

JEE MAIN-2024-25 (Part Test-2)

(Physics, Chemistry and Mathematics)

SYLLABUS

Physics :- Magnetic Effect of Current, Magnetism of matter
Chemistry :- Electrochemistry, Chemical Kinetics
Mathematics :- LCD, MOD, AOD

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PART TEST

CLASS-XIIth

Date :-

Time :- 3:00 Hrs.

Marks :- 300

Important Instructions :

1. The test duration is of **3 hours**.
2. The Test Booklet consists of 90 questions. The maximum marks are 300.
3. There are **three** parts in the question paper consisting of **Physics, Chemistry** and **Mathematics** having 30 questions in each part of equal weightage. Each part (subject) has two sections.
 - (i) **Section-A:** This section contains 20 multiple choice questions which have only one correct answer. Each question carries **4 marks** for correct answer and **-1 mark** for wrong answer.
 - (ii) **Section-B:** This section contains 10 questions. In Section-B, attempt any **five questions out of 10**. The answer to each of the questions is a numerical value. Each question carries **4 marks** for correct answer and **-1 mark** for wrong answer. For Section-B, the answer should be rounded off to the nearest integer.

Student's Name :-

School Name :-

Student's Signature :-

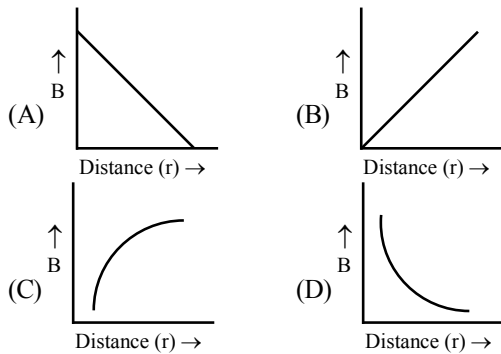
Invigilator's Signature :-

PE

PHYSICS

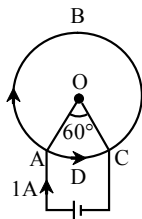
SECTION-A

1. Which of the following graphs represent variation of magnetic field B with distance r for a straight long wire carrying current ?



2. There is magnetic material of coercivity 2×10^3 A/m. What current should flow through solenoid of length 15 cm having 150 turns to demagnetise the substance completely ?
 (A) 4 A (B) 2.5 A (C) 2 A (D) 3.5 A

3. A cell is connected between the points A and C of a circular conductor ABCD with O as centre and angle $AOC = 60^\circ$. If B_1 and B_2 are the magnitudes of the magnetic fields at O due to the currents in ABC and ADC respectively, then ratio $\frac{B_1}{B_2}$ is -



- (A) 1 (B) 2 (C) 5 (D) 6

4. A coil having N turns is wound tightly in the form of a spiral with inner and outer radii a and b respectively. When a current I passes through the coil, the magnetic field at the centre is -

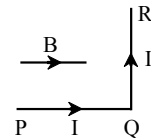
(A) $\frac{\mu_0 NI}{b}$ (B) $\frac{2\mu_0 NI}{a}$
 (C) $\frac{\mu_0 NI}{2(b-a)} \log \frac{b}{a}$ (D) $\frac{\mu_0 IN}{2(b-a)} \log \frac{a}{b}$

5. Two long parallel wires separated by a distance r have equal currents I flowing in each. Either wire experiences a magnetic force F N/m. If the distance r is increased to $3r$ and current in each wire is reduced to $I/3$, the force between them will now be -
 (A) $3F$ N/m (B) $9F$ N/m
 (C) $(F/9)$ N/m (D) $(F/27)$ N/m

6. When a magnet is suspended at an angle 30° from the magnetic meridian, it makes an angle 45° with horizontal. What will be the actual angle of dip?

(A) $\tan^{-1} \left(\frac{\sqrt{3}}{2} \right)$ (B) $\tan^{-1} (\sqrt{3})$
 (C) 45° (D) 30°

7. A wire PQR is bent as shown in figure and is placed in a region of uniform magnetic field B . The length of $PQ = QR = l$. A current I ampere flows through the wire as shown. The magnitude of force on PQ and QR will be -



- (A) $BIl, 0$ (B) $2BIl, 0$
 (C) $0, BIl$ (D) $0, 0$

8. The magnetic susceptibility for diamagnetic materials is -

- (A) small and negative (B) small and positive
 (C) large and positive (D) large and negative

9. At the magnetic north pole of the earth, the value of the horizontal component of earth's magnetic field and angle of dip are respectively -

- (A) zero, maximum (B) maximum, minimum
 (C) maximum, maximum (D) minimum, minimum

