

Sankalp IIT

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IN JEE MAIN AND ADVANCED

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Time : 3 hrs.

Max. Marks: 360

Topics covered in various subjects :

Physics : Magnetic Effect of Current, Magnetism; Electromagnetic Induction, Alternating Current, Electromagnetic Waves

Chemistry : General Principles & Processes of Isolation of Metals, p-block Elements (Group 15 to 18), d & f-Block Elements, Coordination Compounds; Organic Compounds Containing Halogens

Mathematics : Limits, Continuity & Differentiability, Application of Derivatives

Instructions:

- (i) Duration of Test is 3 hrs.
- (ii) The Test booklet consists of 90 questions. The maximum marks are 360.
- (iii) There are **three** parts in the question paper. Distribution of marks subjectwise in each part is as under for each correct response.
 - Part A – PHYSICS (120 marks)** – Questions No.1 to 30 consist **FOUR (4)** marks each for each correct response.
 - Part B – CHEMISTRY (120 marks)** – Questions No.31 to 60 consist **FOUR (4)** marks each for each correct response.
 - Part C – MATHEMATICS (120 marks)** – Questions No.61 to 90 consist **FOUR (4)** marks each for each correct response.
- (iv) One fourth ($\frac{1}{4}$) marks will be deducted for indicating incorrect response of each question. No deduction from the total score will be made if no response is indicated for an item in the answer sheet.
- (v) **Pattern of the Question: Section – I : Multiple Type Objective Questions** (Straight Single Choice Multiple Type Questions); **Section – II: Assertion – Reason Type Questions**; **Section – III: Comprehension Type Questions** : (One Comprehension Type Question should have 3 questions - Multiple Concept Questions); **Section – IV: Straight Objective Questions**: (Straight Single Choice - Multiple Concept Questions and/or Difficulty/Lengthy calculations & Application based questions)

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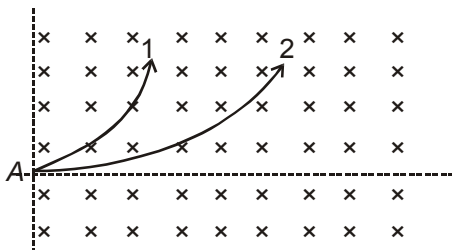
Discuss among yourself or with your teachers in case of doubts. You can post your doubts on website comment section too and We will try to answer as early as possible.

PHYSICS**SECTION - I****Straight Single Choice Multiple Type Questions /
Application Based Single Choice Questions**

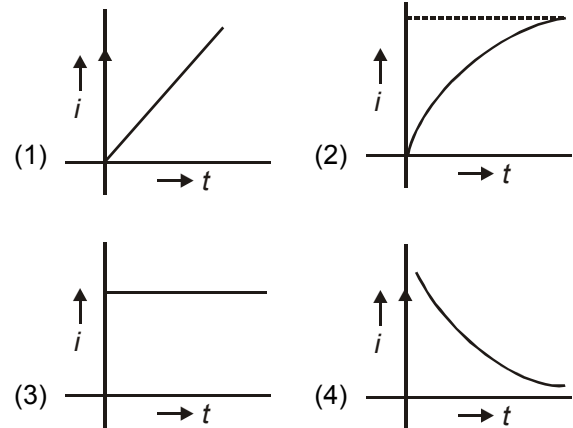
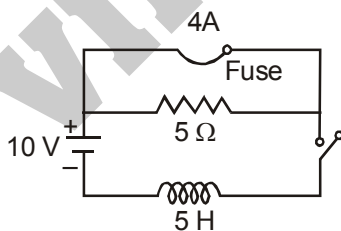
This section contains 16 multiple choice questions numbered 1 to 16. Each question has 4 choices (1), (2), (3) and (4), out of which **ONLY ONE** is correct.

Choose the correct answer :

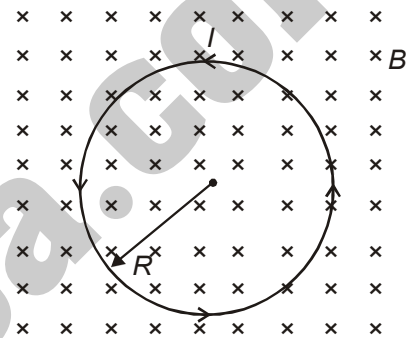
1. Two paths (path 1 & path 2) followed by charge particles in magnetic field is shown in the figure. All the charge particles enters the magnetic field at A with equal kinetic energy. Choose the incorrect statement



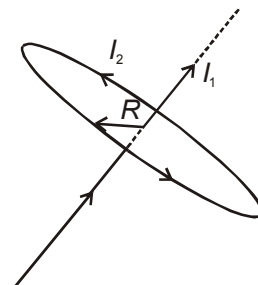
- (1) If 1 is α -particle then 2 may be deuteron
 (2) If 1 is proton then 2 may be deuteron
 (3) If 1 is α -particle then 2 must be proton
 (4) If 1 is deuteron then 2 must be proton
2. Path followed by charge particle in combined electric and magnetic field cannot be
- (1) Straight line
 (2) Helix
 (3) Cycloid
 (4) Parabola
3. In the given circuit, the component in the upper branch is an ideal 4A fuse. It has zero resistance as long as the current through it remains less than 4A. If the current reaches 4A, it blows out and therefore it has infinite resistance. Switch S is closed at $t = 0$, which of the following plots correctly represents the variation of current i in the inductor with time t for $t < 2s$?



