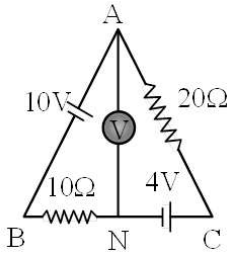


2. Figure shows a Meter bridge wire AC has uniform cross-section. The length of wire AC is 100 cm. X is a standard resistor of 4Ω and Y is a coil. When Y is immersed in melting ice the null point is at 40 cm from point A. When the coil Y is heated to 100°C, a 12Ω resistor has to be connected in parallel with Y in order to keep the bridge balanced at the same point. The temperature coefficient of resistance of the coil is $x \times 10^{-2}$ SI units. Find the value of x.



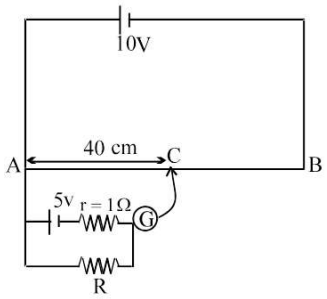
3. The series combination of two batteries, both of the same emf 10 V, but different internal resistance of 20Ω and 5Ω, is connected to the parallel combination of two resistors 30 Ω and R Ω. The voltage difference across the battery of internal resistance 20Ω is zero, the value of R (in Ω) is : _____

4. The reading of the ideal voltmeter (in volt) in the adjoining diagram will be :-

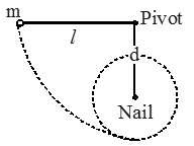


Space for Rough Work /

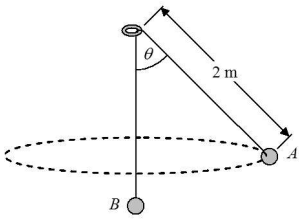
5. A potentiometer wire AB is 100 cm long and has a total resistance of 10 ohm. If the galvanometer shows zero deflection at the position C, then the value of unknown resistance R (in ohm) is.



6. A pendulum of mass m and length l is released from rest in a horizontal position. A nail at a distance d below the pivot, causes the mass to move along the path indicated by the dotted line. The minimum distance such that the mass will swing completely round in the circle shown in figure is d then $\frac{5d}{\ell}$ is



7. Two very small balls A and B of masses 4.0 kg and 5.0 kg are affixed to the ends of a light inextensible cord that passes through a frictionless ring of negligible radius compared to the length of the cord. The ring is fixed at some height above the ground. Ball A is pulled aside and given a horizontal velocity so that it starts moving on a circular path parallel to the ground, keeping ball B in equilibrium as shown. Speed of the ball A is closest to



8. A body crosses the top most point of a vertical circle with critical speed. What will be its centripetal acceleration when the string is horizontal g = 10m/s^2 :-

9. A weightless thread can withstand tension upto 30 N. A stone of mass 0.5 kg is tied to it and is revolved in a circular path of radius 2m in a vertical plane. If g = 10 m/s^2, then the maximum angular velocity of the stone can be:—

10. A body rotating with an angular speed of 600 rpm is uniformly accelerated to 1800 rpm in 10 sec. The number of rotations made in the process is___.

Space for Rough Work /

PART-2 : CHEMISTRY

SECTION-I : (Maximum Marks: 80)

This section contains **20 questions**. Each question has 4 options for correct answer. Multiple-Choice Questions (MCQs) **Only one option is correct**. For each question, marks will be awarded as follows:

Full Marks : +4 If correct answer is selected.

Zero Marks : 0 If none of the option is selected.

Negative Marks : –1 If wrong option is selected.

1. In the reaction, $Cl_2 + OH^- \longrightarrow Cl^- + ClO_4^- + H_2O$, chlorine is :

(A) Oxidised

(B) Reduced

(C) Oxidised as well as reduced

(D) Neither oxidised nor reduced

2. Equivalent weight of $KMnO_4$ in acidic medium

(A) M (B) M/2

(C) M/5 (D) M/3

3. Hydrazine reacts with KIO_3 in presence of HCl as;

$N_2H_4 + IO_3^- + 2H^+ + Cl^- \longrightarrow ICl + N_2 + 3H_2O$

The equivalent masses of N_2H_4 and KIO_3 respectively are : (K = 39, I = 127) :-

