

MELUHA INTERNATIONAL SCHOOL

HYDERABAD

SR MPC

Time: 3 Hours

JEE MAINS SR GT

Date:16-04-2020

Max. Marks: 300

SECTION – I

(SINGLE CORRECT ANSWER TYPE)

This section contains 20 multiple choice questions. Each question has 4 options (A), (B), (C) and (D) for its answer, out of which **ONLY ONE** option can be correct.

Marking scheme: +4 for correct answer, 0 if not attempted and -1 if not correct.

MATHEMATICS

- If Z is a complex number satisfying $z^4+z^3+2z^2+z+1=0$ then the set of possible values of $|z|$ is
A) $\{1,2\}$ B) $\{1\}$ C) $\{1,2,3\}$ D) $\{1,2,3,4\}$
- If α, β, γ are the roots of $x^3-3x^2+3x+7=0$ (ω is cube root of unity) then $\frac{\alpha-1}{\beta-1} + \frac{\beta-1}{\gamma-1} + \frac{\gamma-1}{\alpha-1}$ is
A) $\frac{3}{\omega}$ B) ω^2 C) $2\omega^2$ D) 3ω
- If number of terms in the expansion of $(x-2y+3z)^n$ are 45, then maximum value of n_{c_r} is
A) 70 B) 126 C) 35 D) 127
- The number of eight digit numbers (each having distinct digits) that are divisible by 9 is
A) $15(7!)$ B) $20(7!)$ C) $24(7!)$ D) $36(7!)$
- If the exponents of 5 and 7 in $100_{c_{50}}$ are respectively x and y then
A) $x < y$ B) $x = y$ C) $x > y$ D) $|x - y| = 2$
- 10 identical mangoes are to be distributed among 5 persons. The probability that atleast one of them will receive none is
A) $\frac{35}{143}$ B) $\frac{108}{143}$ C) $\frac{18}{143}$ D) $\frac{125}{143}$
- The weighted mean of first n natural numbers whose weights are equal to the number of selections out of n natural numbers of corresponding numbers respectively is
A) $\frac{n \cdot 2^{n-1}}{2^n - 1}$ B) $\frac{3n(n+1)}{2(2n+1)}$ C) $\frac{(n+1)(2n+1)}{6}$ D) $\frac{n(n+1)}{2}$
- If α is non-real and $\alpha = \sqrt[5]{1}$, then the value of $2^{|1+\alpha+\alpha^2+\alpha^3+\alpha^4|}$ is equal to
A) -1 B) 4 C) 1 D) 2
- A random variable x has the probability distribution

X	1	2	3	4	5	6	7	8
P(X)	0.15	0.23	0.12	0.10	0.20	0.08	0.07	0.05

For the event $E = \{X \text{ is a prime number}\}$ and $F = \{X < 4\}$ the probability of $P(E \cup F)$ is

- A) 0.35 B) 0.77 C) 0.87 D) 0.50
- Which of the following is a tautology
A) $\sim(p \vee \sim q) \rightarrow (p \vee q)$ B) $\neg(p \vee q) \rightarrow (p \vee q)$ C) $\sim(p \wedge \sim q) \rightarrow (p \vee q)$ D) $\sim(p \vee \sim q) \rightarrow (p \wedge q)$
- A pair of tangents are drawn to a unit circle with centre at the origin and these tangents intersect at A, enclosing an angle of 60° . The Area enclosed by these tangents and the arc of the circle is
A) $\frac{2}{\sqrt{3}} - \frac{\pi}{6}$ B) $\sqrt{3} - \frac{\pi}{3}$ C) $\frac{\pi}{3} - \frac{\sqrt{3}}{6}$ D) $\sqrt{3} \left(1 - \frac{\pi}{6}\right)$

