Jee Main 5th April Shift 2 Question Paper

Mathematics

1. Let $f : [-1, 2] \to R$ be given by $f(x) = 2x^2 + x + \lfloor x^2 \rfloor - \lfloor x \rfloor$, where $\lfloor t \rfloor$ denotes the greatest integer less than or equal to t. The number of points where f is not continuous is:

(1) 6

(2) 3

(3) 4

(4) 5

2. The differential equation of the family of circles passing the origin and having center at the line $y = x$ is:

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

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

(3) $(x^2 - y^2 + 2xy)dx = (x^2 - y^2 - 2xy)dy$
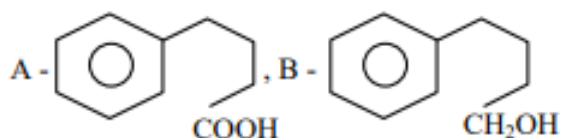
(4) $(x^2 + y^2 - 2xy)dx = (x^2 + y^2 + 2xy)dy$

3. Let $S_1 = \{z \in C : |z| \le 5\}$,
$S_2 = \left\{ z \in C : \text{Im}\left(\frac{z+1-\sqrt{3}i}{1-\sqrt{3}i} \right) \ge 0 \right\}$, and
$S_3 = \{z \in C : \text{Re}(z) \ge 0\}$. Then:

(1) $\frac{125\pi}{6}$

(2) $\frac{125\pi}{24}$

(3) $\frac{125\pi}{4}$

(4) $\frac{125\pi}{12}$

4. The area enclosed between the curves $y = |x|$ and $y = x - |x|$ is:

A - , B -

COOH   CH$_2$OH

(1) $\frac{8}{3}$

(2) $\frac{2}{3}$

(3) 1

(4) $\frac{4}{3}$

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5. 60 words can be made using all the letters of the word BHBJO, with or without meaning. If these words are written as in a dictionary, then the 50$^{\text{th}}$ word is:

(1) OBBHJ

(2) HBBJO

(3) OBBJH

(4) JBBOH

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6. Let $\vec{a} = 2\hat{i} + 5\hat{j} - \hat{k}$, $\vec{b} = 2\hat{i} - 2\hat{j} + 2\hat{k}$, and $\vec{c}$ be three vectors such that:

$$(\vec{c} + \hat{i}) \times (\vec{a} + \vec{b} + \hat{i}) = \vec{a} \times (\vec{c} + \hat{i}) \quad \text{and} \quad \vec{a} \cdot \vec{c} = -29,$$

then $\vec{c} \cdot (-2\hat{i} + \hat{j} + \hat{k})$ is equal to:

(1) 10

(2) 5

(3) 15

(4) 12

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7. Consider three vectors $\vec{a}, \vec{b}, \vec{c}$. Let $|\vec{a}| = 2, |\vec{b}| = 3$, and $\vec{a} = \vec{b} \times \vec{c}$. If $\alpha \in \left[0, \frac{\pi}{3}\right]$ is the angle between the vectors $\vec{b}$ and $\vec{c}$, then the minimum value of $27|\vec{c} - \vec{a}|^2$ is equal to:

(1) 110

(2) 105

(3) 124

(4) 121

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8. Let $A(-1, 1)$ and $B(2, 3)$ be two points and P be a variable point above the line AB such that the area of ΔPAB is 10. If the locus of P is $ax + by = 15$, then $5a + 2b$ is:

(1) $-\frac{12}{5}$

(2) $-\frac{6}{5}$

(3) 4

(4) 6

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9. Let (α, β, γ) be the point $(8, 5, 7)$ in the line

$$\frac{x-1}{2} = \frac{y+1}{3} = \frac{z-2}{5}.$$

Then $\alpha + \beta + \gamma$ is equal to:
(1) 16
(2) 18
(3) 14
(4) 20

10: If the constant term in the expansion of

$$\left(\frac{\sqrt[3]{5}}{x} + \frac{2x}{\sqrt[3]{5}} \right)^{12}, x \neq 0,$$

is $\alpha x^2 \times \sqrt[3]{5}$, then 25α is equal to: (1) 639
(2) 724
(3) 693
(4) 742

11: Let $f, g : R \to R$ be defined as: $f(x) = |x - 1|$ and

$$g(x) = \begin{cases} e^x, & x \geq 0 \\ x + 1, & x \leq 0 \end{cases}. \text{ Then the function } f(g(x)) \text{ is}$$

(1) neither one-one nor onto.
(2) one-one but not onto.
(3) both one-one and onto.
(4) onto but not one-one.