(A) 8,87 (B) 8,35.6

(C) 16,53.5 (D) 8,53.5

4. In the redox reaction

$xMnO + yPbO_2 + zHNO_3 \longrightarrow HMnO_4 + Pb(NO_3)_2 + H_2O$

(A) x = 2, y = 5, z = 10

(B) x = 2, y = 7, z = 8

(C) x = 2, y = 5, z = 8

(D) x = 2, y = 5, z = 5

5. How many moles of stannous oxalate can be oxidised into Sn^{+4} and CO_2 using 1 mole of $K_2Cr_2O_7$?:-

(A) 0.5 (B) 1

(C) 1.5 (D) 2

6. In a biological reaction glucose ($C_6H_{12}O_6$) is converted into 2 molecules of pyruvate ($C_3H_4O_3$). Equivalent weight of glucose in this reaction is-

(A) 180 (B) 90

(C) 45 (D) 60

7. 25 ml of a 0.1 M solution of a cation of transition metal Z reacts exactly with 25 ml of 0.04 M acidified $KMnO_4$ solution. Which of the following is most likely to represent the change in oxidation state of Z ?

(A) $Z^+ \longrightarrow Z^{2+}$

(B) $Z^{2+} \longrightarrow Z^{3+}$

(C) $Z^{3+} \longrightarrow Z^{4+}$

(D) $Z^{2+} \longrightarrow Z^{4+}$

Space for Rough Work /

8. The oxidation state of Fe in $Na_3[Fe(NH_3)(CN)_5].2H_2O$

(A) -1 (B) $+1$

(C) $+2$ (D) $+3$

9. In the reaction, $P_2H_4 \longrightarrow PH_3 + P_4H_2$ the equivalent mass of P_2H_4 may be given as :-

(A) $\frac{3m}{4}$ (B) $\frac{5m}{6}$

(C) $\frac{3m}{5}$ (D) $\frac{12m}{13}$

10. Number of moles of $K_2Cr_2O_7$ that can be reduced by 1 mole of Sn^{+2} ions is -

(A) $\frac{1}{3}$ (B) $\frac{3}{2}$

(C) $\frac{5}{6}$ (D) $\frac{6}{5}$

11. Type of isomerism exhibited $[Cr(NCS)(NH_3)_5]\,[ZnCl_4]$:-

(A) Coordination isomerism

(B) Linkage isomerism

(C) Ionization isomerism

(D) Both coordination and linkage isomerism

12. Complexes $[Co(SO_4)(NH_3)_5]Br$ and $[CoBr(NH_3)_5]SO_4$ can be distinguished by : -

(A) Conductance measurement

(B) using $BaCl_2$

(C) using $AgNO_3$

(D) All

13. Assign the hybridisation, shape and magnetic moment of $[Cu(NH_3)_4]SO_4$

(A) dsp^2, square planer, 1.73 BM

(B) sp^3, tetrahedral, 1.73 BM

(C) dsp^2, square planer, 2.44 BM

(D) sp^3, tetrahedral, 2.44 BM

14. The octahedral complex of a metal ion M^{3+} with four monodentate ligands L_1, L_2, L_3 and L_4 absorb wavelength in the region of red, green, yellow and blue, respectively. The increasing order of ligand strength of the four ligands is:

(A) $L_3 < L_2 < L_4 < L_1$

(B) $L_1 < L_2 < L_4 < L_3$

(C) $L_4 < L_3 < L_2 < L_1$

(D) $L_1 < L_3 < L_2 < L_4$

15. Crystal field stabilization energy for high spin d^4 octahedral complex is :-

(A) $-0.6\,\Delta_0$

(B) $-1.8\,\Delta_0$

(C) $-1.6\,\Delta_0 + P$

(D) $-1.2\,\Delta_0$

16. Which of the following complex is most stable among the following :-

(A) $Na_3\left[Fe(C_2O_4)_3\right]$

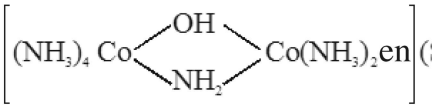
(B) $\left[Co(NH_3)_6\right]^{+3}$

(C) $\left[Cr(NH_3)_6\right]Cl_3$

(D) $Na_3[CoF_6]$

Space for Rough Work /

17. Oxidation state and coordination number of cobalt in given complex –



(A) +3 & 4

(B) +3 & 6

(C) +2 & 4

(D) +2 & 6

18. Match items of Column I with the items of Column II and assign the correct code :

	Column I		Column II
(a)	Cyanide process	(i)	Ultrapure Ge
(b)	Froth Floatation Process	(ii)	Dressing of ZnS
(c)	Electrolytic reduction	(iii)	Extraction of Al
(d)	Zone refining	(iv)	Extraction of Au
		(v)	Purification of Ni