10. In a certain region of space, electric field \vec{E} and magnetic field \vec{B} are perpendicular to each other and an electron enters in the region perpendicular to the direction of \vec{B} and \vec{E} both and moves undeflected, then velocity of electron is -

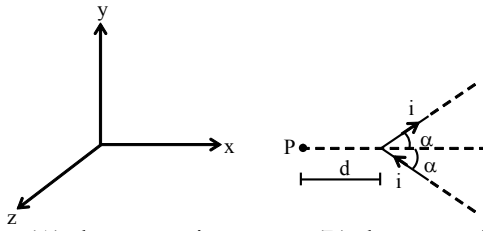
(A) $\frac{|\vec{E}|}{|\vec{B}|}$ (B) $\vec{E} \times \vec{B}$ (C) $\frac{|\vec{B}|}{|\vec{E}|}$ (D) $\vec{E} \cdot \vec{B}$

11. A coil has 200 turns and area of 70 cm^2 . The magnetic field perpendicular to the plane of the coil is 0.3 Wb/m^2 and take 0.1 sec to rotate through 180° . The value of the induced e.m.f. will be -
 (A) 8.4 V (B) 84 V (C) 42 V (D) 4.2 V

12. A ferromagnetic material is placed in an external magnetic field. The size of magnetic domains -

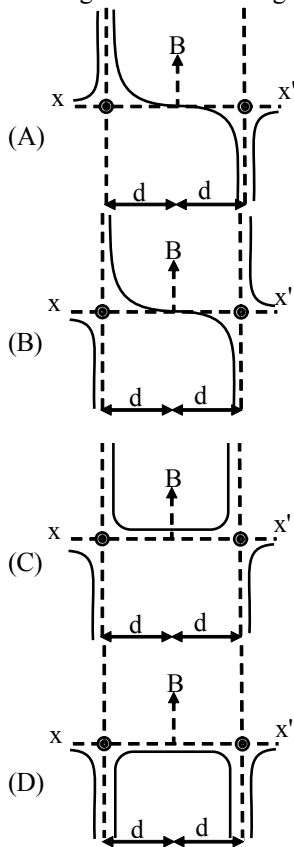
- (A) decreases only
 (B) increases only
 (C) sometimes increases and sometimes decreases
 (D) remains unchanged only

13. V shaped wire is in x-y plane. The direction of the field B at P is -

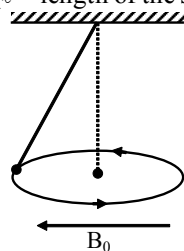


- (A) along + x axis (B) along + z axis
(C) along - x axis (D) along + y axis

14. Two long parallel wires are at a distance 2d apart. They carry steady equal currents flowing out of the plane of the paper, as shown. The variation of the magnetic field B along the line xx' is given by

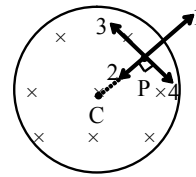


15. A uniform current carrying ring of mass m and radius R is connected by a massless string as shown. A uniform magnetic field B_0 exist in the region to keep the ring in horizontal position, then the current in the ring is (ℓ = length of the string) -



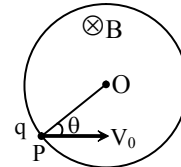
- (A) $\frac{mg}{\pi R B_0}$ (B) $\frac{mg}{R B_0}$
(C) $\frac{mg}{3\pi R B_0}$ (D) $\frac{mg}{\pi R^2 B_0}$

16. A uniform but time varying magnetic field exists in cylindrical region and directed into the paper. If field decrease with time and a positive charge placed at any point inside the region. Then it moves -



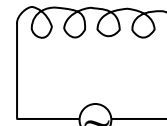
- (A) along 1 (B) along 2
(C) along 3 (D) along 4

17. A particle of charge q and mass m is projected with a velocity V_0 towards a circular region having uniform magnetic field B perpendicular and into the plane of paper from point P as shown in the figure. R is the radius and O is the centre of the circular region. If the line OP makes angle θ with the direction of V_0 , then the value of V_0 so that particle passes through O is -



- (A) $\frac{qBR}{m \sin \theta}$ (B) $\frac{qBR}{2m \sin \theta}$
(C) $\frac{2qBR}{m \sin \theta}$ (D) $\frac{3qBR}{2m \sin \theta}$

18. If a Bismuth rod is introduced in the air coil as shown then current in the coil -



$$V = 10 \sin \omega t$$

- (A) increases (B) remains unchanged
(C) decreases (D) none of these

19. An equilateral triangular loop of side l carries a current I. It is placed in a magnetic field B such that the plane of loop is in the direction of B. The torque on the loop is -

