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IN JEE MAIN AND ADVANCED

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Time : 3 hrs.

Max. Marks: 360

Topics covered in various subjects :

Syllabus of AITS-5, 6 AND 7

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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PHYSICS

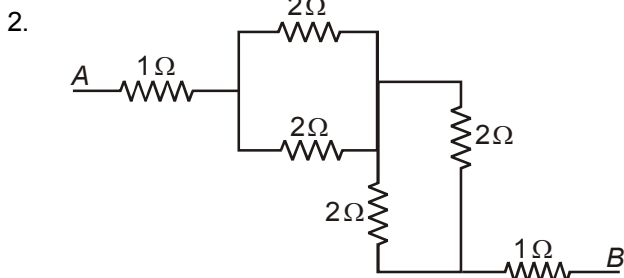
SECTION - I

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. A proton is projected into uniform electric field. Trajectory of the particle cannot be
 (1) Straight line (2) Parabola
 (3) Circle (4) Both (1) & (2)



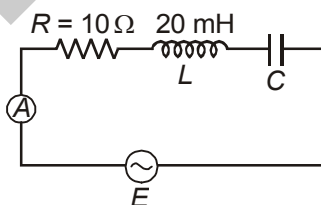
Resistance of the network between A and B is

- (1) $2\ \Omega$ (2) $1\ \Omega$
 (3) $4\ \Omega$ (4) $3\ \Omega$
3. A charge q of mass m is executing uniform circular motion in a circle of radius r with speed v . magnetic field at its centre is

- (1) $\frac{\mu_0 qv}{4\pi r}$ (2) $\frac{\mu_0 qv}{4\pi r^2}$
 (3) $\frac{\mu_0 qv}{2\pi r}$ (4) $\frac{\mu_0 qv}{2\pi r^2}$

4. Magnetic flux linked with a circuit is $\phi = (2t^2 + 4)\text{Wb}$. If the resistance of the circuit is $2\ \Omega$, then current in the circuit at $t = 2\text{ s}$ is
 (1) 4 A (2) 8 A
 (3) 2 A (4) 6 A

5. If the current shown by the hot wire ammeter (A) is 2 A, then average power consumed in the a.c. circuit shown is



- (1) 20 W (2) 80 W
 (3) 40 W (4) Data insufficient

6. Lateral magnification produced by the objective of a compound microscope is 100 and angular magnification produced by the eyepiece is 100. Magnifying power of the compound microscope is

- (1) -10,000 (2) -1
 (3) -1,000 (4) -500

7. A nucleus at rest produced an α -particle of de-Broglie wavelength $0.1\ \text{\AA}$. de-Broglie wavelength of the daughter nucleus produced is

- (1) $0.05\ \text{\AA}$ (2) $0.2\ \text{\AA}$
 (3) $0.1\ \text{\AA}$ (4) $0.3\ \text{\AA}$

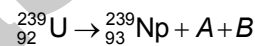
8. The angular momentum of electron in 2nd orbit of hydrogen atom to the 1st excited state of He^+ ion is

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

9. A hydrogen like atom has three energy levels related as $E_1 < E_2 < E_3$. Wavelengths of photon emitted during transition E_3 to E_2 and E_2 to E_1 are $1500\ \text{\AA}$ and $1000\ \text{\AA}$ respectively. Wavelength of photon emitted during transition E_3 to E_1 is

- (1) $1250\ \text{\AA}$ (2) $600\ \text{\AA}$
 (3) $1200\ \text{\AA}$ (4) $2500\ \text{\AA}$

10. Fill in the particles A and B in the nuclear reaction

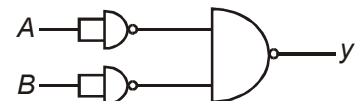


- (1) $A = {}_{-1}^0\text{e}$, $B = \bar{\nu}$ (2) $A = {}_{+1}^0\text{e}$, $B = \nu$
 (3) $A = {}_{-1}^0\text{e}$, $B = \nu$ (4) $A = {}_{+1}^0\text{e}$, $B = \bar{\nu}$

11. $3/4$ th of a radioactive sample decays in 10 year. Half life of the sample is