Code :

(A) a (iv) b (ii) c (iii) d (i)

(B) a (ii) b (iii) c (i) d (v)

(C) a (i) b (ii) c (iii) d (iv)

(D) a (iii) b (iv) c (v) d (i)

19. Si and Ge used for semiconductors are required to be of high purity and hence purified by

(A) zone-refining

(B) electrorefining

(C) Van-Arkel's process

(D) cupellation process

20. In which of the following isolations no reducing agent is required:

(A) iron from haematite

(B) Tin from cassiterite

(C) mercury from cinnabar

(D) zinc from zinc blende

Space for Rough Work /

SECTION-II : (Maximum Marks: 20)

This section contains 10 questions Candidates have to attempt any 5 questions out of 10. If more than 5 questions are attempted, then only first 5 attempted questions will be evaluated.

The answer to each question is a **Numerical Value.**

For each question, enter the correct integer value (In case of non-integer value, the answer should be rounded off to the nearest Integer).

Answer to each question will be evaluated according to the following marking scheme:

Full Marks : +4 If correct answer is entered.

Zero Marks : 0 If the question is unanswered.

Negative Marks : –1 If wrong answer is entered.

1. The eq. wt. of $Na_2S_2O_3$ as reductant in the reaction $Na_2S_2O_3 + H_2O + Cl_2 \longrightarrow Na_2SO_4 + 2HCl + S$ is $\frac{Mw}{x}$, then x will be :-

2. 4 mole of a mixture of Mohr's salt and $Fe_2(SO_4)_3$ requires 500 mL of 1 M $K_2Cr_2O_7$ for complete oxidation in acidic medium. The mole % of the Mohr's salt in the mixture is :-

3. In $H_2\underline{S}O_5$, $K_2\underline{Cr}_2O_7$, $\underline{Cr}O_5$ underline element having oxidation number X,Y,Z respectively then X + Y + Z will be

4. The number of electrons to balance the following equation :-

$NO_3^- + 4H^+ + e^- \longrightarrow 2H_2O + NO$ is

5. How many moles of hydrazine (N_2H_4) can be oxidized into N_2 using 2/3 mole of bromate ions ($BrO_3^- \rightarrow Br^-$):-

6. Sum of number of ions in aqueous solution of $CrCl_3.5NH_3$ and $CrCl_3.4NH_3$:-

7. Find sum of number of unpaired electron in $[CoCl_6]^{-3}$, $[Cr(NH_3)_6]^{+3}$ and $[Zn(NH_3)_4]^{+2}$:-

8. Find the number of optically active isomers for $[Pd(en)_2(NH_3)(H_2O)]^{4+}$ cation.

9. How many of the given ores are ores of Cu ?

Azurite, Pyrolusite, Malachite, Cuprite, Chalcocite, Dolomite, Limonite, Galena

10. Find the number of metals which are commercially extracted by carbon reduction method.

Pb, Fe, Zn, Mg, Al, Na, Au, Ag

Space for Rough Work /

PART-3 : MATHEMATICS

SECTION-I : (Maximum Marks: 80)

This section contains **20 questions**. Each question has 4 options for correct answer. Multiple-Choice Questions (MCQs) **Only one option is correct**. For each question, marks will be awarded as follows:

Full Marks : +4 If correct answer is selected.

Zero Marks : 0 If none of the option is selected.

Negative Marks : –1 If wrong option is selected.

1. The value of expression

$$\frac{2(\sin 1^\circ + \sin 2^\circ + \sin 3^\circ + \ldots + \sin 89^\circ)}{2(\cos 1^\circ + \cos 2^\circ + \ldots + \cos 44^\circ) + 1}$$

equals:-

(A) $\sqrt{2}$ (B) $1/\sqrt{2}$ (C) 1/2 (D) 0

2. If $x\cos\theta = y\cos\left(\theta + \frac{2\pi}{3}\right) = z\cos\left(\theta + \frac{4\pi}{3}\right)$ then $\frac{1}{x} + \frac{1}{y} + \frac{1}{z}$ is equal to :-