- (A) zero (B) IBl
(C) $\frac{\sqrt{3}}{2} I l^2 B^2$ (D) $\frac{\sqrt{3}}{4} I B l^2$

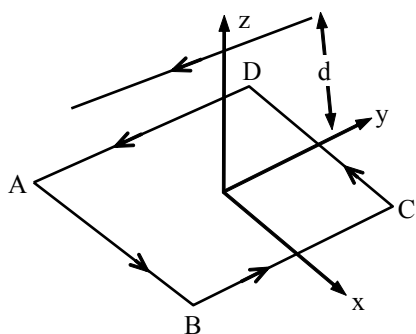
20. A magnet is suspended horizontally in the earth's magnetic field. When it is displaced and released, it oscillates in a horizontal plane with a period T. If a piece of wood of same M.I as the magnet is attached to the magnet, the new period of oscillation of the system would be -

- (A) $\frac{T}{3}$ (B) $\frac{T}{2}$ (C) $\frac{T}{\sqrt{2}}$ (D) $\sqrt{2}T$

SECTION-B

21. A charged particle is accelerated through a potential difference of 12 kV and acquires a speed of 10^6 ms^{-1} . It is projected perpendicularly into the magnetic field of strength 0.2 T. The radius of circle described is..... $\times 10 \text{ cm}$.

22. Figure shows a square loop. 20 cm on each side in the x-y plane with its centre at the origin. The loop carries a current of 7A. Above it at $y=0, z=12\text{cm}$ is an infinitely long wire parallel to the x axis carrying a current of 10 A. The net force on the loop is ——— $\times 10^{-4}\text{N}$.



23. A charge of 1 coulomb is placed at one end of a non-conducting rod of length 0.6m. The rod is rotated in a vertical plane about a horizontal axis passing through the other end of the rod with an angular velocity $10^4\pi \text{ rad/sec}$. Find the magnetic field at a point on the axis of rotation at a distance of 0.8m from the centre of the path is $N\pi \times 10^{-4} \text{ T}$, then find value of N

24. A capacitor of capacitance $50 \mu\text{F}$ is connected to a battery of 20 volts for a long time and then disconnected from it. It is now connected across a long solenoid having 8000 turns per metre. It is found that the potential difference across the capacitor drops to 90% of its maximum value in 2.0 seconds. The average magnetic field produced at the centre of the solenoid during this period is $N\pi \times 10^{-8} \text{ T}$. Then find value of N.

25. Consider a nonconducting disc of radius r and mass m which has a charge q distributed uniformly over it. The disk is rotated about its axis with an angular speed ω . Magnetic moment of the disc is $\frac{1}{N} q\omega r^2$. Then find value of N.

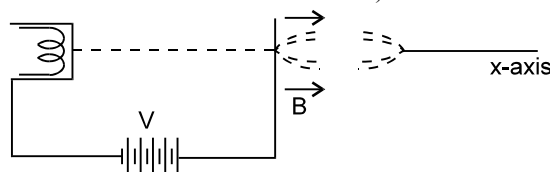
26. A small linear segment of an electric circuit is lying on x-axis extending from $x = -\frac{a}{2}$ to $x = \frac{a}{2}$ and a current i is flowing in it. The magnetic induction due to the segment at a point $x = a$ will be -

27. A circular loop carrying current i is made with a wire of length l . The loop can have integral no. of turns. We want to keep the loop in a uniform magnetic field B such that the torque on it is maximum. When we choose appropriate no. of turns, torque is $\frac{iB\ell^2}{N\pi}$. Fill N in OMR sheet.

28. A solid cylindrical conductor of radius R carries a current along its length. The current density J , however, is not uniform over the cross section of the conductor but is a function of the radius according to $J = br$, where b is a constant. the magnetic field B . at $r_1 < R$ is $\frac{\mu_0 b r_1^2}{N}$. Then find value of N

29. Electrons emitted with negligible speed from an electron gun are accelerated through a potential difference V along the X-axis. These electrons emerges from a narrow hole into a uniform magnetic field B directed along this axis. However, some of the electrons emerging from the hole make slightly divergent angles as shown in figure. These paraxial electrons meet for second time on the X-axis at a

distance $\sqrt{\frac{N\pi^2 mV}{eB^2}}$. Then find value of N. (Neglect interaction between electrons)

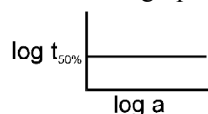


30. A particle of mass $1 \times 10^{-26} \text{ kg}$ and charge $+1.6 \times 10^{-19} \text{ C}$ traveling with a velocity of $1.28 \times 10^6 \text{ m/s}$ in the +x direction enters a region in which a uniform electric field E and a uniform magnetic field of induction B are present such that $E_x = E_y = 0, E_z = -102.4 \text{ kV/m}$ and $B_x = B_z = 0, B_y = 8 \times 10^{-2} \text{ Wb m}^{-2}$. The particle enters this region at the origin at time $t = 0$. If X - coordinate of the particle is $\frac{64}{N}$ at $t = 5 \times 10^{-6} \text{ s}$. Then find value of N.