12. If r_1 and r_2 are the radii of smallest and largest circles which passes through (5,6) and touches the circle $(x-2)^2+y^2=4$ then r_1r_2 is
 A) $\frac{4}{41}$ B) $\frac{41}{4}$ C) $\frac{5}{41}$ D) $\frac{41}{6}$
13. A water jet from a fountain reaches its maximum height of 4m at a distance 0.5m from the vertical passing through the point 'O' of water outlet the height of the jet above the horizontal OX at a distance of 0.75m from the point 'O' is
 A) 5m B) 6m C) 3m D) 7m
14. $\int \frac{1}{(\sqrt{1+x^2}-x)^n} dx (n \neq \pm 1) = \frac{1}{2} \left[\frac{Z^{n+1}}{n+1} + \frac{Z^{n-1}}{n-1} \right] + c$ where $Z = \dots\dots\dots$
 A) $x - \sqrt{1+x^2}$ B) $\sqrt{1+x^2} - x$ C) $x + \sqrt{1+x^2}$ D) $x - \sqrt{1-x^2}$
15. The eccentricity of $19x^2 + 14xy + 16y^2 = 60$ is
 A) $\frac{1}{2}$ B) $\frac{1}{3}$ C) $\frac{1}{4}$ D) $\frac{1}{5}$
16. If $xf(x) = 3f^2(x) + 2$ then $\int \frac{2x^2 - 12xf'(x) + f(x)}{(6f(x) - x)(x^2 - f(x))^2} dx =$
 A) $\frac{1}{x^2 - f(x)} + c$ B) $\frac{1}{x^2 + f(x)} + c$ C) $\frac{1}{x - f(x)} + c$ D) $\frac{1}{x + f(x)} + c$
17. f is an odd function. It is also known that $f(x)$ is continuous for all values of x and is periodic with period 2. If $g(x) = \int_0^x f(t) dt$ then
 A) $g(x)$ is odd B) $g(n) = 0, n \in \mathbb{N}$ C) $g(2n) = 0, n \in \mathbb{N}$ D) $g(x)$ is non-periodic
18. Area bounded by the curve $xy^2 = a^2(a-x)$ and the y -axis is _____ sq units.
 A) $\frac{\pi a^2}{2}$ B) πa^2 C) $3\pi a^2$ D) None of these
19. The differential equation of the family of curves $x^2 = 4b(y+b)$, $b \in \mathbb{R}$ is
 A) $x(y^1)^2 = x - 2yy^1$ B) $xy^{11} = y^1$ C) $x(y^1)^2 = x + 2yy^1$ D) $x(y^1)^2 = 2yy^1 - x$
20. If for $x \geq 0$, $y = y(x)$ is the solution of the differential equation $(x+1)dy = \{(x+1)^2 + y - 3\}dx$, $y(2) = 0$ then $y(3) =$
 A) 1 B) 2 C) -3 D) 3

SECTION-II

(Numerical Value Answer Type)

This section contains 5 questions. The answer to each question is a Numerical values comprising of positive or negative decimal numbers.

Marking scheme: +4 for correct answer, 0 in all other cases.

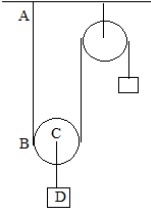
21. If $P(A \cap B) = \frac{1}{4}$, $P(A^1 \cap B^1) = \frac{1}{5}$ and $P(A) = P(B) = P$ then find the value of $40P \dots\dots$
22. If the value of $15C_0 + 15C_1 + 15C_2 + \dots\dots + 15C_7$ is $(m)^2$, then find the value of m .
23. If the median and the range of four numbers $\{x, y, 2x+y, x-y\}$; where $0 < y < x < 2y$, are 10 and 28 respectively, then the mean of the numbers is....
24. If $y = mx + c$ is tangent to the Hyperbola $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$ having eccentricity 5, then the least positive integral value of 'm' is _____
25. If $\int_0^1 \cot^{-1}(1-x+x^2) dx = \lambda \int_0^1 \tan^{-1} x dx$ then $\frac{\lambda}{3} =$ _____

PHYSICS
SECTION – I
(SINGLE CORRECT ANSWER TYPE)

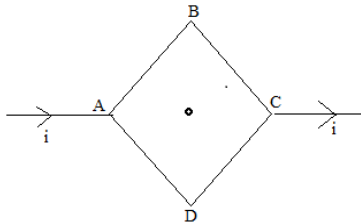
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26. Both the strings, shown in figure, are made of same material and have cross-section. The pulleys are light. The wave speed in the string AB is V_1 and in CD, it is V_2 . Then V_1/V_2 is