- (1) 10 year (2) 5 year
 (3) 2 year (4) 2.5 year

12. If output y in the logic gate shown is



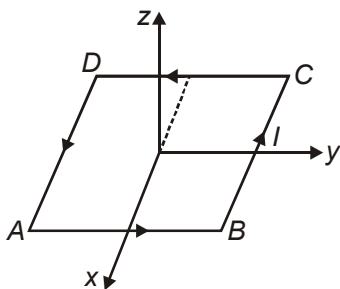
- (1) $y = A + B$ (2) $y = A \cdot B$
 (3) $y = \bar{A} + \bar{B}$ (4) $y = \bar{A} \cdot \bar{B}$

13. Voltage gain and current gain in a transistor CE amplifier are 1000 and 100 respectively. If the input resistance is $10\ \text{k}\Omega$, then load resistance of the amplifier is

- (1) $1000\ \Omega$ (2) $10\ \text{k}\Omega$
 (3) $100\ \text{k}\Omega$ (4) $500\ \text{k}\Omega$

Class (XII)

14. A current carrying square frame $ABCD$ of sides a is in xy plane as shown in figure. The magnetic moment of the frame is



- (1) $-Ia^2 \hat{k}$ (2) $Ia^2 \hat{j}$
 (3) $-Ia^2 \hat{i}$ (4) $Ia^2 \hat{k}$
15. A bulb rated (100W, 200V) is connected across 150 V supply. Power consumed by it is
 (1) 100 W (2) 50 W
 (3) 75 W (4) 56.25 W
16. A capacitor of capacity 50 μF is connected across 10 V battery. The heat lost in connecting wires during complete charging of capacitor is
 (1) 25 mJ (2) 250 mJ
 (3) 2.5 mJ (4) 2500 mJ

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. Statement-1 : Two conductors have capacity even if they did not have equal and opposite charge.
and
 Statement-2 : Every conductor has a capacity to store charge.
 (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. Statement-1 : A battery of emf E and internal resistance r is connected across a load resistance R . The maximum rate at which energy is dissipated in R is

$$P = \frac{\varepsilon^2}{2R}$$

and

Statement-2 : At $R = r$, the rate at which energy is dissipated in R 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
19. Statement-1 : The magnetic induction inside a straight solenoid of finite length is less than $\mu_0 nI$.

and

Statement-2 : The magnetic field inside a solenoid is

$$\beta = \frac{\mu_0 nI}{2} (\sin \alpha_1 + \sin \alpha_2) \text{ with } \sin \alpha_1 \text{ and } \sin \alpha_2 < 1.$$

- (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
20. Statement-1 : Electric lines of force may be closed curves.
and
 Statement-2 : The electric field lines formed by a changing magnetic field is always a closed curve.
 (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 Rutherford's α -scattering experiment, at distance of closest approach potential energy of α -particle is maximum.

and

Statement-2 : The α -particle and the nucleus repel each other.

- (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;

Class (XII)

Statement-2 is NOT a correct explanation for Statement-1

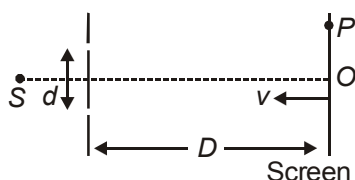
- (3) Statement-1 is True, Statement-2 is False
- (4) Statement-1 is False, Statement-2 is True

SECTION - III

Comprehension Type Questions

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

In YDSE apparatus shown in figure, wavelength of light used is λ . The screen is moved away from the source with a constant speed v . Initial distance between screen and plane of slits is D .



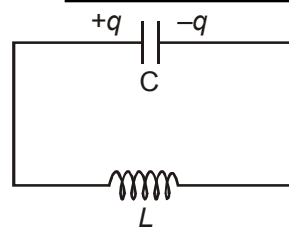
- 22. At a point P on the screen the order of fringe will
 - (1) Increase
 - (2) Decrease
 - (3) Remain constant
 - (4) First increase then decrease
- 23. The angular width of the fringes on the screen will
 - (1) Increase
 - (2) Decrease
 - (3) Remain constant
 - (4) First increase then decrease
- 24. Suppose P is the point where 4th order minima was lying at $t = 0$. Then after how much time 7th order maxima will lie at this point?
 - (1) $\frac{D}{4v}$
 - (2) $\frac{D}{2v}$
 - (3) $\frac{D}{3v}$
 - (4) $\frac{2D}{3v}$