12: Let the circle $C_1 : x^2 + y^2 - 2(x + y) + 1 = 0$ and C_2 be a circle having centre at $(-1, 0)$ and radius 2. If the line of the common chord of C_1 and C_2 intersects the y-axis at the point P, then the square of the distance of P from the centre of C_1 is:

(1) 2
(2) 1
(3) 6
(4) 4

13: Let the set $S = \{2, 4, 8, 16, \ldots, 512\}$ be partitioned into **3** sets A, B, C with an equal number of elements such that $A \cup B \cup C = S$ and $A \cap B = B \cap C = A \cap C = \emptyset$. The maximum number of such possible partitions of S is equal to:
(1) 1680
(2) 1520
(3) 1710
(4) 1640

14: The values of m, n for which the system of equations

$$x + y + z = 4,$$

$$2x + 5y + 5z = 17,$$

$$x + 2y + mz = n$$

has infinitely many solutions, satisfy the equation:
(1) $m^2 + n^2 - m - n = 46$
(2) $m^2 + n^2 + m + n = 64$
(3) $m^2 + n^2 + mn = 68$
(4) $m^2 + n^2 - mn = 39$

15: The coefficients a, b, c in the quadratic equation $ax^2 + bx + c = 0$ are from the set $\{1, 2, 3, 4, 5, 6\}$. If the probability of this equation having one real root bigger than the other is p, then $216p$ equals:
(1) 57
(2) 38
(3) 19
(4) 76

16: Let $ABCD$ and $AEFG$ be squares of side 4 and 2 units, respectively. The point E is on the line segment AB and the point F is on the diagonal AC. Then the radius r of the circle passing through the point F and touching the line segments BC and CD satisfies:

(1) $r = 1$
(2) $r^2 - 8r + 8 = 0$
(3) $2r^2 - 4r + 1 = 0$
(4) $2r^2 - 8r + 7 = 0$

17: Let $\beta(m, n) = \int_0^1 x^{m-1}(1-x)^{n-1}\, dx$, $m, n > 0$. **If**

$$\int_0^1 (1 - x^{10})^{20}\, dx = a \times \beta(b, c),$$

then $100(a + b + x)$ equals:
(1) 1021
(2) 1120
(3) 2012
(4) 2120

18: Let $\alpha\beta \neq 0$ **and** A $= \begin{bmatrix} \beta & \alpha & 3 \\ \alpha & \alpha & \beta \\ -\beta & \alpha & 2\alpha \end{bmatrix}$. If

B $= \begin{bmatrix} 3\alpha & -9 & 3\alpha \\ -\alpha & 7 & -2\alpha \\ -2\alpha & 5 & -2\beta \end{bmatrix}$ is the matrix of cofactors of the elements of A, then $\det(AB)$ is equal to:

(1)343
(2)125
(3)64
(4)216

19: If

$$y(\theta) = \frac{2\cos\theta + \cos 2\theta - 1}{4\cos^3\theta + 8\cos^2\theta + 5\cos\theta + 2},$$

then at $\theta = \frac{\pi}{2}$, $y'' + y' + y$ is equal to:
(1) $\frac{3}{2}$
(2) 1
(3) $\frac{1}{2}$
(4) 2

20: For $x \geq 0$, **the least value of** K **for which** $4^{1+x} + 4^{1-x}$, $\frac{K}{2}$, $16^x + 16^{-x}$ **are three consecutive terms of an arithmetic progression (A.P.) is equal to:**

5

(1) 10
(2) 4
(3) 8
(4) 16

21: Let the mean and the standard deviation of the probability distribution given by:

X	α	1	0	-3
$P(X)$	$\frac{1}{3}$	K	$\frac{1}{6}$	$\frac{1}{4}$

be μ and σ, respectively. If $\sigma - \mu = 2$, then $\sigma + \mu$ is equal to:

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

22: Let $y = y(x)$ be the solution of the differential equation

$$\frac{dy}{dx} + \frac{2x}{(1+x^2)}y = xe^{\frac{1}{1+x^2}}, \quad y(0) = 0.$$

Then the area enclosed by the curve

$$f(x) = y(x)e^{\frac{1}{1+x^2}}$$

and the line $y - x = 4$ is equal to:

23: The number of solutions of

$$\sin^2 x + (2 + 2x - x^2)\sin x - 3(x-1)^2 = 0, \quad \text{where} \ -\pi \le x \le \pi,$$

is:
(1) 1
(2) 2
(3) 3
(4) 4

24: Let the point $(-1, \alpha, \beta)$ lie on the line of the shortest distance between the lines

$$\frac{x+2}{-3} = \frac{y-2}{4} = \frac{z-5}{2} \quad \text{and} \quad \frac{x+2}{-1} = \frac{y+6}{2} = \frac{z-1}{0}.$$

Then $(\alpha - \beta)^2$ is equal to:

25: If

$$1 + \frac{\sqrt{3} - \sqrt{2}}{2\sqrt{3}} + \frac{5 - 2\sqrt{6}}{18} + \frac{9\sqrt{3} - 11\sqrt{2}}{36\sqrt{3}} + \frac{49 - 20\sqrt{6}}{180} + \ldots$$

up to $\infty = 2\left(\sqrt{\frac{b}{a}} + 1\right) \log_e\left(\frac{a}{b}\right)$, where a and b are integers with $\gcd(a, b) = 1$, then $11a + 18b$ is equal to:

26: Let $a > 0$ be a root of the equation

$$2x^2 + x - 2 = 0.$$

If

$$\lim_{x \to 1/a} 16\left(\frac{1 - \cos(2 + x - 2x^2)}{1 - ax^2}\right) = \alpha + \beta\sqrt{17},$$

where $\alpha, \beta \in Z$, then $\alpha + \beta$ is equal to:

27: If

$$f(t) = \int_0^\pi \frac{2x\, dx}{1 - \cos^2 t \sin^2 x}, \quad 0 < t < \pi,$$

then the value of

$$\int_0^{\frac{\pi}{2}} \frac{\pi^2\, dt}{f(t)}$$

is equal to:

28: Let the maximum and minimum values of

$$\left(\sqrt{8x - x^2 - 12} - 4\right)^2 + (x - 7)^2, \quad x \in R$$

be M and m respectively. Then $M^2 - m^2$ is equal to:

29: Let a line perpendicular to the line $2x - y = 10$ touch the parabola

$$y^2 = 4(x - 9)$$

at the point P. The distance of the point P from the centre of the circle

$$x^2 + y^2 - 14x - 8y + 56 = 0$$

is equal to:

30: The number of real solutions of the equation

$$x|x+5| + 2|x+7| - 2 = 0$$

is:

Physics

31: Given below are two statements:
Statement I: When the white light passed through a prism, the red light bends lesser than yellow and violet.
Statement II: The refractive indices are different for different wavelengths in dispersive medium.
In the light of the above statements, choose the answer from the options given below:
(1) Both Statement I and Statement II are true.
(2) Statement I is true but Statement II is false.
(3) Both Statement I and Statement II are false.
(4) Statement I is false but Statement II is true.

32: Which of the following statement is not true about stopping potential (V_0)?
(1) It depends on the nature of emitter material.
(2) It depends upon frequency of the incident light.
(3) It increases with increase in intensity of the incident light.
(4) It is $1/e$ times the maximum kinetic energy of electrons emitted.

33: The angular momentum of an electron in a hydrogen atom is proportional to (where r is the radius of orbit of the electron):
(1) $\sqrt{r}$
(2) $\frac{1}{r}$
(3) r
(4) $\frac{1}{\sqrt{r}}$

34: A galvanometer of resistance $100\,\Omega$ when connected in series with $400\,\Omega$ measures a voltage of up to $10\,V$. The value of resistance required to convert the galvanometer into an ammeter to read up to $10\,A$ is $x \times 10^{-2}\,\Omega$. The value

of x is:
(1) 2
(2) 800
(3) 20
(4) 200

35: The vehicles carrying inflammable fluids usually have metallic chains touching the ground:
(1) To conduct excess charge due to air friction to ground and prevent sparking.
(2) To alert other vehicles.
(3) To protect tyres from catching dirt from ground.
(4) It is a custom.

36: If n is the number density and d is the diameter of the molecule, then the average distance covered by a molecule between two successive collisions (i.e., mean free path) is represented by:
(1) $\frac{1}{\sqrt{2}\pi d^2}$
(2) $\sqrt{2}\pi d^2$
(3) $\frac{1}{\sqrt{2}\pi d^2 n}$
(4) $\frac{1}{\sqrt{2}n\pi^2 d^2}$

37: A particle moves in the x-y plane under the influence of a force $\vec{F}$ such that its linear momentum is

$$\vec{P}(t) = \hat{i}\cos(kt) - \hat{j}\sin(kt).$$

If k is constant, the angle between $\vec{F}$ and $\vec{P}$ will be:
(1) $\frac{\pi}{2}$
(2) $\frac{\pi}{6}$
(3) $\frac{\pi}{4}$
(4) $\frac{\pi}{3}$

38: The electrostatic force ($\vec{F_1}$) and magnetic force ($\vec{F_2}$) acting on a charge q moving with velocity $\vec{v}$ can be written as:
(1) $\vec{F_1} = q\vec{v} \cdot \vec{E}$, $\vec{F_2} = q(\vec{B} \cdot \vec{v})$
(2) $\vec{F_1} = q\vec{B}$, $\vec{F_2} = q(\vec{B} \times \vec{v})$
(3) $\vec{F_1} = q\vec{E}$, $\vec{F_2} = q(\vec{v} \times \vec{B})$