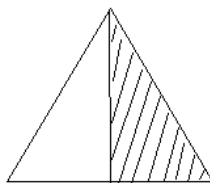
- A. 1 B. 2 C. $\sqrt{2}$ D. $\frac{1}{\sqrt{2}}$
27. If the sound level in a room is increased from 50dB to 60dB, by what factor level is the pressure amplitude increased?
A. $\sqrt{10}$ B. $\sqrt{5}$ C. 10 D. $\sqrt{2}$
28. A charged particle (q, m) is released from origin in an electric field $E = \alpha - \beta x$ where α and β are constants and x is distance from origin. Find the velocity of particle
A. $V = \sqrt{\frac{q}{m}(\beta x - 2\alpha x)}$ B. $V = \sqrt{\frac{q}{m}\left(\frac{x}{2\alpha} - \beta x^2\right)}$
C. $V = \sqrt{\frac{q}{m}(2\alpha x - \beta x^2)}$ D. $V = \sqrt{qm(2\alpha x - \beta x^2)}$
29. Two large conducting plates are placed parallel to each other with a separation 'd'. An electron ($-e, m$) starting from rest near one of the plates reaches the other plate in time t_0 . The surface charge density on the inner surface is
A) $\sigma = \frac{2\epsilon_0 d}{emt_0^2}$ B) $\frac{2m\epsilon_0 d}{et_0^2}$ C) $\frac{m\epsilon_0 d}{2et_0}$ D) $\frac{2mt_0^2}{e\epsilon_0 d}$
30. Two isolated metallic solid spheres of radii R and $2R$ are charged such that both of these have same surface charge density σ . The spheres are located far away from each other and connected by a thin conducting wire. Find the new charge density on the bigger sphere.
A) $\frac{5\sigma}{6}$ B) $\frac{5\sigma}{2}$ C) $\frac{5\sigma}{4}$ D) $\frac{5\sigma}{3}$
31. ABCD is a square of edge 'a' and resistance of wire ABC is R_0 and of ADC is $2R_0$. Find magnetic field magnitude and direction at O.



- A) $\frac{2\mu_0 i}{5\pi a} \otimes$ B) $\frac{\mu_0 i}{3\pi a} \odot$ C) $\frac{\sqrt{2}\mu_0 i}{3\pi a} \otimes$ D) $\frac{\sqrt{2}\mu_0 i}{3\pi a} \odot$

32. A tightly wound, long solenoid has n turns per unit length of radius r carries a current i . A particle having charge q and mass m is projected from a point on the axis in a direction perpendicular to the axis. What can be the maximum speed for which the particle does not strike the solenoid?
- A) $\frac{\mu_0 ni}{2mqr}$ B) $\frac{\mu_0 ir}{2nmq}$ C) $\frac{\mu_0 nr}{2mqi}$ D) $\frac{\mu_0 niqr}{2m}$
33. A square coil of edge L having ' n ' turns carries a current i . It is kept on a smooth horizontal plate. A uniform magnetic field B exists in a direction parallel to an edge. The total mass of the coil is M . What should be the minimum value of B for which the coil will start tipping over?
- A) $B_{\min} = \frac{Mg}{2niL}$ B) $B_{\min} = \frac{ML}{2nig}$ C) $B_{\min} = \frac{Mi}{2ngL}$ D) $B_{\min} = \frac{Mg}{niL}$
34. Find magnetic potential due to a short dipole of magnetic moment $\sqrt{5} A - m^2$ at a point $2m$ away from it in a direction making an angle of 45° with the dipole axis.
- A) $\frac{\sqrt{5}}{2\sqrt{2}} \times 10^{-7} T.m$ B) $\frac{\sqrt{5}}{4\sqrt{2}} \times 10^{-7} T.m$ C) $\frac{\sqrt{3}}{2\sqrt{2}} \times 10^{-7} T.m$ D) $\frac{\sqrt{3}}{4\sqrt{2}} \times 10^{-7} T.m$
35. A magnetic flux through a stationary loop with a resistance R varies during the time interval T as $\phi = at(T - t)$. Find the amount of heat generated in the loop during that time.
- A) $\frac{a^2 T}{3R}$ B) $\frac{a^2 T^2}{3R}$ C) $\frac{a^2 T^3}{3R}$ D) $\frac{a T^3}{3R}$
36. An alternating voltage $V = 200\sqrt{2} \sin(100t)V$ is connected to a $1 \mu F$ capacitor through an AC ammeter. What will be the reading of the ammeter?
- A) 20 mA B) 2 mA C) 40 mA D) 20 A
37. A small metal plate (work function ϕ) is kept at distance d from a singly ionized, fixed ion. A monochromatic light beam is incident on the metal and photo electrons are emitted. Find maximum wavelength so that some of photoelectrons may go round the ion along a circle.
- A) $\frac{hc}{\frac{e}{8\pi \epsilon_0 d} + \phi}$ B) $\frac{hc}{\frac{e^2}{4\pi \epsilon_0} + \phi}$ C) $\frac{hc}{4\pi \epsilon_0 de^2 + \phi}$ D) $\frac{hc}{\frac{e^2}{8\pi \epsilon_0 d} + \phi}$
38. A small particle of mass m moves in such away that the potential energy $U = \frac{1}{2} m \omega^2 r^2$, where ω is a constant and r is the distance of the particle from the origin. Assume Bohr's model of quantisation of angular momentum and circular orbits. Find the radius of n th orbit.
- A) $\sqrt{\frac{nh}{4\pi m\omega}}$ B) $\sqrt{\frac{nh}{2\pi m\omega}}$ C) $\sqrt{\frac{nh}{8\pi m\omega}}$ D) $\sqrt{\frac{nh}{\pi m\omega}}$
39. Calculate the activity of one gram sample ${}_{28}\text{Sr}^{90}$ whose half life period is 28 years.
- A) 5 dps B) 5×10^6 dps C) 5×10^9 dps D) 50×10^2 dps
40. A p-type semiconductor has acceptor levels 57 meV above the valance band. Find the maximum wavelength of light to an create a hole.
- A) $2.18 \times 10^{-5} \text{ m}$ B) $4 \times 10^5 \text{ m}$ C) $1.5 \times 10^{-2} \text{ m}$ D) $3.2 \times 10^{-8} \text{ m}$
41. A concave mirror of focal length f produces a real image n time the size of the object. What is the distance of the object from the mirror?
- A) $\frac{(n+2)f}{n}$ B) $(n+1)f$ C) $\left(\frac{n+3}{n}\right)f$ D) $\left(\frac{n+1}{n}\right)f$