31. $aA + bB \longrightarrow \text{Product}$, $dx/dt = k [A]^a [B]^b$. If concentration of A is doubled, rate becomes four times. If concentration of B is made four times, rate is doubled. What is relation between rate of disappearance of A and that of B ?

- (A) $-\{d[A]/dt\} = -\{d[B]/dt\}$
 (B) $-\{d[A]/dt\} = -\{4d[B]/dt\}$
 (C) $-\{4d[A]/dt\} = -\{d[B]/dt\}$
 (D) None of these

32. A graph plotted between $\log t_{50\%}$ vs. \log concentration is a straight line. What conclusion can you draw from this graph ?



- (A) $n = 1$; $t_{1/2} \propto a$ (B) $n = 2$, $t_{1/2} \propto 1/a$
 (C) $n = 1$; $t_{1/2} = (0.693/k)$ (D) None of these

33. The data for the reaction $A + B \rightarrow C$ is

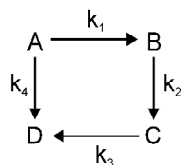
Exp.	[A]0	[B]0	initial rate
1	0.012	0.035	0.10
2	0.024	0.035	0.80
3	0.012	0.070	0.10
4	0.024	0.070	0.80

- (A) $r = k [B]^3$ (B) $r = k [A]^3$
 (C) $r = k [A] [B]^4$ (D) $r = k [A]^2 [B]^2$

34. In the reaction $\text{NH}_4\text{NO}_2(\text{aq.}) \rightarrow \text{N}_2(\text{g}) + 2\text{H}_2\text{O}(\text{l})$ the volume of N_2 after 20 min and after a long time is 40 mL and 70 mL respectively. The value of rate constant is :

- (A) $(1/20) \ln(7/4) \text{ min}^{-1}$
 (B) $(2.303/1200) \log(7/3) \text{ s}^{-1}$
 (C) $(1/20) \log(7/3) \text{ min}^{-1}$
 (D) $(2.303/20) \log(11/7) \text{ min}^{-1}$

35. Consider the elementary reaction sequence shown in figure. Which of the following equations are correct?



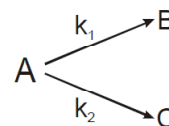
(A) $\frac{d[A]}{dt} = -k_1[A] + k_4[D]$

(B) $\frac{d[C]}{dt} = -k_2[B] + k_3[C]$

(C) $\frac{d[D]}{dt} = -k_4[D] + k_3[C]$

- (D) Nothing can be said about order of reactions in this problem

36. The substance undergoes first order decomposition. The decomposition follows two parallel first order reactions as :



$k_1 = 1.26 \times 10^{-4} \text{ s}^{-1}$ and $k_2 = 3.8 \times 10^{-5} \text{ s}^{-1}$

The percentage distribution of B and C

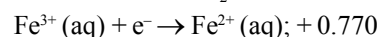
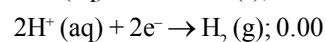
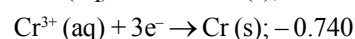
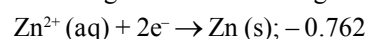
- (A) 80% B and 20% C

- (B) 76.83% B and 23.17% C

- (C) 90% B and 10% C

- (D) 60% B and 40% C

37. At 298 K, the standard reduction potentials for the following half reactions are given as



The strongest reducing agent is -

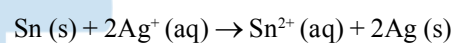
- (A) Zn(s)

- (B) $\text{H}_2(\text{g})$

- (C) Cr(s)

- (D) $\text{Fe}^{2+}(\text{aq})$

38. Which of the following will increase the voltage of the cell ?



- (A) Increase in the concentration of Sn^{2+} ions

- (B) Increase in the concentration of Ag^+ ions

- (C) Increase in the size of silver rod

- (D) None

39. The value of the reaction quotient, Q, for the cell $\text{Zn}(\text{s})|\text{Zn}^{2+}(0.01 \text{ M})||\text{Ag}^+(1.25 \text{ M})|\text{Ag}(\text{s})$ is -