(4) $\vec{F_1} = q\vec{E}$, $\vec{F_2} = q(\vec{B} \times \vec{v})$

39: A man carrying a monkey on his shoulder cycles smoothly on a circular track of radius $9\,\mathrm{m}$ and completes 120 revolutions in 3 minutes. The magnitude of centripetal acceleration of the monkey is (in m/s^2):
(1) zero
(2) $16\pi^2\,\mathrm{m/s}^2$
(3) $4\pi^2\,\mathrm{m/s}^2$
(4) $57600\pi^2\,\mathrm{m/s}^2$

40: A series LCR circuit is subjected to an AC signal of $200\,V$, $50\,Hz$. If the voltage across the inductor (L $= 10\,\mathrm{mH}$) is $31.4\,V$, then the current in this circuit is:
(1) 68 A
(2) 63 A
(3) 10 A
(4) 10 mA

41: What is the dimensional formula of ab^{-1} in the equation

$$\left(P + \frac{a}{V^2}\right)(V - b) = RT,$$

where letters have their usual meaning?
(1) $[M^0L^3T^{-2}]$
(2) $[ML^2T^{-2}]$
(3) $[M^1L^5T^{-2}]$
(4) $[M^4L^7T^4]$

42: The output (Y) of the logic circuit given below is 0 only when:
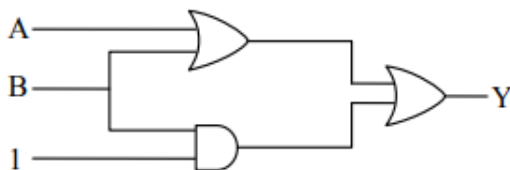
(1) $A = 1, B = 0$
(2) $A = 0, B = 0$
(3) $A = 1, B = 1$

(4) $A = 0, B = 1$

43: A body is moving unidirectionally under the influence of a constant power source. Its displacement in time t is proportional to:
(1) t^2
(2) $t^{2/3}$
(3) $t^{3/2}$
(4) t

44: Match List-I with List-II:

List-I (EM-Wave)	**List-II** (Wavelength Range)
(A) Infra-red	(I) $< 10^{-3}$ nm
(B) Ultraviolet	(II) 400 nm to 1 nm
(C) X-rays	(III) 1 mm to 700 nm
(D) Gamma rays	(IV) 1 nm to 10^{-3} nm

Choose the answer from the options given below:
(1) (A)-(III), (B)-(I), (C)-(IV), (D)-(III)
(2) (A)-(III), (B)-(II), (C)-(IV), (D)-(I)
(3) (A)-(IV), (B)-(III), (C)-(II), (D)-(I)
(4) (A)-(I), (B)-(III), (C)-(II), (D)-(IV)

45: During an adiabatic process, if the pressure of a gas is found to be proportional to the cube of its absolute temperature, then the ratio of $\frac{C_P}{C_V}$ for the gas is:
(1) $\frac{5}{3}$
(2) $\frac{9}{7}$
(3) $\frac{7}{5}$
(4) $\frac{3}{2}$

46:

Match **List-I** with **List-II** :

	List-I		List-II
(A)	A force that restores an elastic body of unit area to its original state	(I)	Bulk modulus
(B)	Two equal and opposite forces parallel to opposite faces	(II)	Young's modulus
(C)	Forces perpendicular everywhere to the surface per unit area same everywhere	(III)	Stress
(D)	Two equal and opposite forces perpendicular to opposite faces	(IV)	Shear modulus

Choose the answer from the options given below :
(1) (A)-(II), (B)-(IV), (C)-(I), (D)-(III)
(2) (A)-(IV), (B)-(II), (C)-(III), (D)-(I)
(3) (A)-(III), (B)-(IV), (C)-(I), (D)-(II)
(4) (A)-(III), (B)-(I), (C)-(II), (D)-(IV)

47: A vernier calipers has 20 divisions on the vernier scale, which coincides with the 19th division on the main scale. The least count of the instrument is 0.1 mm. One main scale division is equal to $mm.$
   (1) 1
(2) 0.5
(3) 2
(4) 5

48: A heavy box of mass 50 kg is moving on a horizontal surface. If the coefficient of kinetic friction between the box and the horizontal surface is 0.3, then the force of kinetic friction is:
(1) 14.7 N
(2) 147 N
(3) 1.47 N
(4) 1470 N

49: A satellite revolving around a planet in a stationary orbit has a time

period of **6 hours**. The mass of the planet is one-fourth the mass of Earth. The radius of the orbit of the planet is (Given: Radius of geo-stationary orbit for Earth is 4.2×10^4 km):