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. In a $L - C$ circuit shown in figure :
 - $C = 1 \text{ F}$ and $L = 5 \text{ H}$
 - At time $t = 0$, charge in the capacitor is 10 coulomb and it is decreasing at a rate of 5 C/s. The maximum charge in the capacitor can be

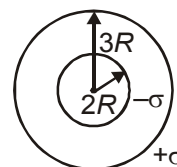


- (1) 10 C
- (2) 15 C
- (3) 20 C
- (4) 25 C

- 26. A charged particle (q, m) is released from origin with velocity $\vec{v} = v_0 \hat{i}$ in a uniform magnetic field $\vec{B} = \frac{\vec{B}_0}{\sqrt{2}} \hat{i} + \frac{\vec{B}_0}{\sqrt{2}} \hat{j}$. Pitch of the helical path described by the particle is

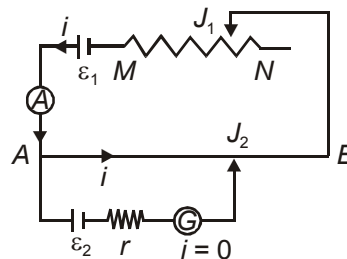
- (1) $\frac{\pi m v_0}{q B_0}$
- (2) $\frac{\pi m v_0}{\sqrt{2} q B_0}$
- (3) $\frac{\sqrt{3} \pi m v_0}{2 q B_0}$
- (4) $\frac{\sqrt{2} \pi m v_0}{q B_0}$

- 27. The outer surface charge densities of two thin concentric spherical shells, having radii $2R$ and $3R$, are σ and $-\sigma$ respectively. Now they are arranged as shown below and connected by a thin wire. Potential on either of the shells will be



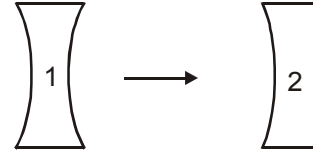
- (1) $\frac{5\sigma R}{3\epsilon_0}$
- (2) $\frac{\sigma R}{3\epsilon_0}$
- (3) $\frac{2\sigma R}{3\epsilon_0}$
- (4) $\frac{7\sigma R}{3\epsilon_0}$

- 28. Choose the correct option from the following



- (1) If the emf ε_1 is increased, keeping all other things to be fixed then to get null point in galvanometer jockey J_2 will have to be moved towards right
- (2) When jockey J_1 is moved towards right over the resistance wire MN , jockey J_2 will also have to be moved towards right to get null point in galvanometer
- (3) When jockey J_1 is moved towards right over the resistance wire MN , jockey J_2 will have to be moved towards left to get null point in galvanometer
- (4) If the emf ε_1 is increased, keeping all other things to be fixed then to get null point in galvanometer jockey J_2 will have to be moved either to the left or right
29. A biconvex lens is cut from the middle as shown in figure. Refractive index of material of lens is $\frac{3}{2}$. Now

lens 1 as shown in figure is immersed in a liquid of refractive index μ_0 . It is observed that the focal length of 1st lens becomes equal to lens 2. What is the value of μ_0 ?



- (1) 1.3 (2) 1.1
(3) 1.4 (4) 1.2
30. The half-life of a radioactive element is 1 h. The probability that a particular nucleus will decay in 2 h is
- (1) $\frac{1}{4}$ (2) $\frac{1}{2}$
(3) $\frac{1}{3}$ (4) $\frac{1}{8}$

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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. In crystalline solid, distance between two Na^+ (if edge length is a)

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

32. A crystal is made of x , y and z . x forms f.c.c. packing, y occupies all the octahedral voids of x and z occupies all the tetrahedral voids of x . If all the particles along one body diagonal are removed then the formula of the crystal would be

- (1) xyz_3 (2) x_2yZ_2
(3) $x_8y_4Z_5$ (4) $x_5y_4Z_8$

33. Which of the following ion have highest ionic mobility?

- (1) H^+ (2) Li^+
(3) Na^+ (4) K^+

34. The rate of reaction $3A + 2B \rightarrow \text{product}$ is given by the rate expression rate = $k[A][B]^2$.

If A is taken in excess the order of the reaction would be

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

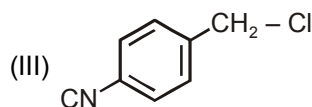
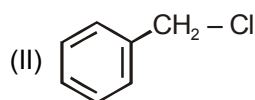
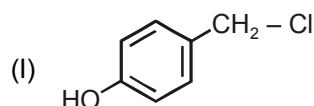
35. Which of the following forms maximum boiling azeotrope?