- (A) 156

- (B) 125

- (C) 1.25×10^{-2}

- (D) 6.40×10^{-3}

40. The Zn acts as sacrificial or cathodic protection to prevent rusting of iron because -

- (A) E_{OP}° of Zn < E_{OP}° of Fe

- (B) E_{OP}° of Zn > E_{OP}° of Fe

- (C) E_{OP}° of Zn = E_{OP}° of Fe

- (D) Zn is cheaper than iron

41. One gram metal M^{+2} was discharged by the passage of 1.81×10^{22} electrons. What is the atomic weight of metal ?

- (A) 33.35

- (B) 133.4

- (C) 66.7

- (D) 55

42. The density of Cu is 8.94 g cm^{-3} . The quantity of electricity needed to plate an area $10 \text{ cm} \times 10 \text{ cm}$ to a thickness of 10^{-2} cm using CuSO_4 solution would be

- (A) 13586 C

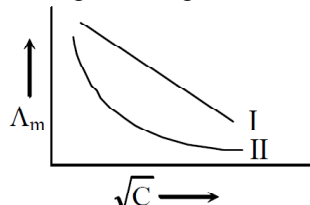
- (B) 27172 C

- (C) 40758 C

- (D) 20348 C

43. A solution of Na_2SO_4 in water is electrolysed using Pt electrodes. The products at the cathode and anode are respectively -
 (A) H_2, SO_2 (B) O_2, NaOH
 (C) H_2, O_2 (D) O_2, SO_2

44. Below plot represents the variation of molar conductance against \sqrt{C} (where C = molar concentration of the electrolyte). Select the correct option among following -



- (A) Both I and II are for strong electrolyte
 (B) Both I and II are for weak electrolyte
 (C) I is for strong electrolyte and II for weak electrolyte
 (D) I is for weak electrolyte and II for strong electrolyte

45. The resistance of a solution 'A' is 40 ohm and that of solution 'B' is 70 ohm, both solutions being taken in the same conductivity cell. If equal volumes of solutions 'A' and 'B' are mixed, what will be the resistance of the mixture using the same cell? (Assume that there is no increase in the degree of dissociation of 'A' and 'B' on mixing.)
 (A) 50.9 ohm (B) 101.8 ohm
 (C) 110 ohm (D) 50 ohm

46. The limiting molar conductivities λ° for NaCl, KBr and KCl are 126, 152 and 150 $\text{S cm}^2 \text{mol}^{-1}$ respectively. The λ° for NaBr is
 (A) 128 $\text{S cm}^2 \text{mol}^{-1}$ (B) 176 $\text{S cm}^2 \text{mol}^{-1}$
 (C) 278 $\text{S cm}^2 \text{mol}^{-1}$ (D) 302 $\text{S cm}^2 \text{mol}^{-1}$

47. The cell, $\text{Zn} | \text{Zn}^{2+} (1 \text{ M}) || \text{Cu}^{2+} (1 \text{ M}) | \text{Cu}$ ($E^\circ_{\text{cell}} = 1.10 \text{ V}$), was allowed to be completely discharged at 298 K. The relative concentration of Zn^{2+} to Cu^{2+} $\left(\frac{[\text{Zn}^{2+}]}{[\text{Cu}^{2+}]} \right)$ is
 (A) Antilog (24.08) (B) 37.3
 (C) $10^{37.3}$ (D) 9.65×10^4

48. The equivalent conductance of NaCl at concentration C and at infinite dilution are λ_c and λ_∞ respectively. The correct relationship between λ_c and λ_∞ is given as. (where the constant B is positive)
 (A) $\lambda_c = \lambda_\infty$ (B) \sqrt{C} (C) $\lambda_c = \lambda_\infty + (B) \sqrt{C}$
 (C) $\lambda_c = \lambda_\infty + (B) C$ (D) $\lambda_c = \lambda_\infty$ (B) C

49. How long (approximate) should water be electrolysed by passing through 100 amperes current so that the oxygen released can completely burn 27.66 g of diborane?
 (Atomic weight of B = 10.8 u)
 (A) 1.6 hours (B) 6.4 hours
 (C) 0.8 hours (D) 3.2 hours

50. Rate of formation of SO_3 in the following reaction $2\text{SO}_2 + \text{O}_2 \rightarrow 2\text{SO}_3$ is 100 g min^{-1} . Hence rate of disappearance of O_2 is :
 (A) 50 g min^{-1} (B) 40 g min^{-1}
 (C) 200 g min^{-1} (D) 20 g min^{-1}