42. A light ray is incident on a prism in minimum deviation position and suffers a deviation of 40° . If the shaded half of the prism is removed off then the same ray will suffer a deviation of



- A) 20° B) 40° C) 80° D) 0°
43. Diameter of a plano-convex lens is 6 cm and its thickness at the centre is 3mm. What is the focal length of the lens if the speed of light in the material of lens is 2×10^8 m/sec?
A) 10 cm B) 20 cm C) 30 cm D) 5 cm
44. In a compound microscope, the object is 1cm from the objective lens. The lenses are 30 cm apart and the intermediate image is 5 cm from the eye-piece. What magnification is produced?
A) +125 B) -125 C) +120 D) -120
45. Two coherent sources of light of intensity ratio β interfere, then $\frac{I_{max} - I_{min}}{I_{max} + I_{min}}$ is
A) $\frac{2\beta}{1+\beta}$ B) $\frac{\sqrt{\beta}}{2(1+\beta)}$ C) $\frac{\sqrt{2\beta}}{1+\beta}$ D) $\frac{2\sqrt{\beta}}{1+\beta}$

SECTION - II

(Numerical Value Answer Type)

This section contains 5 questions. The answer to each question is a Numerical values comprising of positive or negative decimal numbers.

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46. When a certain potentiometer is used to measure an unknown emf, the standard emf has a value of 1.2076V. When the standard emf is in the circuit and resistances R_1 and R_2 are adjusted so that no current flows through the galvanometer, the values of R_1 and R_2 are 2.42Ω and 4.84Ω . When the unknown emf is in circuit, the value of R_2 is 3.66Ω . What is the value of unknown emf _____ volts.
47. The potential difference across the terminals of a battery of emf 12V and internal resistance 2Ω drops to 10V when it is connected to a silver voltmeter. Find the silver deposited at the cathode in half an hour _____ (in grams) (Atomic Weight of silver is 107.9 g/mole)
48. The input resistance of a common emitter transistor amplifier, if the output resistance is $500K\Omega$, the current gain $\alpha=9.98$ and power gain is 6.0625×10^6 is _____ Ω
49. A bulb is placed at a depth of $2\sqrt{7}$ cm in water and a floating opaque disc is placed over the bulb so that the bulb is not visible from the surface. The minimum diameter of the disc is _____ cm.
50. In young's double slit experiment, we get 60 fringes in the field of views if we use light of wavelength 4000\AA . The number of fringes we will get if the same field of view if we use light of wavelength 6000\AA is _____

CHEMISTRY

SECTION - I

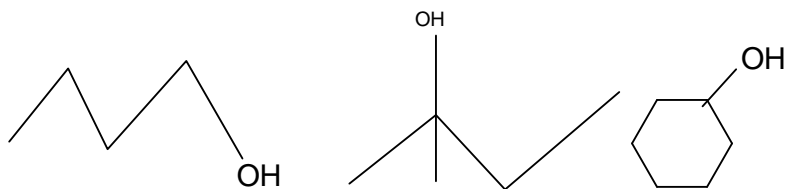
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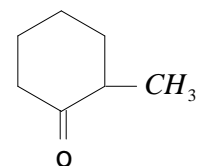
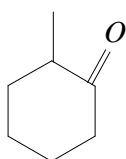
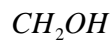
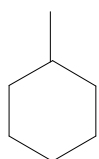
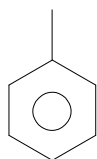
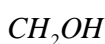
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51. The vapour pressure of pure benzene at $25^\circ C$ is 639.7mm Hg and the vapour pressure of a solution of solute in benzene at $25^\circ C$ is 631.9 mm Hg. The molarity of the solution is.
A) 0.156 B) 0.108 C) 0.518 D) 0.815