- (1) Water and ethanol
(2) n -butyl chloride and n -butyl bromide
(3) Acetic acid and pyridine
(4) Pyridine and water

36. Which of the following processes are not involved in extraction of cast iron?

- (1) Concentration by gravity process
(2) Calcination in reverberatory furnace
(3) Smelting in blast furnace
(4) Quenching

37. Arrange the following in decreasing order of reactivity



- (1) I > II > III (2) II > III > I
(3) III > I > II (4) I > III > II

38. The hybridisation may be expected for Cl in liquid ClF_3

- (1) sp^3d (2) sp^3
(3) sp^3d^2 (4) All of these

39. Stability of oxidation state in aqueous medium depend on

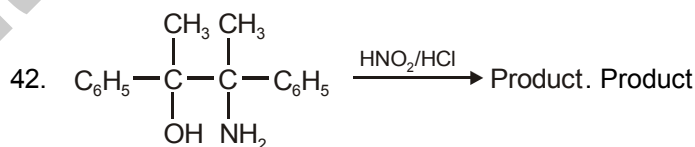
- (1) Electronic configuration
(2) Sum of ionisation energy
(3) Hydration energy
(4) Both (2) & (3)

40. Which of the following is coloured due to charge transfer?

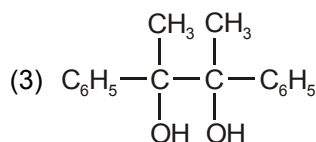
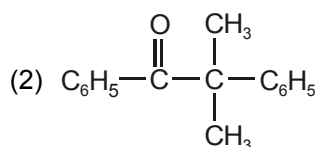
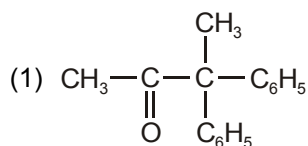
- (1) $\text{Cr}_2(\text{SO}_4)_3$ (2) $\text{Cu}_2[\text{Fe}(\text{CN})_6]$
(3) Ag_3PO_4 (4) AgCl

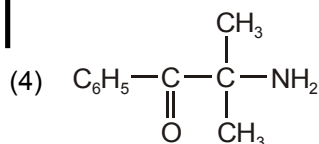
41. 0.02 molar NaCl having degree of dissociation of 90% at 27°C has osmotic pressure equal to

- (1) 94 bar (2) 9.4 bar
(3) 0.094 bar (4) 0.94 bar

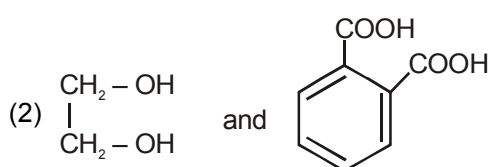
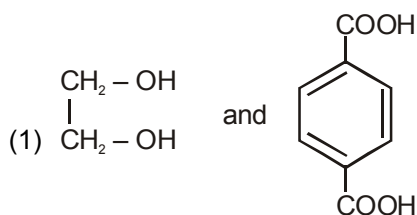


formed is



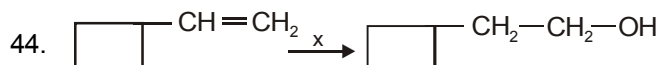


43. Terylene is a polymer of

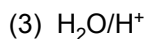
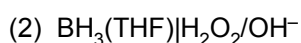
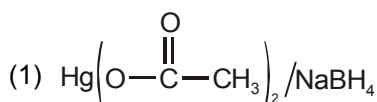


(3) Adipic acid and sebacic acid

(4) All of these



Reagent X may be

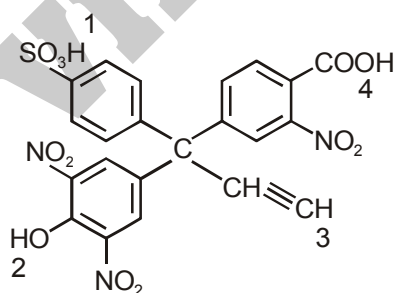


45. 0.6g org compound when subjected to Duma's method produces 300 ml gas mixture containing water vapours with aq. tension 40mm of Hg at 1 atm pressure. % of N in the compound is:

(1) 53.84 (2) 47.14

(3) 43.14 (4) 56.86

46. The acidic strength order is



(1) $1 > 2 > 3 > 4$

(2) $1 > 4 > 2 > 3$

(3) $1 > 2 > 4 > 3$

(4) $1 > 3 > 4 > 2$

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 : Due to defects, conductance of crystal increases.

and

Statement-2 : Due to defects, hole formation take place which move under applied electric field.