(1) 1.4×10^4 km
(2) 8.4×10^4 km
(3) 1.68×10^5 km
(4) 1.05×10^4 km

50: The ratio of heat dissipated per second through the resistances $5\,\Omega$ and $10\,\Omega$ in the circuit given below is:
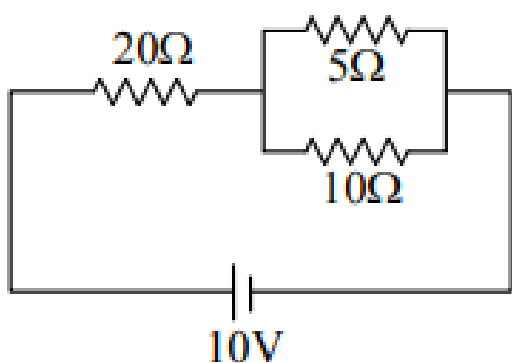
(1) $1 : 2$
(2) $2 : 1$
(3) $4 : 1$
(4) $1 : 1$

51: A solenoid of length 0.5 m has a radius of 1 cm and is made up of m number of turns. It carries a current of 5 A. If the magnitude of the magnetic field inside the solenoid is 6.28×10^{-3} T, then the value of m is:

52: The shortest wavelength of the spectral lines in the Lyman series of the hydrogen spectrum is $915\,\text{Å}$. The longest wavelength of spectral lines in the Balmer series will be ___ $\overset{\circ}{A}$.

53: In a single slit experiment, a parallel beam of green light of wavelength 550 nm passes through a slit of width 0.20 mm. The transmitted light is collected on a screen 100 cm away. The distance of first order minima from the central maximum will be $x \times 10^{-5}$ m. The value of x is:

54: A sonometer wire of resonating length $90\,\text{cm}$ has a fundamental frequency of $400\,\text{Hz}$ when kept under some tension. The resonating length of the wire with a fundamental frequency of $600\,\text{Hz}$ under the same tension is _____ cm.

55: A hollow sphere is rolling on a plane surface about its axis of symmetry. The ratio of rotational kinetic energy to its total kinetic energy is $\frac{x}{5}$. The value of x is _____.

56: A hydraulic press containing water has two arms with diameters as mentioned in the figure. A force of $10\,\text{N}$ is applied on the surface of water in the thinner arm. The force required to be applied on the surface of water in the thicker arm to maintain equilibrium of water is _____ N.
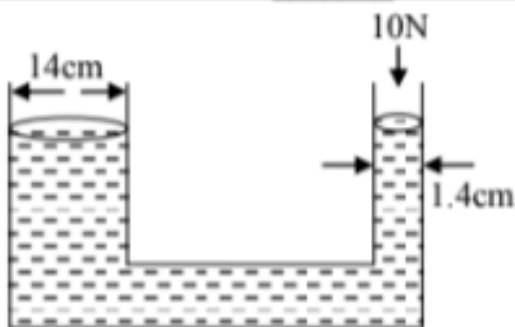
57: The electric field at point P due to an electric dipole is E. The electric field at point R on the equatorial line will be $\frac{E}{x}$. The value of x is:
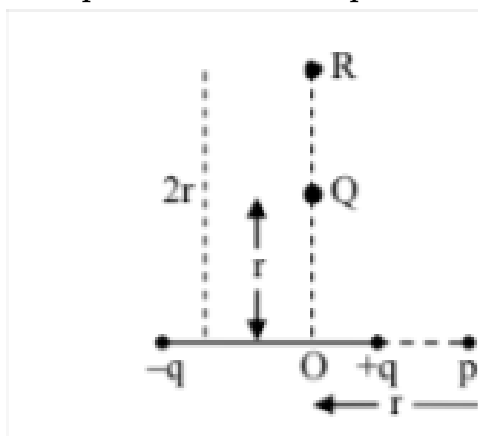
58: The maximum height reached by a projectile is $64\,\text{m}$. If the initial velocity is halved, the new maximum height of the projectile is _____ m.

59: A wire of resistance $20\,\Omega$ is divided into 10 equal parts. A combination of two parts is connected in parallel, and so on. Now the resulting pairs of parallel combinations are connected in series. The equivalent resistance of the final combination is _____ Ω.

60: The current in an inductor is given by $I = (3t + 8)$, where t is in seconds. The magnitude of the induced emf produced in the inductor is $12\,\text{mV}$. The self-inductance of the inductor is _____ mH.

Chemistry

61: Match List-I with List-II.

List-I	List-II
(A) ICl	(I) T-Shape
(B) ICl$_3$	(II) Square pyramidal
(C) ClF$_5$	(III) Pentagonal bipyramidal
(D) IF$_7$	(IV) Linear

    (1) (A)–(I), (B)–(IV), C–(III), D–(II)
(2) (A)–(I), (B)–(III), C–(II), D–(IV)
(3) (A)–(IV), (B)–(I), C–(II), D–(III)
(4) (A)–(IV), (B)–(III), C–(II), D–(I)

Answer: (3)
(A) - (IV), (B) - (I), (C) - (II), (D) - (III)