(A) 0 (B) 1 (C) 2 (D) None

3. The difference between the greatest and the least possible value of the expression $3 - \cos x + \sin^2 x$ is

(A) $\frac{13}{4}$ (B) $\frac{17}{4}$ (C) $\frac{9}{4}$ (D) $\frac{1}{4}$

4. One root of the equation $\cos x - x + \frac{1}{2} = 0$ lies in the interval :-

(A) $\left(0, \frac{\pi}{2}\right)$ (B) $\left(-\frac{\pi}{2}, 0\right)$

(C) $\left(\frac{\pi}{2}, \pi\right)$ (D) $\left(\pi, \frac{3\pi}{2}\right)$

5. The number of solutions of the equation $\tan^2 x - \sec^{10} x + 1 = 0$ in $(0, 10)$, is –

(A) 3 (B) 8

(C) 10 (D) None of these

6. Let $\theta \in [0, 4\pi]$ satisfy the equation $(\sin\theta + 2)(\sin\theta + 3)(\sin\theta + 4) = 6$. If the sum of all the values of θ is of the form $k\pi$, then the value of k is:-

(A) 6 (B) 5

(C) 4 (D) 2

7. If $x \in (\pi, 2\pi)$ & $\frac{\sqrt{1+\cos x} + \sqrt{1-\cos x}}{\sqrt{1+\cos x} - \sqrt{1-\cos x}} = \cot\left(a + \frac{x}{2}\right)$ then 'a' equals :-

(A) $\frac{\pi}{4}$ (B) $\frac{\pi}{2}$

(C) $\frac{\pi}{3}$ (D) None of these

8. Find no. of solution of equation $16^{\sin^2 x} + 16^{\cos^2 x} = 10 ; 0 \leq x \leq 2\pi$

(A) 2 (B) 4 (C) 8 (D) 0

9. If α, β, γ and δ are the solutions of the equation $\tan\left(\theta + \frac{\pi}{4}\right) = 3\tan 3\theta$, no two of which have equal tangents, then the value of $\tan\alpha + \tan\beta + \tan\gamma + \tan\delta$ is

(A) 0 (B) 1

(C) 2 (D) 1/3

10. In a ΔABC, A : B : C = 3 : 5 : 4 Then $[a + b + c\sqrt{2}]$ is equal to

(A) 2b (B) 2c

(C) 3b (D) 3a

Space for Rough Work /

11. An observer on the top of tree, finds the angle of depression of a car moving towards the tree to be 30º. After 3 minutes this angle becomes 60º, so the time taken by car to reach the tree is:-

(A) 4.5 min.

(B) 3 min.

(C) 1.5 min.

(D) None of these

12. In ΔABC, $b^2 + c^2 = 1999\, a^2$,

then $\frac{\cot B + \cot C}{\cot A}$ is equal to :-

(A) $\frac{1}{999}$ (B) $\frac{1}{1999}$

(C) 999 (D) 1999

13. In a triangle ABC, a : b : c = 4 : 5 : 6. The ratio of the radius of the circumcircle to that of the incircle is :-

(A) $\frac{16}{7}$

(B) $\frac{7}{16}$

(C) $\frac{16}{3}$

(D) none of these

14. In a triangle ABC, if $\frac{\cos A}{a} = \frac{\cos B}{b} = \frac{\cos C}{c}$ and a = 2, then its area is –

(A) $2\sqrt{3}$ (B) $\sqrt{3}$

(C) $\frac{\sqrt{3}}{2}$ (D) $\frac{\sqrt{3}}{4}$

15. $\int \frac{1+x^2}{(1-x^2)\sqrt{1+x^4}}\,dx$ equals -

(A) $\ln\left(\frac{(x^2+1)+\sqrt{x^4+1}}{x}\right)+C$

(B) $C-\frac{1}{\sqrt{2}}\ln\left(\frac{\sqrt{x^4+1}-\sqrt{2}x}{(x^2-1)}\right)$

(C) $C-\tan^{-1}\left(\sqrt{\sqrt{1+\frac{1}{x^4}}-1}\right)$

(D) $\frac{\sqrt{x^4+x^2+1}}{x}+C$

16. $\int e^{\tan^{-1}x}(1+x+x^2)\,d(\cot^{-1}x) =$

(A) $e^{\tan^{-1}x}+c$

(B) $-e^{\tan^{-1}x}+c$

(C) $-xe^{\tan^{-1}x}+c$

(D) $xe^{\tan^{-1}x}+c$

17. If $f(x) = \int \left(x^2+2x^4+3x^6\right)\left(1+x^2+x^4\right)^{\frac{1}{2}}dx$ and $f(0) = 0$, then value of $(f(1))^2$ is

(A) 2 (B) 0 (C) 1 (D) 3

18. $\int \frac{1}{\sqrt{\sin^3 x \sin(x+\alpha)}}\,dx,\ \alpha \neq n\pi, n \in Z$ is equal to