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

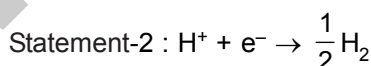
(2) Statement-1 is True, Statement-2 is True; Statement-2 is NOT a correct explanation for Statement-1

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

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

48. Statement-1 : Hydrogen electrode dipped in a solution of HCl having concentration 10^{-3}M has reduction potential zero.

and



(C₁)

For this reaction Nernst equation is

$$E = \frac{-0.0591}{1} \log \frac{1}{[\text{H}^+]}$$

(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 : Fructose is sweeter than glucose.

and

Statement-2 : Fructose is a ketose sugar.

(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 : Amino acid may exist as Zwitter ion in aqueous solution.

and

Statement-2 : All amino acids are neutral.

- (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 : Aromatic anhydrides have lower boiling point than aromatic acids.

and

Statement-2 : Intermolecular H-bonding increases boiling point.

- (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

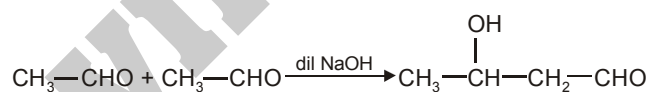
SECTION - III

Comprehension Type Questions

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

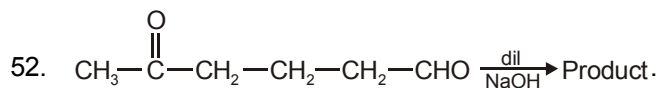
Aldol condensation:

When two molecule of aldehyde or ketone having α -hydrogen (at least two) are treated with dil. NaOH, we get a aldol product

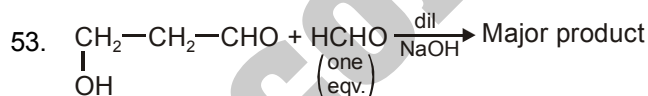
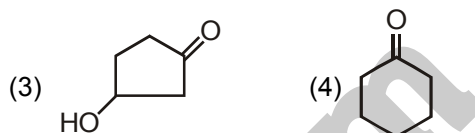


Aldol may be of following type

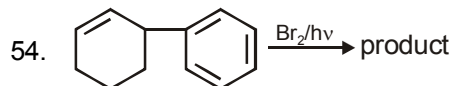
- (i) Cross aldol condensation
 (ii) Intra molecular aldol condensation

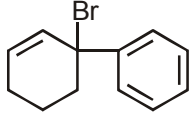
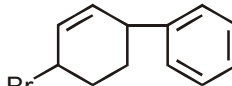
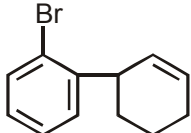
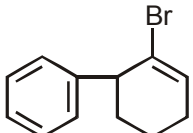


Product formed is



- (1) $\left(\text{CH}_2\right)_2\text{CH—CHO}$
 (2) $\text{CH}_2\text{—CH}_2\text{—CH}_2\text{—CHO}$
 (3) HCOONa
 (4) No reaction



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

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. When excess of dilute NH_4OH is added to an aqueous solution of copper sulphate an intense blue colour is obtained. This is due to formation of

- (1) CuSO_4 (2) $\text{Cu}(\text{OH})_2$
 (3) $[\text{Cu}(\text{NH}_3)_4]^{+2}$ (4) $(\text{NH}_4)_2\text{SO}_4$

56. Rate of reaction of a particular reaction increases by 5 times. If temperature is raised by 100°C . If initial rate is at 300 K, then activation energy of that reaction will be

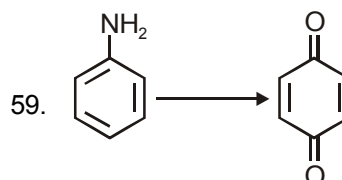
- (1) 0.4 kcal (2) 3.86 kcal
 (3) 800 kcal (4) 10 kcal