4. I current flows in a metal ring which is placed in a uniform crossed magnetic field B as shown in figure. The tension in the ring is



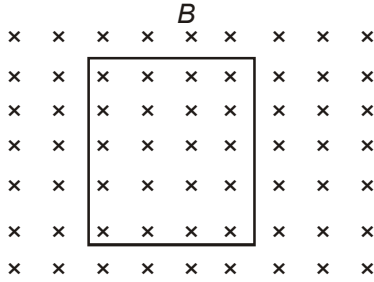
- (1) IRB (2) $\frac{IRB}{2}$
 (3) $2IRB$ (4) Zero
5. A infinitely long current carrying wire having current I_1 is passed through the centre of circular ring having current I_2 perpendicularly from the centre of the ring. Net force experienced by the circular coil is



- (1) $\frac{\mu_0 I_1 I_2 R}{2\pi}$ (2) Zero
 (3) $\frac{\mu_0 I_1 I_2 R}{\pi}$ (4) $\frac{\mu_0 I_1 I_2 R}{4\pi}$
6. A square loop of side l is placed in crossed magnetic field as shown in figure. Now the square loop starts rotating with constant angular speed in its plane. The

Class (XII)

emf induced in the loop is



- (1) $2B\omega l^2$ (2) $B\omega l^2$
 (3) $\frac{B\omega l^2}{2}$ (4) Zero

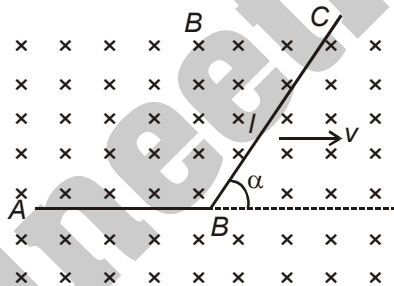
7. If $I = 2t$, then the R.M.S. value of current between zero to 2 second is

- (1) $\sqrt{\frac{2}{3}}$ (2) $\frac{4}{\sqrt{3}}$
 (3) $2\sqrt{\frac{2}{3}}$ (4) Zero

8. In a sinusoidal A.C., choose the incorrect statement

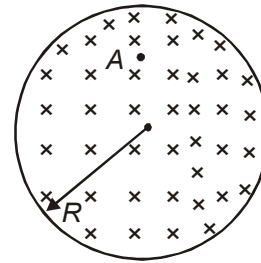
- (1) Mean value of A.C. can be positive, negative and zero
 (2) Mean value of A. C is calculated during half cycle
 (3) D.C is more dangerous than A.C.
 (4) $I_{av} = \frac{2I_0}{\pi}$

9. Two rods AB and BC are connected at point B. The entire geometry moves with velocity $v\hat{i}$ in crossed magnetic field B as shown in figure. The potential difference between the points A and C is



- (1) $l\{1 + \sin\alpha\}vB$ (2) $l\{1 + \cos\alpha\}vB$
 (3) $vBl \sin\alpha$ (4) $vBl \cos\alpha$

10. In the cylindrical region magnetic field increases at a constant rate α . If an electron is placed at A then it will experience force along



- (1) Left (2) Right
 (3) Upwards (4) Downwards

11. Lenz's law in electro magnetic induction is according to

- (1) Conservation of energy
 (2) Conservation of linear momentum
 (3) Conservation of charge
 (4) Conservation of mass

12. Power factor of choke coil is

- (1) Small (2) High
 (3) 1 (4) Zero

13. A conducting rod of length l is rotated, with angular velocity w about an axis passing through mid point and $\perp r$ to the length of rod. There exists a uniform magnetic field which is $\perp r$ to the plane of rotation. The emf induced between two ends of rod, will be

- (1) Zero (2) $\frac{1}{2}Bwl^2$
 (3) $\frac{1}{4}Bwl^2$ (4) $\frac{1}{8}Bwl^2$

14. In EM waves, the phase difference between electric field and magnetic field vectors is

- (1) Zero (2) $\frac{\pi}{2}$
 (3) π (4) $\frac{3\pi}{2}$

15. Out of the following, which is not the unit of magnetic field

- (1) Tesla (2) $\frac{\text{Webber}}{\text{m}^2}$
 (3) $\frac{\text{Newton}}{\text{Amp}\times\text{meter}}$ (4) $\frac{\text{Joule}}{\text{Amp}^2}$

16. An electron (charge e , mass m) revolves in a circular path of radius r with frequency f revolution per sec, the ratio of magnetic moment and angular momentum depends upon

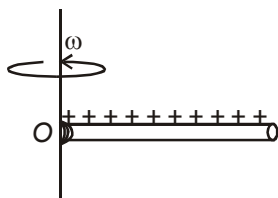
- (1) e, m, r (2) e, r, f

Class (XII)

(3) e, m (4) e, m, r, f **SECTION - II****Assertion – Reason Type Questions**

Directions : Questions number 17 to 21 are Assertion-Reason type questions. Each of these questions contains two statements. Statement-1 (Assertion) and Statement-2 (Reason). Each of these questions also has four alternative choices, only one of which is the correct answer. You have to select the correct choice.