SECTION-B

51. For the following electrochemical cell at 298 K,
 $\text{Pt(s)} | \text{H}_2(\text{g}, 1 \text{ bar}) | \text{H}^+(\text{aq}, 1 \text{ M}) || \text{M}^{4+}(\text{aq}), \text{M}^{2+}(\text{aq}) | \text{Pt(s)}$

$$E_{\text{cell}} = 0.092 \text{ V when } \frac{[\text{M}^{2+}(\text{aq})]}{[\text{M}^{4+}(\text{aq})]} = 10^x$$

$$\text{Given : } E^\circ_{\text{M}^{4+}/\text{M}^{2+}} = 0.151 \text{ V}; 2.303 \frac{RT}{F} = 0.059 \text{ V}$$

The value of x is

52. The rate constant of reaction $2 \text{ A} + \text{ B} \longrightarrow \text{ C}$ is $2.57 \times 10^{-5} \text{ L mol}^{-1} \text{ s}^{-1}$ after 10 second, $2.65 \times 10^{-5} \text{ L mol}^{-1} \text{ s}^{-1}$ after 20 second and $2.55 \times 10^{-5} \text{ L mol}^{-1} \text{ s}^{-1}$ after 30 second. The order of the reaction is:

53. In a gaseous state reaction, $\text{A}_2(\text{g}) \longrightarrow \text{B}(\text{g}) + (1/2)\text{C}(\text{g})$, The increase in pressure from 100 mm to 120 mm is noticed in 5 minutes. The rate of disappearance of A_2 in mm min^{-1} is :

54. 1 mole of Al is deposited by X coulomb of electricity passing through aluminium nitrate solution. The number of moles of silver deposited by X coulomb of electricity from silver nitrate solution is -

55. The molar conductances of HCl, NaCl and CH_3COONa are 426, 126 and $91 \Omega^{-1} \text{ cm}^2 \text{ mol}^{-1}$ respectively. The molar conductance for CH_3COOH is-

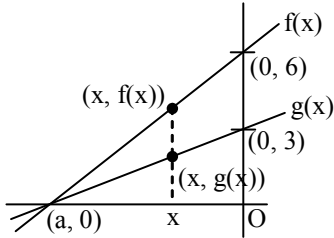
56. $t_{\frac{1}{4}}$ can be taken as the time taken for the concentration of a reactant to drop to $\frac{3}{4}$ of its initial value. If the rate constant for a first order reaction is k, $t_{\frac{1}{4}}$ can be written as -

57. The following mechanism has been proposed for the reaction of NO with Br₂ to form NOBr :
- $$\text{NO(g)} + \text{Br}_2(\text{g}) \rightleftharpoons \text{NOBr}_2(\text{g})$$
- $$\text{NOBr}_2(\text{g}) + \text{NO(g)} \rightarrow 2\text{NOBr(g)}$$
- If the second step is the rate determining step, the order of the reaction with respect to NO (g) is -
58. The energies of activation for forward and reverse reactions for $\text{A}_2 + \text{B}_2 \rightleftharpoons 2\text{AB}$ are 180 kJ mol⁻¹ and 200 kJ mol⁻¹ respectively. The presence of a catalyst lowers the activation energy of both (forward and reverse) reactions by 100 kJ mol⁻¹. The enthalpy change of the reaction ($\text{A}_2 + \text{B}_2 \rightarrow 2\text{AB}$) in the presence of catalyst will be (in kJ mol⁻¹)
59. The time for half life period of a certain reaction $\text{A} \rightarrow \text{products}$ is 1 hour. When the initial concentration of the reactant 'A' is 2.0 mol L⁻¹, how much time does it take for its concentration to come from 0.50 to 0.25 mol L⁻¹ if it is a zero order reaction ?
60. Two reactions R₁ and R₂ have identical pre-exponential factors. Activation energy of R₁ exceeds that of R₂ by 10 kJ mol⁻¹. If k₁ and k₂ are rate constants for reactions R₁ and R₂ respectively at 300 K, then $\ln(k_2/k_1)$ is equal to : (R=8.314 J mol⁻¹K⁻¹)

PE

61. $\lim_{x \rightarrow \infty} x^2 \sin \left(\log_e \sqrt{\cos \frac{\pi}{x}} \right)$ is equal to
 (A) 0 (B) $-\frac{\pi^2}{2}$ (C) $-\frac{\pi^2}{4}$ (D) $\frac{\pi^2}{8}$

62. Suppose you have two linear functions f and g shown below.



Then $\lim_{x \rightarrow a} \frac{f(x)}{g(x)}$ is -

- (A) does not exist
- (B) not enough information
- (C) 2
- (D) 3

63. Let $f: \mathbb{R} \rightarrow \mathbb{R}$ be such that $f(1) = 3$ and $f'(1) = 6$,

Then, $\lim_{x \rightarrow 0} \left\{ \frac{f(1+x)}{f(1)} \right\}^{1/x}$ is equal to