57. Which of the following shows maximum sweetness:

- (1) Sucrose (2) Fructose
 (3) Sucralose (4) Galactose

58. CN^- is a strong field ligand. This is due to the fact that

- (A) It carries negative charge
 (B) It is a conjugate base of weak acid
 (C) It can accept electrons from metal species
 (D) It forms high spin complexes with metal species



This conversion can be converted by

- (1) CF_3COOH (2) H_2SO_5
 (3) H_2CrO_4 (4) KMnO_4/H^+

60. In electrophoresis:

- (1) negative colloidal particles move towards cathode
 (2) positive colloidal particles move towards anode
 (3) positive colloidal particles move towards cathode
 (4) colloidal particles move towards opposite poles in any experiment

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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. If $\hat{a}, \hat{b}, \hat{c}$ be unit coplanar vectors, then

$[\hat{a} + 2\hat{b} + 3\hat{c} \hat{a} - 2\hat{b} - 4\hat{c} 2\hat{a} - 3\hat{b}]$ is equal to

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

62. $\lim_{x \rightarrow 0} \left(\frac{7}{2 + \sqrt{25 + x}} \right)^{\frac{1}{\sin x}}$ is equal to

- (1) $e^{-\frac{1}{70}}$ (2) $e^{-\frac{1}{7}}$
(3) $e^{-\frac{1}{10}}$ (4) $e^{-\frac{1}{35}}$

63. The mean of 5 observations is 4.4 and their variance is 8.24. If three observations are 1, 2 and 6, the other two observations are

- (1) 4 and 8 (2) 4 and 9
(3) 5 and 7 (4) 5 and 9

64. Solution of differential equation

$x^2 y dx - xy dx + (1 + y^2) dy = 0$ is

- (1) $x^3 - x^2 + \ln(1 + y^2) + C = 0$
(2) $\ln(1 + x^2) + y \ln y + C = 0$

(3) $\frac{x^3}{3} - \frac{x^2}{2} + \ln y + \frac{y^2}{2} + C = 0$

(4) $\frac{x^2}{3} - \frac{x}{2} + \ln y + \frac{y^2}{2} + C = 0$

65. Number of points where $y = \{\sin\{x\}\}$ is discontinuous in interval $[0, 5]$ is, where $\{x\}$ represents fractional part of x

- (1) 3
(2) 6
(3) 4
(4) 5

66. If $f''(x) > 0 \forall x \in R$ and $g(x) = f(x) + f(1 - x)$ then the interval of x in which $g(x)$ is increasing is

- (1) $\left(-\infty, \frac{1}{2}\right)$ (2) $\left(-\infty, \frac{-1}{2}\right)$
(3) $\left(\frac{1}{2}, \infty\right)$ (4) $\left(\frac{-1}{2}, \frac{1}{2}\right)$

67. The equation of the plane passing through the intersection of the planes $2x - 3y + z - 4 = 0$ and $x - y + z + 1 = 0$ and perpendicular to the plane $x + 2y - 3z + 6 = 0$ is

- (1) $5x - 3y - 5z - 23 = 0$
(2) $x - 5y - 3z - 23 = 0$
(3) $x + y - 3z - 25 = 0$
(4) $x + 5y + 3z + 23 = 0$

68. If the system of equations

$$x + 2y - 3z = 1, (p + 2)z = 3, (2p + 1)y + z = 2$$

is inconsistent, then the value of p is

(1) -2

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

(3) 0

(4) 2

69. A biased die is constructed such that the probability of coming even number is twice to that of an odd number. If die is rolled 6 times, then the probability that the number greater than 3 has come exactly 3 times is

(1) $\left(\frac{1}{2}\right)^6 \cdot {}^6C_3 5^3$ (2) ${}^6P_3 \left(\frac{20}{9}\right)^3$

(3) $\left(\frac{1}{9}\right)^6 \cdot {}^6C_3 5^3$ (4) $\left(\frac{1}{9}\right)^6 \cdot {}^6C_3 (20)^3$