17. A charged rod is rotating about an axis passing through O and perpendicular to length of rod.



Statement-1 : If we place a magnetic needle near O it will show some deflection.

and

Statement-2 : A rotating charge generates magnetic dipole moment.

- (1) Statement-1 is True, Statement-2 is True; Statement-2 **is** a correct explanation for Statement-1
 (2) Statement-1 is True, Statement-2 is True; Statement-2 **is NOT** a correct explanation for Statement-1
 (3) Statement-1 is True, Statement-2 is False
 (4) Statement-1 is False, Statement-2 is True
18. A charge particle enters the region of crossed magnetic field.

Statement-1 : Its speed remains constant.

and

Statement-2 : Its angular momentum is conserved about all the points.

- (1) Statement-1 is True, Statement-2 is True; Statement-2 **is** a correct explanation for Statement-1
 (2) Statement-1 is True, Statement-2 is True; Statement-2 **is NOT** a correct explanation for Statement-1
 (3) Statement-1 is True, Statement-2 is False
 (4) Statement-1 is False, Statement-2 is True
19. Statement-1 : In case of A.C series, LC circuit average power dissipated is zero.

and

Statement-2 : Power factor of circuit is zero.

- (1) Statement-1 is True, Statement-2 is True; Statement-2 **is** a correct explanation for Statement-1
 (2) Statement-1 is True, Statement-2 is True; Statement-2 **is NOT** a correct explanation for Statement-1
 (3) Statement-1 is True, Statement-2 is False
 (4) Statement-1 is False, Statement-2 is True
20. In a series LCR circuit the resonance frequency is ω_r .
 Statement-1 : If ω of source is increased from ω_r then current in the circuit decreases.

and

Statement-2 : At $\omega = \omega_r$, z is minimum.

- (1) Statement-1 is True, Statement-2 is True; Statement-2 **is** a correct explanation for Statement-1
 (2) Statement-1 is True, Statement-2 is True; Statement-2 **is NOT** a correct explanation for Statement-1
 (3) Statement-1 is True, Statement-2 is False
 (4) Statement-1 is False, Statement-2 is True
21. Statement-1 : In parallel L-C, AC circuit, at resonance current becomes minimum.

and

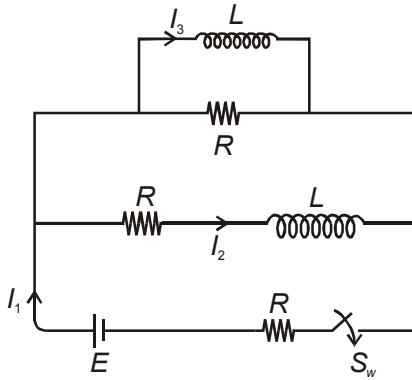
Statement-2 : In series LC AC circuit, at resonance, impedance is maximum

- (1) Statement-1 is True, Statement-2 is True; Statement-2 **is** a correct explanation for Statement-1
 (2) Statement-1 is True, Statement-2 is True; Statement-2 **is NOT** a correct explanation for Statement-1
 (3) Statement-1 is True, Statement-2 is False
 (4) Statement-1 is False, Statement-2 is True

SECTION - III**Comprehension Type Questions**

Directions : Question No. 22 to 24 are based on the following paragraph.

Figure consists of ideal inductors and resistances shown in the figure. The cell is ideal and its emf is E . At $t = 0$, the switch S_w is closed.



22. At $t = 0$, the current I_1 is

- (1) $\frac{E}{R}$ (2) $\frac{E}{2R}$
 (3) $\frac{2E}{R}$ (4) Zero

23. At $t = \infty$, the current I_3 is

- (1) $\frac{E}{R}$ (2) $\frac{E}{2R}$
 (3) $\frac{2E}{R}$ (4) Zero

24. At $t = \infty$, the current I_2 is

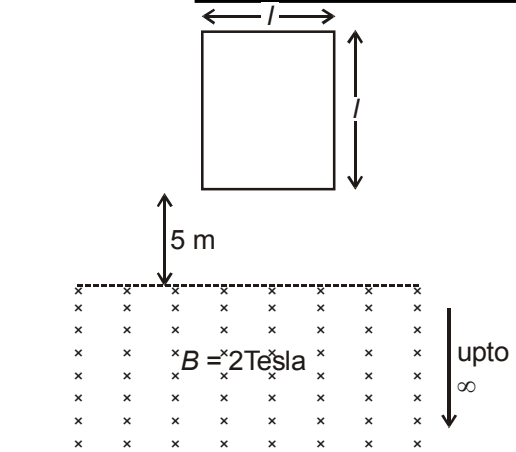
- (1) $\frac{E}{R}$ (2) $\frac{E}{2R}$
 (3) $\frac{2E}{R}$ (4) Zero

SECTION - IV

Straight Objective Questions

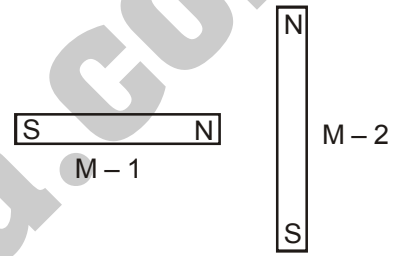
Directions : Question No. 25 to 30 are based on the following Multiple concept questions and/or difficulty/lengthy calculations & application based questions.