- (A) 1 (B) $e^{1/2}$ (C) e^2 (D) e^3

64. If $\lim_{x \rightarrow 0} \frac{ae^{2x} - b \cos 2x + ce^{-2x} - x \sin x}{x \sin x} = 1$ and

$f(t) = (a+b)t^2 + (a-b)t + c$, then

- (A) $a = \frac{1}{4}$ (B) $c = \frac{1}{2}$
- (C) $f(1) = \frac{4}{3}$ (D) $f(1) = 1$

65. If $\lim_{x \rightarrow a} \frac{a^x - x^a}{x^x - a^a} = -1$, then

- (A) $a = 1$ (B) $a = 0$
- (C) $a = e$ (D) None of these

66. True statement for $\lim_{x \rightarrow 0} \frac{\sqrt{1+x} - \sqrt{1-x}}{\sqrt{2+3x} - \sqrt{2-3x}}$ is

- (A) Does not exist
- (B) Lies between 0 and $\frac{1}{2}$
- (C) Lies between 1 and 2
- (D) Greater than 1

67. If $f(x) = a_0 + a_1x^2 + a_2x^4 + \dots + a_nx^{2n}$ be a polynomial where $0 < a_0 < a_1 < a_2 < \dots < a_n$ then $f(x)$ has
 (A) neither a maximum nor a minimum
 (B) only one maximum
 (C) only one minimum
 (D) both maxima and minima

68. Let $f: \mathbb{R} \rightarrow [0, \infty)$ be such that $\lim_{x \rightarrow 5} f(x)$ exists and

$$\lim_{x \rightarrow 5} \frac{(f(x))^2 - 9}{\sqrt{|x-5|}} = 0$$

Then $\lim_{x \rightarrow 5} f(x)$ equals :

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

69. Let $f(x)$ be a second degree polynomial function such that $\ln(f(x)) > 0 \forall x \in \mathbb{R}$ and the equation $f'(x) + 21f(x) = 0$ has no real roots. If $g(x) = e^{21x} f(x)$.

Then

- (A) $g(x)$ is an increasing function
- (B) $g(x)$ is an even function
- (C) $g(x)$ is a decreasing function
- (D) the graph of $g(x)$ cuts x-axis exactly once

70. The values of a and b such that

$$\lim_{x \rightarrow 0} \frac{x(1 + a \cos x) - b \sin x}{x^3} = 1, \text{ are}$$

- (A) $\frac{5}{2}, \frac{3}{2}$ (B) $\frac{5}{2}, -\frac{3}{2}$
- (C) $-\frac{5}{2}, -\frac{3}{2}$ (D) None of these

71. If $f: \mathbb{R} \rightarrow \mathbb{R}$ is a function defined by $f(x) = [x] \cos \left(\frac{2x-1}{2} \right) \pi$, where $[x]$ denotes the greatest integer function, then f is :

- (A) continuous for every real x .
- (B) discontinuous only at $x = 0$.
- (C) discontinuous only at non-zero integral values of x .
- (D) continuous only at $x = 0$.

72. If $y = 1 + x + \frac{x^2}{2!} + \frac{x^3}{3!} + \dots + \frac{x^n}{n!}$, then $\frac{dy}{dx} =$

- (A) y (B) $y + \frac{x^n}{n!}$
- (C) $y - \frac{x^n}{n!}$ (D) $y - 1 - \frac{x^n}{n!}$