70. If $\int_{\cos x}^1 t^2 f(t) dt = 1 + \cos x \forall x \in \left(0, \frac{\pi}{2}\right)$, then $f\left(\frac{1}{4}\right)$ is

equal to

- (1) -4
(2) 4
(3) -16
(4) -12

71. $\int \frac{1 - x^7}{x(1 + x^7)} dx$ is equal to

(1) $\ln|x| - \frac{2}{7} \ln|x^7 + 1| + c$

(2) $\ln|x| + \frac{2}{7} \ln|x^7 + 1| + c$

(3) $-\ln|x| - \frac{2}{7} \ln|x^7 + 1| + c$

$$(4) \ln|x| + \frac{1}{7} \ln|x^7 + 1| + c$$

72. Area bounded by the curve $y = 2^{|x|}$ and the lines $|x| = 1$ is equal to

(1) $\frac{1}{\ln 2}$ sq. units (2) $\ln 2$ sq. units

(3) $\frac{2}{\ln 2}$ sq. units (4) $2\ln 2$ sq. units

73. If A is a non-singular square matrix of order 3, then $|\text{adj}(\text{adj}A)|$ is equal to

(1) $|A|$

(2) $|A|^2$

(3) $|A|^3$

(4) $|A|^4$

74. If $f(x) = xe^{x(1-x)}$, then $f(x)$ is

(1) Increasing on $\left(-\infty, -\frac{1}{2}\right) \cup (1, \infty)$

(2) Decreasing on $\left(-\infty, -\frac{1}{2}\right) \cup (1, \infty)$

(3) Increasing on R

(4) Decreasing on $(0, \infty)$

75. If $\vec{a}, \vec{b}, \vec{c}$ is three non-coplanar vectors, then

$(\vec{a} - 2\vec{b}) \cdot \{(\vec{b} + 2\vec{c} - \vec{a}) \times (\vec{a} - 2\vec{b} + 3\vec{c})\}$ is equal to

(1) 0

(2) $[\vec{a} \vec{b} \vec{c}]$

(3) $-2[\vec{a} \vec{b} \vec{c}]$

(4) $-3[\vec{a} \vec{b} \vec{c}]$

76. One ball is being drawn from each of the boxes containing 3 white, 1 red, 2 white, 2 red and 1 white, 3 red balls. The probability of drawing 1 white and 2 red balls is

(1) $\frac{13}{32}$ (2) $\frac{13}{64}$

(3) $\frac{9}{32}$ (4) $\frac{9}{64}$

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 : $y = x^{1/3}$ is not differentiable at $x = 0$.

and

Statement-2 : If the graph of the function $y = f(x)$ has a corner point at $x = a$, then function is non-differentiable at $x = a$.

(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 : $\sim(p \wedge (\sim q)) = \sim p \vee q$.

and

Statement-2 : $\sim(p \wedge q) = \sim p \wedge \sim q$.

(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 : If $\begin{vmatrix} x & y & z \\ 1 & -1 & 3 \\ 2 & 1 & 5 \end{vmatrix} = 5$, then the value of

$$\begin{vmatrix} -8 & 1 & 3 \\ z-5y & 5x-2z & 2y-x \\ 3y+z & z-3x & -x-y \end{vmatrix} \text{ is } 25.$$

and

Statement-2 : If $A = [a_{ij}]_{n \times n}$, be square matrix then $\text{adj}A = |A|^2$.

(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 : The shortest distance between the lines

$$\vec{r} = (1+2\lambda)\hat{i} + (2+3\lambda)\hat{j} + (6\lambda-4)\hat{k} \quad \text{and}$$

$$\vec{r} = (3 + 2\mu)\hat{i} + (3 + 3\mu)\hat{j} + (6\mu - 5)\hat{k} \text{ is } \frac{\sqrt{293}}{7}.$$

and

Statement-2 : The shortest distance between two skew lines $\vec{r} = \vec{a}_1 + \lambda\vec{b}_1$ and $\vec{r} = \vec{a}_2 + \lambda\vec{b}_2$ is

$$\frac{(\vec{a}_2 - \vec{a}_1) \cdot (\vec{b}_1 \times \vec{b}_2)}{|\vec{b}_1 \times \vec{b}_2|}.$$

- (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 :

$$\int \left\{ \ln(\ln x) + \frac{1}{(\ln x)^2} \right\} dx = x \left\{ \ln(\ln x) - \frac{1}{\ln x} \right\} + c$$

and

$$\text{Statement-2 : } \frac{d}{dx} \{e^x \cdot f(x)\} = e^x \{f(x) + f'(x)\}.$$

- (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

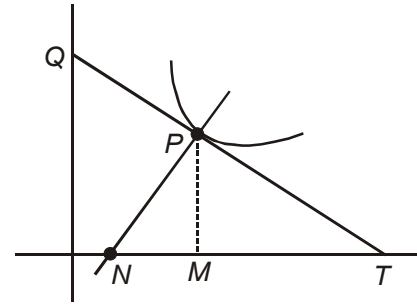
Comprehension Type Questions

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

Let $y = f(x)$ be a given curve whose graph is as shown in figure, and QPT be tangent to the curve at P then

$$MN = \text{Length of subnormal} = y \frac{dy}{dx}$$

$$MT = \text{Length of subtangent} = \frac{y}{\left(\frac{dy}{dx}\right)}$$



With the above information answer the following questions.