(A) $-2\,\text{cosec}\,\alpha\,(\cos\alpha - \tan x \sin\alpha)^{1/2}+C$

(B) $-2(\cos\alpha + \cot x \sin\alpha)^{1/2}+C$

(C) $-2\,\text{cosec}\,\alpha\,(\cos\alpha + \cot x \sin\alpha)^{1/2}+C$

(D) $-2\,\text{cosec}\,\alpha\,(\sin\alpha + \cot x \cos\alpha)^{1/2}+C$

Space for Rough Work /

19. $\int \frac{dx}{\sin^4 x + \cos^4 x}$ is equal to-

(A) $\frac{1}{\sqrt{2}} \tan^{-1}\left(\frac{1}{\sqrt{2}}\tan 2x\right) + C$

(B) $\sqrt{2}\tan^{-1}\left(\frac{1}{\sqrt{2}}\tan 2x\right) + C$

(C) $\frac{1}{\sqrt{2}} \tan^{-1}\left(\frac{1}{\sqrt{2}}\cot 2x\right) + C$

(D) None of these

20. If $\int f(x)\,dx = \Psi(x)$, then $\int x^5 f(x^3)\,dx$ is equal to

(A) $\frac{1}{3}[x^3\Psi(x^3) - \int x^2\Psi(x^3)dx] + C$

(B) $\frac{1}{3}x^3\Psi(x^3) - 3\int x^3\Psi(x^3)dx + C$

(C) $\frac{1}{3}x^3\Psi(x^3) - \int x^2\Psi(x^3)dx + C$

(D) $\frac{1}{3}[x^3\Psi(x^3) - \int x^3\Psi(x^3)dx] + C$

SECTION-II : (Maximum Marks: 20)

This section contains 10 questions Candidates have to attempt any 5 questions out of 10. If more than 5 questions are attempted, then only first 5 attempted questions will be evaluated.

The answer to each question is a **Numerical Value.**

For each question, enter the correct integer value (In case of non-integer value, the answer should be rounded off to the nearest Integer).

Answer to each question will be evaluated according to the following marking scheme:

Full Marks : +4 If correct answer is entered.

Zero Marks : 0 If the question is unanswered.

Negative Marks : –1 If wrong answer is entered.

1. Let α and β be two real roots of the equation $(k+1)\tan^2 x - \sqrt{2}.\lambda \tan x = (1-k)$, where $k(\neq -1)$ and λ are real numbers. If $\tan^2(\alpha+\beta) = 50$, then a value of $|\lambda|$ is ;-

2. If $2\tan^2 x - 5\sec x$ is equal to 1 for exactly 7 distinct values of $x \in \left[0, \frac{n\pi}{2}\right]$, $n \in N$, then the greatest value of n is :-

3. If solution of equation $3\cos^2\theta - 2\sqrt{3}\sin\theta\cos\theta - 3\sin^2\theta = 0$ are $n\pi + \frac{\pi}{r}$ and $n\pi + \frac{\pi}{s}$ then $|r-s|$ is equal to :-

4. The angle of elevation of the top of a vertical tower from a point A, due east of it is 45°. The angle of elevation of the top of the same tower from a point B, due south of A is 30°. If the distance between A and B is $54\sqrt{2}$ m, then the height of the tower (in metres), is :-

Space for Rough Work /

5. A house of height 100 m subtends a right angle at the window of an opposite house. If the height of the window be 64 m, then the distance between the two houses is

6. Two vertical poles of heights, 20m and 80m stand a part on a horizontal plane. The height (in meters) of the point of intersection of the lines joining the top of each pole to the foot of the other, from this horizontal plane is :-

7. If two adjacent sides of a cyclic quadrilateral are 2 and 5 and the angle between them is 60^{o}. If the third side is 3, then the remaining fourth side is :-

8. A chimney of 20 m height standing on the top of a building subtends an angle whose tangent is $\frac{1}{6}$ at a distance of 70 m from the foot of the building, then the height of building is

9. If the integral $\int \frac{5\tan x}{\tan x - 2}\,dx = x + a\,\ell n\,|\sin x - 2\cos x| + k$, then a is equal to :

10. If, $\int \frac{x + \cos 2x + 1}{x\cos^2 x}dx = f(x) + K.\,\ell n|x| + C$

where $f\left(\frac{\pi}{4}\right) = 1$, then $f(0) + 10K$ is equal to

Space for Rough Work /