25. A square loop of side $l = 1$ m is released from a height of 5 m from the region of crossed magnetic field. If mass of the loop is 2 kg, then find the speed of loop when it completely enters into the magnetic field (take resistance of loop equal to 2Ω and $g = 10 \text{ m/s}^2$)



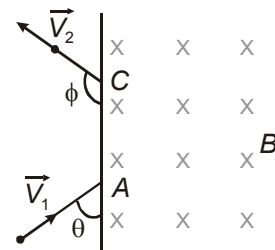
- (1) 10 m/s (2) 5 m/s
 (3) 8 m/s (4) 12 m/s

26. Two very short bar magnets are arranged as shown in the figure. Choose the correct statement regarding magnet-1



- (1) F_{net} downwards and clockwise torque
 (2) F_{net} downwards and anti-clockwise torque
 (3) F_{net} upwards and anti-clockwise torque
 (4) F_{net} upwards and clockwise torque

27. On right of line there is uniform magnetic field. A positively charged particle moving in the plane of paper enters and leaves magnetic field as shown. Then



- (1) $\theta + \phi > 180^\circ$
 (2) $\theta + \phi < 180^\circ$
 (3) $|\vec{v}_1| \neq |\vec{v}_2|$
 (4) $|\vec{v}_1| = |\vec{v}_2|$ and $\theta + \phi = 180^\circ$

Class (XII)

28. A charged particle of unit mass and unit charge moves with velocity $\vec{v} = (6\hat{i} + 8\hat{j})\text{ms}^{-1}$ in a magnetic field of $\vec{B} = 2\hat{k}\text{T}$. Then radius of path of particle is
- (1) 10 m (2) 5 m
(3) 15 m (4) 20 m
29. A wire lying along y -axis from $y = 0$ to $y = 1$ m carries a current of 2 mA in negative y direction, the wire lies in magnetic field of $B = (0.5\hat{i} + 0.3\hat{j})\text{T}$. The magnetic force acting on the wire is
- (1) $-10^{-3}\hat{k}\text{N}$
(2) $10^{-3}\hat{k}\text{N}$
(3) $(0.5\hat{i} + 0.3\hat{j})\text{N}$
(4) $0.008\hat{k}\text{N}$
30. An electron is moving on circular path of radius R in uniform magnetic field. If kinetic energy is doubled and magnetic induction is tripled, then the radius will become
- (1) $\frac{2R}{3}$
(2) $\frac{\sqrt{2}R}{3}$
(3) $\sqrt{\frac{2}{3}}R$
(4) $\frac{2}{\sqrt{3}}R$

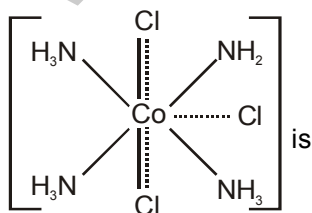
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CHEMISTRY**SECTION - I****Straight Single Choice Multiple Type Questions /
Application Based Single Choice Questions**

This section contains 16 multiple choice questions numbered 31 to 46. Each question has 4 choices (1), (2), (3) and (4), out of which **ONLY ONE** is correct.

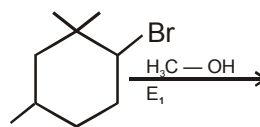
Choose the correct answer :

31. Out of following which is paramagnetic?
 (1) $[\text{Fe}(\text{CN})_6]^{4-}$ (2) $[\text{Cu}(\text{NH}_3)_4]^{+2}$
 (3) $[\text{Co}(\text{NH}_3)_6]^{+3}$ (4) $[\text{CoF}_6]^{-2}$
32. Which one of the following metal cannot form hydroxide?
 (1) Zn (2) Hg
 (3) Fe (4) Cd
33. In metallurgical processes, the function of roasting is
 (1) To oxidise the metal
 (2) To remove the volatile impurities
 (3) To decompose carbonate ores into oxides
 (4) To make a slag out of the impurities
34. Which of the following has no $p\pi-d\pi$ bonding?
 (1) $\text{N}(\text{SiH}_3)_3$
 (2) P_4O_{10}
 (3) SO_3
 (4) $\text{SiO}_2(\text{s})$
35. Outer orbital complexes among the following is
 (1) $[\text{Fe}(\text{CN})_6]^{4-}$
 (2) $[\text{Fe}(\text{CN})_6]^{3-}$
 (3) $[\text{Ni}(\text{NH}_3)_6]^{2+}$
 (4) $[\text{Cr}(\text{NH}_3)_6]^{3+}$
36. Which of the following is true for the species having $3d^4$ configuration?
 (1) Cr^{2+} is reducing in nature
 (2) Mn^{3+} is oxidising in nature
 (3) Both (1) and (2)
 (4) None of these
37. Number of molecule of AgNO_3 required for precipitation of



- (1) 1 (2) 2
 (3) 3 (4) Cannot be predicted

38. Consider the following reaction



Which of the following is not formed?

