JEE Main 2023 April 11 Shift-2 Question Paper

| **Time Allowed :**3 Hours | **Maximum Marks :**300 | **Total Questions :**90 |

General Instructions

Read the following instructions very carefully and strictly follow them:

1. The Duration of test is 3 Hours.

2. This paper consists of 90 Questions.

3. There are three parts in the paper consisting of Physics, Chemistry and Mathematics having 30 questions in each part of equal weightage..

4. Each part (subject) has two sections.
   (i) Section-A: This section contains 20 multiple choice questions which have only one correct answer. Each carries 4 marks for correct answer and –1 mark for wrong answer..

5. (ii) Section-B: This section contains 10 questions. In Section-B, attempt any five questions out of 10. The answer to each of the questions is a numerical value. Each carries 4 marks for correct answer and –1 mark for wrong answer. For Section-B, the answer should be rounded off to the nearest integer.

Mathematics

Section A

1: The angle of elevation of the top P of a tower from the feet of one person standing due South of the tower is $45°$ and from the feet of another person standing due West of the tower is $30°$. If the height of the tower is 5 meters, then the distance (in meters) between the two persons is equal to:

(1) 10

(2) $5\sqrt{5}$

(3) $\frac{5}{2}\sqrt{5}$

(4) 5

2: Let a, b, c, and d be positive real numbers such that $a+b+c+d = 11$. If the maximum value of $a^5 b^3 c^2 d$ is 3750β, then the value of β is:

(1) 55

(2) 108

(3) 90

(4) 110

3: If $f : \mathbb{R} \to \mathbb{R}$ is a continuous function satisfying

$$\int_0^{\frac{\pi}{2}} f(\sin 2x) \sin x \, dx + \alpha \int_0^{\frac{\pi}{4}} f(\cos 2x) \cos x \, dx = 0,$$

then the value of α is:

(1) $-\sqrt{3}$

(2) $\sqrt{3}$

(3) $-\sqrt{2}$

(4) $\sqrt{2}$

4: Let f and g be two functions defined by:

$$f(x) = \begin{cases} x + 1, & x < 0 \\ |x - 1|, & x \geq 0 \end{cases}, \quad g(x) = \begin{cases} x + 1, & x < 0 \\ 1, & x \geq 0 \end{cases}.$$

Then $(g \circ f)(x)$ is:

(1) continuous everywhere but not differentiable at $x = 1$

(2) continuous everywhere but not differentiable exactly at one point

(3) differentiable everywhere

(4) not continuous at $x = -1$

5: If the radius of the largest circle with centre $(2, 0)$ inscribed in the ellipse $x^2 + 4y^2 = 36$ is r, then $12r^2$ is equal to:

(1) 69

(2) 72

(3) 115

(4) 92

6: Let the mean of 6 observations $1, 2, 4, 5, x,$ and y and their variance be 10. Then their mean deviation about the mean is equal to:

(1) $\frac{7}{3}$

(2) $\frac{10}{3}$

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

(4) 3

7: Let $A = \{1, 3, 4, 6, 9\}$ and $B = \{2, 4, 5, 8, 10\}$. Let R be a relation defined on $A \times B$ such that $R = \{((a_1, b_1), (a_2, b_2)) : a_1 \leq b_2 \text{ and } b_1 \leq a_2\}$. Then the number of elements in the set R is:

(1) 52

(2) 160

(3) 26

(4) 180

8: Let P be the plane passing through the points $(5, 3, 0)$**,** $(13, 3, -2)$**, and** $(1, 6, 2)$**. For** $\alpha \in \mathbb{N}$**, if the distances of the points** $A(3, 4, \alpha)$ **and** $B(2, \alpha, a)$ **from the plane** P **are** 2 **and** 3 **respectively, then the positive value of** a **is:**

(1) 5

(2) 6

(3) 4

(4) 3

9: If the letters of the word MATHS are permuted and all possible words so formed are arranged as in a dictionary with serial number, then the serial number of the word THAMS is:

(1) 102

(2) 103

(3) 101

(4) 104

10: If four distinct points with position vectors $\vec{a}, \vec{b}, \vec{c}, and\ \vec{d}$ **are coplanar, then** $[\vec{a}\vec{b}\vec{c}]$ **is equal to:**