73. If $y = a \sin x + b \cos x$, then $y^2 + \left(\frac{dy}{dx}\right)^2$ is a
 (A) Function of x (B) Function of y
 (C) Function of x and y (D) Constant
74. If $f(x) = \begin{cases} xe^{-\left(\frac{1}{|x|} + \frac{1}{x}\right)}, & x \neq 0 \\ 0, & x = 0 \end{cases}$, then $f(x)$ is
 (A) Continuous as well as differentiable for all x
 (B) Continuous for all x but not differentiable at $x = 0$
 (C) Neither differentiable nor continuous at $x = 0$
 (D) Discontinuous every where
75. If $y = \frac{e^{2x} \cos x}{x \sin x}$, then $\frac{dy}{dx} =$
 (A) $\frac{e^{2x} [(2x-1) \cot x - x \operatorname{cosec}^2 x]}{x^2}$
 (B) $\frac{e^{2x} [(2x+1) \cot x - x \operatorname{cosec}^2 x]}{x^2}$
 (C) $\frac{e^{2x} [(2x-1) \cot x + x \operatorname{cosec}^2 x]}{x^2}$
 (D) None of these
76. If $xe^{xy} = y + \sin^2 x$, then at $x = 0, \frac{dy}{dx} =$
 (A) -1 (B) -2 (C) 1 (D) 2
77. If $y = x^{x^{\dots \infty}}$, then $\frac{dy}{dx} =$
 (A) $\frac{y^2}{x(1+y \log x)}$ (B) $\frac{y^2}{x(1-y \log x)}$
 (C) $\frac{y}{x(1+y \log x)}$ (D) $\frac{y}{x(1-y \log x)}$
78. If $I_n = \frac{d^n}{dx^n}(x^n \log x)$, then $I_n - nI_{n-1} =$
 (A) n (B) $n-1$
 (C) $n!$ (D) $(n-1)!$
79. The volume of a spherical balloon is increasing at the rate of 40 cubic centimetre per minute. The rate of change of the surface of the balloon at the instant when its radius is 8 centimetre, is
 (A) $\frac{5}{2}$ sq cm/min (B) 5 sq cm/min
 (C) 10 sq cm/min (D) 20 sq cm/min

80. The function $f(x) = [x] \cos \left[\frac{2x-1}{2} \right] \pi$, where $[.]$ denotes the greatest integer function, is discontinuous at
 (A) All x
 (B) No x
 (C) All integer points
 (D) x which is not an integer

SECTION-B

81. If a curve is represented parametrically by the equations $x = 4t^3 + 3$ and $y = 4 + 3t^4$ and $\left(\frac{d^2x}{dy^2}\right)^n$ is constant then value of n is
82. The number of points of discontinuity of $f(x) = \begin{cases} |4x-5| [x] & \text{for } x > 1 \\ [\cos \pi x] & \text{for } x \leq 1 \end{cases}$ (where $[x]$ is the greatest integer not greater than x) in $[0, 2]$ is
83. $\lim_{n \rightarrow \infty} \left(\frac{1}{\sqrt{n^2}} + \frac{1}{\sqrt{n^2+1}} + \frac{1}{\sqrt{n^2+2}} + \dots + \frac{1}{\sqrt{n^2+2n}} \right)$ is equal to
84. A variable ΔABC in the xy plane has its orthocentre at vertex 'B', a fixed vertex 'A' at the origin and the third vertex 'C' restricted to lie on the parabola $y = 1 + \frac{7x^2}{36}$. The point B starts at the point (0, 1) at time $t = 0$ and moves upward along the y axis at a constant velocity of 2 cm/sec. If the area of the triangle increasing at the rate of 'p' cm²/sec when $t = \frac{7}{2}$ sec, then $7p$ is.
85. Let $f(x) = \frac{1-\sin x}{(\pi-2x)^2} \cdot \frac{\ln(\sin x)}{(1+\pi^2-4\pi x+4x^2)^x} \neq \frac{\pi}{2}$. The value of $f\left(\frac{\pi}{2}\right)$ so that the function is continuous at $x = \frac{\pi}{2}$ is λ and $|\lambda|\alpha\beta = 1$ where $\alpha, \beta \in \mathbb{N}$ then find product of all possible values of β

86. Let $f(x) = \begin{cases} x \sin\left(\frac{1}{x}\right) + \sin\left(\frac{1}{x^2}\right), & x \neq 0 \\ 0, & x = 0 \end{cases}$, then

$\lim_{x \rightarrow \infty} f(x)$ is equal to

87. If $f(x) = \begin{cases} x^2 e^{2(x-1)} & \text{for } 0 \leq x \leq 1 \\ a \operatorname{sgn}(x+1) \cos(2x-2) + bx^2 & \text{for } 1 < x \leq 2 \end{cases}$ is differentiable at $x = 1$ then $a^3 + b^3 =$

88. A sheet of poster has its area 18 m^2 . The margin at the top & bottom are 75 cms. and at the sides 50 cms. Let ℓ, n are the dimensions of the poster in meters when the area of the printed space is maximum. The value of $\ell^2 + n^2$ is :

89. Let $[x]$ denote the greatest integer less than or equal to x . The number of integral points in $[-1, 1]$ where $f(x) = [x \sin \pi x]$ is differentiable are

90. If $f(x) = \sin\left(\cos^{-1}\left(\frac{1-2^{2x}}{1+2^{2x}}\right)\right)$ and its first derivative with respect to x is $-\frac{b}{a} \log_e 2$ when $x = 1$, where a and b are integers, then the minimum value of $|a^2 - b^2|$ is _____.

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