62: While preparing crystals of Mohr's salt, dil. H_2SO_4 is added to a mixture of ferrous sulphate and ammonium sulphate. Before dissolving this mixture in water, dil. H_2SO_4 is added here to:
(1) prevent the hydrolysis of ferrous sulphate
(2) prevent the hydrolysis of ammonium sulphate
(3) make the medium strongly acidic
(4) increase the rate of formation of crystals

63: Identify the major product in the following reaction.

$$\xrightarrow[\text{C}_2\text{H}_5\text{OH}]{\bar{O}H} \text{Major Product}$$

(1)

(2)

(3)

(4)
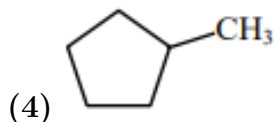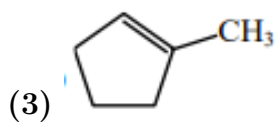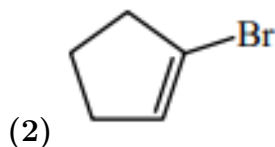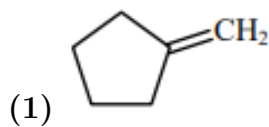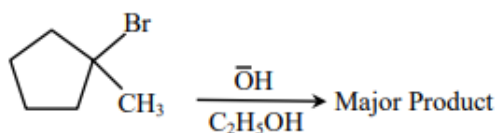
64: The nomenclature for the following compound is:
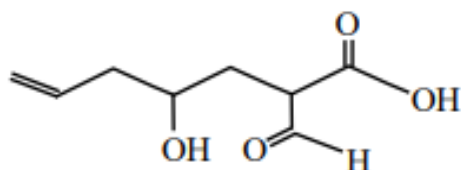
(1) 2-carboxy-4-hydroxyhept-6-enal
(2) 2-carboxy-4-hydroxyhept-7-enal
(3) 2-formyl-4-hydroxyhept-6-enoic acid
(4) 2-formyl-4-hydroxyhept-7-enoic acid

65: Given below are two statements: one is labeled as Assertion (A) and the other is labeled as Reason (R).

Assertion (A): NH_3 and NF_3 molecules have a pyramidal shape with a lone pair of electrons on the nitrogen atom. The resultant dipole moment of $NH3$ is greater than that of NF_3.

Reason (R): In $NH3$, the orbital dipole due to the lone pair is in the same direction as the resultant dipole moment of the $N-H$ bonds. F is the most electronegative element.

In the light of the above statements, choose the answer from the options given below:

(1) Both (A) and (R) are true, and (R) is the explanation of (A).
(2) (A) is false, but (R) is true.

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(3) (A) is true, but (R) is false.

(4) Both (A) and (R) are true, but (R) is NOT the explanation of (A).

66: Given below are two statements:

Statement I: On passing $HCl(g)$ through a saturated solution of $BaCl_2$, at room temperature, white turbidity appears.

Statement II: When $HCl(g)$ is passed through a saturated solution of $NaCl$, sodium chloride is precipitated due to the common ion effect.

In the light of the above statements, choose the most appropriate answer from the options given below:

(1) Statement I is but Statement II is in

(2) Both Statement I and Statement II are in

(3) Statement I is inbut Statement II is

(4) Both Statement I and Statement II are

67:

The metal atom present in the complex $MABXL$ (where A, B, X, and L are unidentate ligands and M is metal) involves sp^3 hybridization. The number of geometrical isomers exhibited by the complex is:

(1) 4

(2) 0

(3) 2

(4) 3

68: Match List-I with List-II.

List-I (Pair of Compounds)	List-II (Isomerism)
(A) n-propanol and isopropanol	(I) Metamerism
(B) Methoxypropane and ethoxyethane	(II) Chain Isomerism
(C) Propanone and propanal	(III) Position Isomerism
(D) Neopentane and isopentane	(IV) Functional Isomerism

(1) (A)–(III), (B)–(I), (C)–(IV), (D)–(II)

(2) (A)–(II), (B)–(I), (C)–(IV), (D)–(III)

(3) (A)–(I), (B)–(III), (C)–(IV), (D)–(II)

(4) (A)–(IV), (B)–(I), (C)–(III), (D)–(II)

69: The quantity of silver deposited when one coulomb charge is passed through $AgNO_3$ solution:

    (1) 0.1 g atom of silver

(2) 1 chemical equivalent of silver

(3) 1 g of silver

(4) 1 electrochemical equivalent of silver

70: Which one of the following reactions is NOT possible?