- (1) (2)
- (3)
- (4)

39. $\text{K}_2[\text{PtCl}_4] + \text{CH}_2 = \text{CH}_2 \xrightarrow{\Delta} \text{A} + \text{KCl}$

A is

- (1) Zeise salt
 (2) π bonded complex
 (3) Organometallic
 (4) All of these

40. When benzene sulphonic acid and p-nitrophenol are treated with NaHCO_3 , the gases released respectively are

- (1) SO_2, NO_2 (2) SO_2, NO
 (3) SO_2, CO_2 (4) CO_2, CO_2

41. Which of the following cation is most stable

- (1) (2)
- (3) $(\text{CH}_3)_3\text{C}^{\oplus}$ (4) $\text{CH}_2 = \text{CH}-\text{CH}_2^{\oplus}$

42. Which of the following method will form maximum amount of cyclopentyl ethyl ether?

- (1) + $\text{CH}_3\text{CH}_2-\text{Br} \longrightarrow$
 (2) + $\text{CH}_3\text{CH}_2\text{ONa} \longrightarrow$
 (3) + $\text{CH}_3\text{CH}_2-\text{Cl} \longrightarrow$
 (4) + $\text{H}_3\text{O}^+ + \text{CH}_3\text{CH}_2\text{Cl} \longrightarrow$

43. Coordination number of iron in $[\text{Fe}(\text{C}_5\text{H}_5)_2]$ is

- (1) 6 (2) 4

Class (XII)

- (3) 2 (4) 10
44. Hybridisation of Cl in solid Cl_2O_6 are
 (1) sp^2, sp^3d (2) sp^3, sp^3d
 (3) sp, sp^3 (4) sp^2, sp^3
45. The spin magnetic moment of cobalt in $\text{Hg}[\text{Co}(\text{SCN})_4]$ is
 (1) $\sqrt{3}$ (2) $\sqrt{8}$
 (3) $\sqrt{15}$ (4) $\sqrt{24}$
46. Thermal decomposition of acetone gives
 (1) $\text{CH}_2\text{CO} + \text{CH}_4$ (2) $\text{CO}_2 + \text{H}_2\text{O}$
 (3) CH_3COOH (4) $\text{CH}_3\text{CHO} + \text{CO}_2$

SECTION - II

Assertion – Reason Type Questions

Directions : Questions number 47 to 51 are Assertion-Reason type questions. Each of these questions contains two statements. Statement-1 (Assertion) and Statement-2 (Reason). Each of these questions also has four alternative choices, only one of which is the correct answer. You have to select the correct choice.

47. Statement-1 : Liquid IF_5 conducts electricity.

and

Statement-2 : Liquid IF_5 self ionizes as,
 $2\text{IF}_5 \rightleftharpoons \text{IF}_4^{\oplus} + \text{IF}_6^{\ominus}$

- (1) Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1
 (2) Statement-1 is True, Statement-2 is True; Statement-2 is **NOT** a correct explanation for Statement-1
 (3) Statement-1 is True, Statement-2 is False
 (4) Statement-1 is False, Statement-2 is True
48. Statement-1 : Hydrazine is a neutral ligand.
 and
 Statement-2 : It has two N as donor atom and behaves as a good chelating ligand.
 (1) Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1
 (2) Statement-1 is True, Statement-2 is True; Statement-2 is **NOT** a correct explanation for Statement-1
 (3) Statement-1 is True, Statement-2 is False
 (4) Statement-1 is False, Statement-2 is True
49. Statement-1 : Ammonical Silver nitrate converts glucose to gluconic acid and metallic silver is precipitated.

and

Statement-2 : Glucose acts as a weak reducing agent.

- (1) Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1
 (2) Statement-1 is True, Statement-2 is True; Statement-2 is **NOT** a correct explanation for Statement-1
 (3) Statement-1 is True, Statement-2 is False
 (4) Statement-1 is False, Statement-2 is True
50. Statement-1 : Fe can be purified by amalgamation

and

Statement-2 : At temperature approximately 1073K or above coke can reduce FeO to Fe and at lower temperature Co reduces oxide of iron

- (1) Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1
 (2) Statement-1 is True, Statement-2 is True; Statement-2 is **NOT** a correct explanation for Statement-1
 (3) Statement-1 is True, Statement-2 is False
 (4) Statement-1 is False, Statement-2 is True
51. Statement-1 : Hell volhard zelensky reaction is used to prepare α -bromoacetic acid
 and
 Statement-2 : α -bromoacetic acid in an useful substrate for further α -substitution
 (1) Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1
 (2) Statement-1 is True, Statement-2 is True; Statement-2 is **NOT** a correct explanation for Statement-1
 (3) Statement-1 is True, Statement-2 is False
 (4) Statement-1 is False, Statement-2 is True

SECTION - III

Comprehension Type Questions

Directions : Question No. 52 to 54 are based on the following paragraph.

Compound A is greenish crystalline salt which give the following results when tested.

- \Rightarrow Addition of BaCl_2 solution to a solution of 'A' results in the formation of a white ppt 'B', which is insoluble in dil HCl.
 \Rightarrow On heating 'A' water vapour and two oxides of sulphur, 'C' and 'D' are liberated leaving a red brown

Class (XII)

residue 'E'.

⇒ 'E' dissolves in warm conc. HCl to give yellow solution 'F'.