52. The concentration of cation vacancies per mole when $NaCl$ is doped with 10^{-3} mole percentage of $SrCl_2$
 A) 6.023×10^{20} B) 6.023×10^{23} C) 6.023×10^{21} D) 6.023×10^{18}
53. During the electrolysis of acidulated water, the ratio of mass of hydrogen, oxygen obtained at cathode and Anode is.
 A) 3:1 B) 1:1 C) 2:1 D) 1:8
54. The initial concentration is reduced to $\frac{1}{4}$ th in a first order reaction, The time taken for half the reaction to complete
 A) Remains same B) Becomes 4 times C) Becomes one- fourth D) Doubles
55. The coagulation of 200ml of positive colloid took place when 0.73 gr HCl added to it without changing the volume much. The flocculation value of HCl for the colloid is.
 A) 36.5 B) 100 C) 200 D) 150
56. $C_6H_6 + O_3 \rightarrow x \xrightarrow{Zn/H_2O} y$; x and y are respectively
 A) Diozonide; glycol B) triozonide, glyoxalic acid
 C) Triozonide, glyoxal D) monoozonide, oxalic acid
57. The ion that cannot undergo disproportionation is
 A) ClO_4^- B) ClO_3^- C) ClO_2^- D) ClO^-
58. The pair that does not require calcination is
 A) ZnO and MgO B) $ZnCO_3$ and CaO
 C) Fe_2O_3 and $CaCO_3, MgCO_3$ D) ZnO, and Fe_2O_3, xH_2O
59. In the extraction of iron from haematite, the charge used is haematite, coke and limestone in the following weight ratio.
 A) 1:1:1 B) 8:4:1 C) 8:1:4 D) 1:4:8
60. The difference in the number of unpaired electrons of a metal ion in its high – spin and low – spin octahedral complexes is two the metal ion is.
 A) Co^{2+} B) Fe^{2+} C) Mn^{2+} D) Ni^{2+}
61. The relative rates of reaction with concentrated H_2SO_4 of the following is.
 a) b) c)

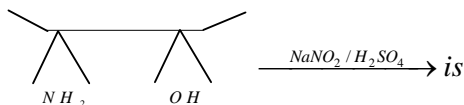


- A) $a > b > c$ B) $b > a > c$ C) $a > c > b$ D) $b > c > a$
62. Which of the following will react fastest with sodium?
 A) B) C) D)



63. A sample of acetaldehyde contained some ethyl alcohol as impurity. The reagent useful for the purification of CH_3CHO is
 A) $NaHCO_3$ B) Na_2CO_3 C) $NaHSO_3$ D) PCl_5

64. Oxidation product of 'X' with molecular formula C_2H_4O is 'Y' with molecular formula $C_2H_4O_2$. The compound Y is.
 A) Acetic acid B) Formic acid C) Propionic acid D) Butyric acid
65. The major product of the reaction



- A) B) C) D)
66. Nylon 6,6 is a condensation polymer of two monomer X and Y, The number of $-CH_2-$ groups in X and Y are respectively.
 A) 6,4 B) 6,6 C) 5,6 D) 6,2
67. Which polymer is used in the manufacture of paint and lacquers?
 A) Bakelite B) Glyptal C) poly vinyl chloride D) poly propene
68. Among the following, the essential amino acid is.
 A) Alanine B) Valine C) Aspartic acid D) serine
69. Medicine which is an antibiotic is
 A) Ampicillin B) Aspirin C) Cal pole D) Chloroquine.
70. Which of following is a bactericidal antibiotic?
 A) Ofloxacin B) Tetracycline C) Chloramphenicol D) Erythromycin

SECTION-II

(Numerical Value Answer Type)

This section contains 5 questions. The answer to each question is a Numerical values comprising of positive or negative decimal numbers.

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71. Total number of $Cr - O$ bonds in chromate ion and dichromate ion is. _____
72. Compound

$$A \xrightarrow[H_3O^+]{CH_3MgBr} B \xrightarrow[573K]{Cu} CH_3 - \underset{\substack{| \\ CH_3}}{C} = CH - CH_3$$
- Percentage carbon in compound 'A' is
73. Given a solution of HNO_3 of density 1.4g/ml and 63 w/w .Determine molarity of HNO_3 solution.
74. The number of chiral carbons in Chloramphenicol is.
75. The number of π bonds in ClO_4^- ion is