(1)

(2)

(3)

(4)
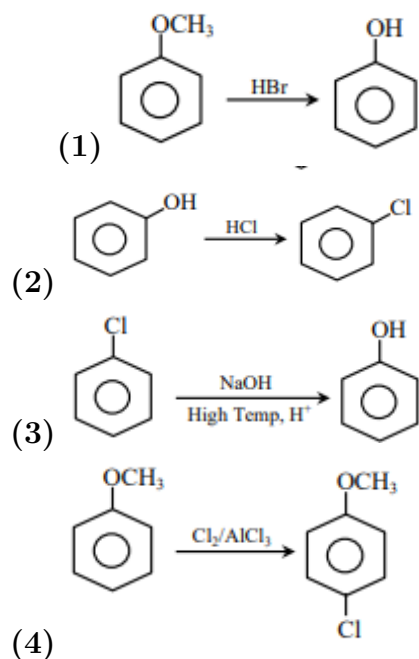
71: Given below are two statements:

Statement I: The metallic radius of Na is 1.86 Å, and the ionic radius of Na^+ is lesser than 1.86 Å.

Statement II: Ions are always smaller in size than the corresponding elements.

    In the light of the above statements, choose the answer from the options given below:

    (1) Statement I is true but Statement II is false

(2) Both Statement I and Statement II are true

(3) Both Statement I and Statement II are false

(4) Statement I is false but Statement II is true

72:

CH_3CH_2-OH $\xrightarrow{\begin{array}{l}\text{(i) Jone's Reagent}\\\text{(ii) KMnO}_4\\\text{(iii)NaOH, CaO,}\Delta\end{array}}$ P
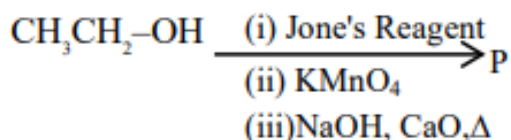
Consider the above reaction sequence and identify the major product P.
(1) Methane
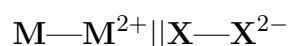(2) Methanal
(3) Methoxymethane
(4) Methanoic acid

73: Consider the given chemical reaction:
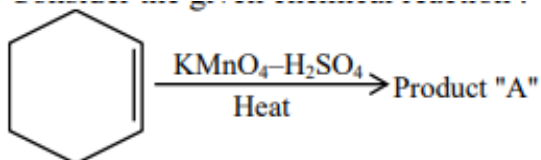
Product "A" is:
(1) Picric acid
(2) Oxalic acid
(3) Acetic acid
(4) Adipic acid

74: For the electrochemical cell:

$$M—M^{2+}||X—X^{2-}$$

If:
$$E°(M^{2+}/M) = 0.46\,\text{V}, \quad E°(X/X^{2-}) = 0.34\,\text{V},$$

Which of the following is correct?
(1) $E_{cell} = -0.80\,\text{V}$
(2) $M + X^{2-} -> M^{2+} + X^{2-}$ is a spontaneous reaction
(3) $M^{2+} + X^{2-} -> M + X$ is a spontaneous reaction
(4) $E_{cell} = 0.80\,\text{V}$

75: The number of moles of methane required to produce 11 g of $CO_2(g)$ after complete combustion is:
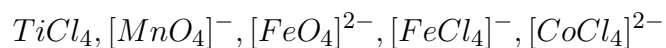(Given molar mass of methane in g mol^{-1}: 16)
(1) 0.75
(2) 0.25

19

(3) 0.35
(4) 0.5

76: The number of complexes from the following with no electrons in the t_2 orbital is:

$$TiCl_4, [MnO_4]^-, [FeO_4]^{2-}, [FeCl_4]^-, [CoCl_4]^{2-}$$

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

77: The number of ions from the following that have the ability to liberate hydrogen from a dilute acid is _____ : Ti^{2+}, Cr^{2+}, V^{2+}
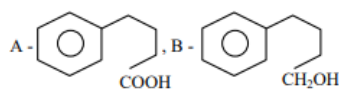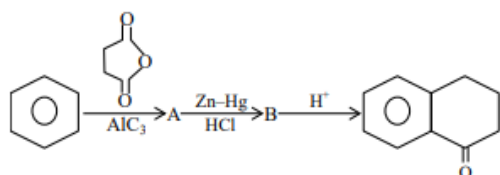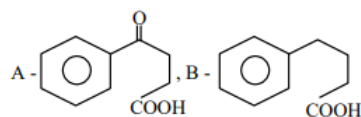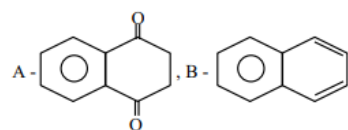
   (1) 0
(2) 2
(3) 3
(4) 1

78: Identify A and B in the given chemical reaction sequence : -
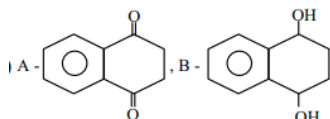

(1)

(2)

(3)

(4)

79: The statements from the following are:

(A) The decreasing order of atomic radii of group 13 elements is $Tl > In > Ga > Al > B$.
(B) Down the group 13, electronegativity decreases from top to bottom.
(C) Al dissolves in dilute HCl and liberates $H2$, but concentrated $HNO3$ renders Al passive by forming a protective oxide layer on the surface.
(D) All elements of group 13 exhibit a highly stable $+1$ oxidation state.
(E) Hybridization of Al in $[Al(H2O)_6]^{3+}$ ion is sp^3d^2.