⇒ With H₂S, the solution 'F' yields a yellow ppt 'G'. when filtered leaves a greenish filtrate 'H'.

52. Compound 'A' is

- (1) FeCl₃
- (2) FeSO₄·7H₂O
- (3) NiSO₄
- (4) COSO₄

53. Formation of a white ppt 'B' indicates the presence of

- (1) SO₃²⁻
- (2) SO₄²⁻
- (3) NO₃⁻
- (4) Cl[⊖]

54. In the conversion of F to H, the transition metal ion undergoes

- (1) Oxidation
- (2) Reduction
- (3) Disproportionation
- (4) Neither oxidation nor reduction

SECTION - IV**Straight Objective Question**

Directions : Question No. 55 to 60 are based on (Straight Single Choice - Multiple Concept Questions and/or Difficulty/Lengthy calculations & Application based questions)

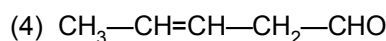
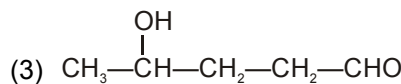
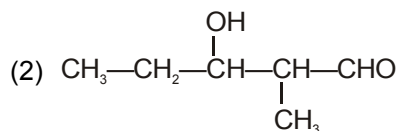
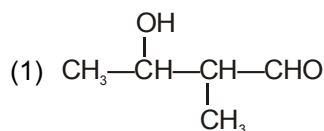
55. A mixture of two salts is not water soluble but dissolves completely in dilute hydrochloric acid to form a colourless solution. The mixture would be

- (1) AgNO₃ & KBr
- (2) BaCO₃ & ZnS
- (3) FeCl₃ & CaCO₃
- (4) Mn(NO₃)₂ & MgSO₄

56. $\text{CH}_3\text{—C}\equiv\text{CH} \xrightarrow[\text{(ii) H}_2\text{O}_2/\text{OH}]{\text{(i) B}_2\text{H}_6} \text{A}$

$$\text{A} + \text{CH}_3\text{CHO} \xrightarrow{\text{dil. NaOH/OH}^-} \text{B}_{\text{major}}$$

Product B is

57. The cation formed in the reaction of XeF₄ and SbF₅ has hybridization of the type

- (1) sp³
- (2) d²sp³
- (3) sp³d
- (4) dsp²

58. Which is mismatched regarding refining method?

- (1) Distillation ——— cd
- (2) Zone refining ——— Si
- (3) Liquation ——— Sn
- (4) Van Arkel method ——— Ni

59. Which one is correct reactivity order of the halides w.r.t. nucleophilic substitution as well as elimination

- (1) R-I > R-Br > R-Cl > R-F
- (2) R-Br > R-Cl > R-I > R-F
- (3) R-F > R-Br > R-Cl > R-I
- (4) R-F > R-Cl > R-Br > R-I

60. Correct among the following

- (1) ArS_N1 is feasible for aromatic halides
- (2) ArS_N1 is not feasible for benzene diazonium chloride
- (3) ArS_N2 is feasible under mild conditions
- (4) ArS_N2 is feasible under vigorous conditions

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MATHEMATICS**SECTION - I****Straight Single Choice Multiple Type Questions /
Application Based Single Choice Questions**

This section contains 16 multiple choice questions numbered 61 to 76. Each question has 4 choices (1), (2), (3) and (4), out of which **ONLY ONE** is correct.

Choose the correct answer :

61. The value of $\lim_{x \rightarrow 0} \left[\frac{\sin x}{x} \right]$ is (where [] denotes greatest integer function)

- (1) 0 (2) 1
(3) -1 (4) Non-existent

62. If $f(x) = e^x$, $g(x) = 2$ and $g'(0) = 1$, then $f'(0)$ is equal to

- (1) 1 (2) 3
(3) 2 (4) 0

63. The function $f(x) = \max\{\sin x, \tan x\}$ is non-differentiable at

- (1) 0, $\pi/2$, $-\pi/2$ (2) $\pi/2$
(3) 0, $\pi/2$ (4) 0, $-\pi/2$

64. The global maximum value of $f(x) = 12\sin x - 5\cos x$ is

- (1) 13 (2) -13
(3) 12 (4) Non-existent

65. If normal to the curve $y = f(x)$ at the point (5, 4) makes an angle $\frac{3\pi}{4}$ with positive x-axis, then $f'(5)$ is equal to

- (1) 2 (2) -2
(3) 1 (4) -1

66. $\lim_{x \rightarrow \infty} \frac{4^x - 7^x + 6^x + 2^{3x}}{7^{x+9} + 6^{x+5} - 5^{x-1} + 2^{3x+1}}$ is

- (1) 1 (2) $\frac{1}{2}$
(3) 2 (4) $-\frac{1}{9}$

67. A function f defined as $f(x) = x^3 - 6x^2 + 9x + 3$ is a decreasing function when x belongs to

- (1) $(-\infty, -1) \cup (3, \infty)$ (2) (1, 3)
(3) (3, ∞) (4) (-1, 3)