82. If parametric equation of $y = f(x)$ is $x = a(t + \sin t)$, $y = a(1 - \cos t)$, then length of the sub-tangent at t is
- (1) $a \sin t$ (2) $a \sin \frac{t}{2}$
- (3) $a \cos t$ (4) $a \tan \frac{t}{2}$
83. For $x = a(t + \sin t)$, $y = a(1 - \cos t)$ the length of the sub-normal at t is
- (1) $a \tan \frac{t}{2}$ (2) $a \tan \frac{t}{2} \cdot (1 + \cos t)$
- (3) $a(1 + \cos^2 t)$ (4) $a \tan \frac{t}{2} \cdot (1 - \cos t)$
84. For the curve $y = 3e^{\frac{x}{2}}$, length of subnormal at $x = 0$ is
- (1) 4 (2) 9 (3) 3 (4) $\frac{9}{2}$

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)

$$85. \text{ Let } f(x) = \begin{cases} x^n \cos \frac{1}{x}, & x \neq 0 \\ 0, & x = 0 \end{cases}$$

If $f(x)$ is differentiable at $x = 0$, then minimum value of n is

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

86. $\int \frac{x^4 + x^2 + 1}{\sqrt{2x^4 + 3x^2 + 6}} dx$ is equal to

- (1) $\sqrt{2x^6 + 3x^4 + 6x^2} + c$
 (2) $\frac{1}{6}\sqrt{2x^6 + 3x^4 + 6x^2} + c$
 (3) $\frac{1}{6}\sqrt{2x^6 - 3x^4 + 6x^2} + c$
 (4) $\frac{1}{3}\sqrt{2x^6 - 3x^4 + 6x^2} + c$

87. $\int_0^{\frac{8\pi}{3}} \sqrt{1 + \cos 2x} dx$ is equal to

- (1) 0
 (2) $\frac{16}{3}$
 (3) $6\sqrt{2} - \sqrt{\frac{3}{2}}$
 (4) $5\sqrt{2} + \sqrt{\frac{3}{2}}$

88. The number of distinct real roots of the equation

$$\begin{vmatrix} \operatorname{cosec} \theta & \sec \theta & \sec \theta \\ \sec \theta & \operatorname{cosec} \theta & \sec \theta \\ \sec \theta & \sec \theta & \operatorname{cosec} \theta \end{vmatrix} = 0 \quad \text{in the interval}$$

$$\left[-\frac{\pi}{4}, \frac{\pi}{4}\right] \text{ is}$$

- (1) 2
 (2) 3
 (3) 0
 (4) 1
89. Two consecutive vertex of a rectangle lies on line $y = x$, and line $y = -3x + 5$ and other two lies on positive x-axis, then maximum area of rectangle is
- (1) $\frac{5}{48}$
 (2) $\frac{25}{48}$
 (3) $\frac{25}{12}$
 (4) $\frac{25}{36}$
90. Let $f(x)$ be a cubic polynomial with $x = 0$ as repeated root. If $f'(x)$ has a point of local maxima at $x = 1$ and $f(1) = 2$, then the distance between points of maxima and minima of $y = f(x)$ is
- (1) $\sqrt{5}$
 (2) 5
 (3) $3\sqrt{5}$
 (4) $2\sqrt{5}$

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5.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	20.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	35.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	50.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	65.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	80.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
6.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	21.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	36.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	51.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	66.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	81.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
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9.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	24.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	39.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	54.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	69.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	84.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
10.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	25.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	40.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	55.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	70.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	85.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
11.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	26.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	41.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	56.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	71.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	86.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
12.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	27.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	42.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	57.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	72.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	87.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
13.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	28.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	43.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	58.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	73.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	88.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
14.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	29.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	44.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	59.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	74.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	89.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
15.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	30.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	45.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	60.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	75.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	90.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>