Choose the answer from the options given below:
(1) (C) and (E) only
(2) (A), (C) and (E) only
(3) (A), (B), (C) and (E) only
(4) (A) and (C) only

80: Coagulation of egg, on heating, is because of:
(1) Denaturation of protein occurs
(2) The secondary structure of protein remains unchanged
(3) Breaking of the peptide linkage in the primary structure of protein occurs
(4) Biological property of protein remains unchanged

81: Combustion of 1 mole of benzene is expressed as:

$$C_6H_6(l) + \frac{15}{2}O_2(g) -> 6CO_2(g) + 3H_2O(l)$$
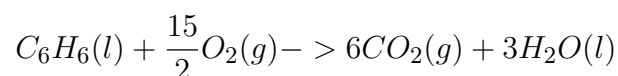
The standard enthalpy of combustion of **2 mol of benzene is** $-x$ **kJ.** Calculate the value of x given the following data:
Standard enthalpy of formation of $C_6H_6(l)$: 48.5 kJ mol^{-1}.
Standard enthalpy of formation of $CO_2(g)$: -393.5 kJ mol^{-1}.
Standard enthalpy of formation of $H_2O(l)$: -286 kJ mol^{-1}.

82:
The fusion of chromite ore with sodium carbonate in the presence of air leads to the formation of products A and B along with the evolution of CO_2. The sum of spin-only magnetic moment values of A and B is ____B.M. (Nearest

integer).
(Given atomic numbers: $C = 6, Na = 11, O = 8, Fe = 26, Cr = 24$)

83: X of ethanamine was subjected to reaction with $NaNO_2/HCl$ followed by hydrolysis to liberate N_2 and HCl. The HCl generated was completely neutralized by 0.2 moles of $NaOH$. X is ____ g.

84: In an atom, the total number of electrons having quantum numbers $n = 4$, $|m_l| = 1$, and $m_s = -\frac{1}{2}$ is:

85: Using the given figure, the ratio of R_f values of sample A and sample C is $x \times 10^{-2}$. Value of x is:
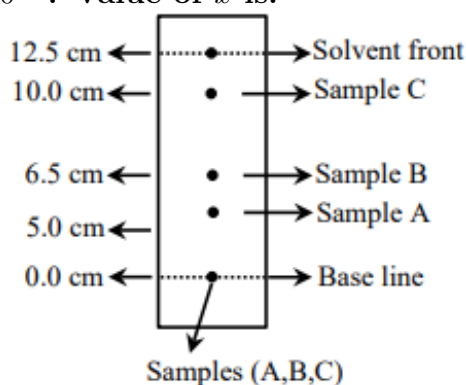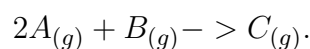

Fig : Paper chromatography of Samples

86: In the Claisen-Schmidt reaction to prepare 351 g of dibenzalacetone using 87 g of acetone, the amount of benzaldehyde required is _____ g. (Nearest integer)

87: Consider the following single-step reaction in the gas phase at constant temperature:

$$2A_{(g)} + B_{(g)} -> C_{(g)}.$$

The initial rate of the reaction is recorded as r_1, when the reaction starts with 1.5 atm pressure of A and 0.7 atm pressure of B. After some time, the rate r_2 is recorded when the pressure of C becomes 0.5 atm. The ratio $\frac{r_1}{r_2}$ is _____ $\times 10^{-1}$ (Nearest integer).

88: The product C in the following sequence of reactions has _____ π bonds:
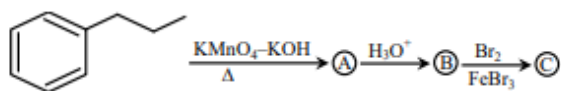
89: Considering acetic acid dissociates in water, its dissociation constant is 6.25×10^{-5}. If 5 mL of acetic acid is dissolved in 1 litre of water, the solution will freeze at $-x \times 10^{-2}\,°\text{C}$, provided pure water freezes at $0°\text{C}$.
Given:

- K_f of water $= 1.86\,\text{K kg mol}^{-1}$,

- Density of acetic acid $= 1.2\,\text{g cm}^{-3}$,

- Molar mass of water $= 18\,\text{g mol}^{-1}$,

- Molar mass of acetic acid $= 60\,\text{g mol}^{-1}$,

- Density of water $= 1\,\text{g cm}^{-3}$.

Acetic acid dissociates as:

$$CH_3COOH <=> CH_3COO^- + H^+.$$

90: The number of compounds from the following with zero dipole moment is _____:

$$HF, H_2, H_2S, CO_2, NH_3, BF_3, CH_4, CHCl_3, SiF_4, H_2O, BeF_2.$$