68. A function f defined as $f(x) = kx^3 - 9x^2 + 9x + 3$ is

increasing on R , then k satisfy

- (1) $k < 3$
(2) $k > 3$
(3) $k \leq 3$
(4) $k = 1$

69. Sum of maximum and minimum values of $(\sin^{-1}x)^4 + (\cos^{-1}x)^4$ is

- (1) $\frac{137\pi^2}{128}$ (2) $\frac{\pi^4}{17}$

- (3) $\frac{17\pi^4}{16}$ (4) $\frac{137\pi^4}{128}$

70. Angle between curves $y^2 = 2x$ and $x^2 = 2y$ at origin is

- (1) $\frac{\pi}{4}$ (2) π
(3) $\frac{\pi}{2}$ (4) $\frac{\pi}{3}$

71. The limiting value of $\lim_{n \rightarrow \infty} (4^n + 5^n)^{\frac{1}{n}}$ is

- (1) 4 (2) 5
(3) Limit does not exist (4) 1

72. If $y = \frac{1}{x}$, then $\frac{dy}{\sqrt{1+y^4}} + \frac{dx}{\sqrt{1+x^4}}$ is

- (1) 1 (2) -1
(3) 0 (4) $-\frac{1}{x^2}$

73. If a function f is defined and continuous on $[2, 5]$ such that f attains rational values for all x and $f(4) = 8$, then $f(3)$ is

- (1) 6 (2) 2
(3) 3 (4) 8

74. Let $f(x) = (1 + b^2)x^2 + 2bx + 1$ and $m(b)$ the minimum value of $f(x)$ for a given b . As b varies, then the range of $m(b)$ is

- (1) (0, 2) (2) (0, 1]
(3) (2, 4] (4) [-1, 1]

75. The length of a longest interval in which the function $f(x) = 3\sin x - 4\sin^3 x$ is increasing is

Class (XII)

(1) $\frac{\pi}{3}$

(2) $\frac{\pi}{2}$

(3) $\frac{\pi}{6}$

(4) π

76. The equation of the common tangent to the curves $y^2 = 8x$ and $xy = -1$ is

(1) $3y = 9x + 2$

(2) $y = 2x + 1$

(3) $2y = x + 8$

(4) $y = x + 2$

SECTION - II

Assertion – Reason Type Questions

Directions : Questions number 77 to 81 are Assertion-Reason type questions. Each of these questions contains two statements. Statement-1 (Assertion) and Statement-2 (Reason). Each of these questions also has four alternative choices, only one of which is the correct answer. You have to select the correct choice.

77. Statement-1 : $\lim_{x \rightarrow 0} \left[\frac{9x}{\sin x} \right] = 9$.

and

Statement-2 : $\lim_{x \rightarrow 0} \left[\frac{9 \sin x}{x} \right] = 8$.

(1) Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1

(2) Statement-1 is True, Statement-2 is True; Statement-2 is NOT a correct explanation for Statement-1

(3) Statement-1 is True, Statement-2 is False

(4) Statement-1 is False, Statement-2 is True

78. Statement-1 : $f(x) = x^3$ has neither maximum nor minimum value at $x = 0$.

and

Statement-2 : $x = 0$ is a critical point for the function f defined as $f(x) = x^3$.

(1) Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1

(2) Statement-1 is True, Statement-2 is True; Statement-2 is NOT a correct explanation for Statement-1

(3) Statement-1 is True, Statement-2 is False

(4) Statement-1 is False, Statement-2 is True

79. Statement-1 : A function $f(x)$ is strictly monotonic increasing, if and only if it is non periodic.

and

Statement-2 : A periodic function can not be strictly

increasing.

(1) Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1

(2) Statement-1 is True, Statement-2 is True; Statement-2 is NOT a correct explanation for Statement-1

(3) Statement-1 is True, Statement-2 is False

(4) Statement-1 is False, Statement-2 is True

80. Statement-1 : Maximum value of $3 - 2 \sin x + 2 \cos^2 x$ is $\frac{11}{2}$.

and

Statement-2 : The maxima of $3 - 2 \sin x + 2 \cos^2 x$ occurs

at $x = \frac{5\pi}{6}$.

(1) Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1

(2) Statement-1 is True, Statement-2 is True; Statement-2 is NOT a correct explanation for Statement-1

(3) Statement-1 is True, Statement-2 is False

(4) Statement-1 is False, Statement-2 is True

81. Statement-1 : The square root of any function lying between $(0, 1)$ is greater than the number.

and

Statement-2 : The function \sqrt{x} is monotonically decreasing function in $(0, 1)$.

(1) Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1

(2) Statement-1 is True, Statement-2 is True; Statement-2 is NOT a correct explanation for Statement-1

(3) Statement-1 is True, Statement-2 is False

(4) Statement-1 is False, Statement-2 is True

SECTION - III

Comprehension Type Questions

Directions : Question No. 82 to 84 are based on the following paragraph.

A real valued function f is differentiable at $x = a$, then it must be continuous at $x = a$. A function $f(x)$ attains maximum value if $f'(x)$ changes its sign from +ve to -ve and minima is attained by $f(x)$ if $f'(x)$ changes its sign from -ve to +ve.

For a continuous function f , a root of $f(x)$ lies in (p, q) if $f(p)f(q) < 0$.

Class (XII)

Let $f(x)$ be a real valued function defined and differentiable in its domain and

$$f'(c_1) = f'(c_2) = 0, f''(c_1)f''(c_2) < 0$$

$$f(c_1) = 5, f(c_2) = 0 \text{ and } c_1 < c_2.$$

Then

82. If $f(x)$ is continuous in $[c_1, c_2]$ and $f''(c_1) - f''(c_2) > 0$, then minimum number of roots of $f'(x) = 0$ in $[c_1 - 1, c_1 + 1]$ is

- (1) 2 (2) 3
(3) 4 (4) 5

83. If $f(x)$ is continuous in $[c_1, c_2]$ and $f''(c_1) - f''(c_2) < 0$, then minimum number of roots of $f'(x) = 0$ in $[c_1 - 1, c_2 + 1]$ is

- (1) 1 (2) 2
(3) 3 (4) 4

84. If $f(x)$ is continuous in $[c_1, c_2]$ and $f''(c_1) - f''(c_2) \geq 0$, then minimum number of roots of $f'(x) = 0$ in $[c_1 - 1, c_2 + 1]$ is

- (1) 2
(2) 3
(3) 4
(4) 5

SECTION - IV

Straight Objective Question

Directions : Question No. 85 to 90 are based on (Straight Single Choice - Multiple Concept Questions and/or Difficulty/Lengthy calculations & Application based questions)

85. The limiting value of $\lim_{x \rightarrow \infty} \frac{[x]}{x}$, where $[\] = \text{GIF}$ is

- (1) 2 (2) 1
(3) Not defined (4) ∞

86. Let $f(x) = ||x| - 1|$, then the number of points, where $f(x)$ is not differentiable is

- (1) 1 (2) 2
(3) 3 (4) 0

87. Let $f(x) = x^2 + x + 1 + \sin x$, $x \in [0, 2\pi]$. Then the number of real roots of $f(x) = 0$ is

- (1) 1 (2) 2
(3) 3 (4) 0

88. The value of the limit $\lim_{n \rightarrow \infty} \prod_{k=2}^n \left(1 - \frac{1}{k^2}\right)$ is

- (1) 1 (2) $\frac{1}{2}$
(3) $\frac{1}{3}$ (4) $\frac{1}{4}$

89. The function $f(x) = \sin^4 x + \cos^4 x$ increases, if

- (1) $0 < x < \frac{\pi}{8}$ (2) $\frac{\pi}{4} < x < \frac{3\pi}{8}$
(3) $\frac{3\pi}{4} < x < \frac{5\pi}{8}$ (4) $\frac{5\pi}{8} < x < \frac{3\pi}{4}$

90. If $27a + 9b + 3c + d = 0$, then the equation $4ax^3 + 3bx^2 + 2cx + d = 0$ has atleast one real root lying in the interval is

- (1) (0, 1) (2) (0, 2)
(3) (0, ∞) (4) (0, 3)

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WRONG METHODS



CORRECT METHOD



A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D										
1.	○	○	○	○	16.	○	○	○	○	31.	○	○	○	○	46.	○	○	○	○	61.	○	○	○	○	76.	○	○	○	○
2.	○	○	○	○	17.	○	○	○	○	32.	○	○	○	○	47.	○	○	○	○	62.	○	○	○	○	77.	○	○	○	○
3.	○	○	○	○	18.	○	○	○	○	33.	○	○	○	○	48.	○	○	○	○	63.	○	○	○	○	78.	○	○	○	○
4.	○	○	○	○	19.	○	○	○	○	34.	○	○	○	○	49.	○	○	○	○	64.	○	○	○	○	79.	○	○	○	○
5.	○	○	○	○	20.	○	○	○	○	35.	○	○	○	○	50.	○	○	○	○	65.	○	○	○	○	80.	○	○	○	○
6.	○	○	○	○	21.	○	○	○	○	36.	○	○	○	○	51.	○	○	○	○	66.	○	○	○	○	81.	○	○	○	○
7.	○	○	○	○	22.	○	○	○	○	37.	○	○	○	○	52.	○	○	○	○	67.	○	○	○	○	82.	○	○	○	○
8.	○	○	○	○	23.	○	○	○	○	38.	○	○	○	○	53.	○	○	○	○	68.	○	○	○	○	83.	○	○	○	○
9.	○	○	○	○	24.	○	○	○	○	39.	○	○	○	○	54.	○	○	○	○	69.	○	○	○	○	84.	○	○	○	○
10.	○	○	○	○	25.	○	○	○	○	40.	○	○	○	○	55.	○	○	○	○	70.	○	○	○	○	85.	○	○	○	○
11.	○	○	○	○	26.	○	○	○	○	41.	○	○	○	○	56.	○	○	○	○	71.	○	○	○	○	86.	○	○	○	○
12.	○	○	○	○	27.	○	○	○	○	42.	○	○	○	○	57.	○	○	○	○	72.	○	○	○	○	87.	○	○	○	○
13.	○	○	○	○	28.	○	○	○	○	43.	○	○	○	○	58.	○	○	○	○	73.	○	○	○	○	88.	○	○	○	○
14.	○	○	○	○	29.	○	○	○	○	44.	○	○	○	○	59.	○	○	○	○	74.	○	○	○	○	89.	○	○	○	○
15.	○	○	○	○	30.	○	○	○	○	45.	○	○	○	○	60.	○	○	○	○	75.	○	○	○	○	90.	○	○	○	○