(1) $[\vec{d}\vec{c}\vec{a}] + [\vec{b}\vec{d}\vec{a}] + [\vec{c}\vec{d}\vec{b}]$

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

(3) $[\vec{a}\vec{d}\vec{b}] + [\vec{d}\vec{c}\vec{a}] + [\vec{d}\vec{b}\vec{c}]$

(4) $[\vec{b}\vec{c}\vec{d}] + [\vec{d}\vec{a}\vec{c}] + [\vec{d}\vec{b}\vec{a}]$

11: The sum of the coefficients of three consecutive terms in the binomial expansion of $(1+x)^{n+2}$**, which are in the ratio** $1 : 3 : 5$**, is equal to:**

(1) 63

4

(2) 92

(3) 25

(4) 41

12: Let $y = y(x)$ be the solution of the differential equation $\frac{dy}{dx} + \frac{5}{x(x^5+1)}y = \frac{(x^5+1)^2}{x^7}$, $x > 0$. If $y(1) = 2$, then $y(2)$ is equal to:

(1) $\frac{693}{128}$

(2) $\frac{637}{128}$

(3) $\frac{697}{128}$

(4) $\frac{679}{128}$

13: The converse of $((\sim p) \wedge q) \Rightarrow r$ is:

(1) $(p \vee (\sim q)) \Rightarrow (\sim r)$

(2) $((\sim p) \vee q) \Rightarrow r$

(3) $(\sim r) \Rightarrow ((\sim p) \wedge q)$

(4) $(\sim r) \Rightarrow (p \wedge q)$

14: If the 1011th term from the end in the binomial expansion of $\left(\frac{4x}{5} - \frac{5}{2x}\right)^{2022}$ is 1024 times the 1011th term from the beginning, the $|x|$ is equal to:

(1) 8

(2) 12

(3) $\frac{5}{16}$

(4) 15

15: If the system of linear equations:

$$7x + 11y + \alpha z = 13, \quad 5x + 4y + 7z = \beta, \quad 175x + 194y + 57z = 361,$$

has infinitely many solutions, then $\alpha + \beta + 2$ is equal to:

(1) 3

(2) 6

(3) 5

(4) 4

16: Let the line passing through the point $P(2, -1, 2)$ and $Q(5, 3, 4)$ meet the plane $x - y + z = 4$ at the point T. Then the distance of the point R from the plane $x + 2y + 3z + 2 = 0$, measured parallel to the line $\frac{x-7}{2} = \frac{y+3}{2} = \frac{z-2}{1}$, is equal to:

(1) 3

(2) $\sqrt{61}$

(3) $\sqrt{31}$

(4) $\sqrt{189}$

17: Let the function $f : [0, 2] \to \mathbb{R}$ be defined as:

$$f(x) = \begin{cases} e^{\min\{x^2, x - \lfloor x \rfloor\}}, & x \in [0, 1), \\ e^{x - \log_e x}, & x \in [1, 2), \end{cases}$$

where $\lfloor t \rfloor$ denotes the greatest integer less than or equal to t.

Then the value of the integral $\int_0^2 x f(x) \, dx$ is:

(1) $(e - 1)\left(e^2 + \frac{1}{2}\right)$

(2) $1 + \frac{3e}{2}$

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

(4) $2e - 1$

18: For $a \in \mathbb{C}$, let:

$$A = \{z \in \mathbb{C} : \mathrm{Re}(a + \bar{z}) > \mathrm{Im}(\bar{a} + z)\}, \textbf{ and } \quad B = \{z \in \mathbb{C} : \mathrm{Re}(a + \bar{z}) < \mathrm{Im}(\bar{a} + z)\}.$$

Among the two statements:

(S1): If $\mathrm{Re}(a), \mathrm{Im}(a) > 0$, then the set A contains all the real numbers.

(S2): If $\text{Re}(a), \text{Im}(a) < 0$, then the set B contains all the real numbers.

(1) Only (S1) is true

(2) Both are false

(3) Only (S2) is true

(4) Both are true

19: If:

$$\begin{vmatrix} x+1 & x & x \\ x & x+\lambda & x \\ x & x & x+\lambda^2 \end{vmatrix} = \frac{9}{8}(103x + 81),$$

then $\lambda, \frac{\lambda}{3}$ are the roots of the equation:

(1) $4x^2 - 24x - 27 = 0$

(2) $4x^2 + 24x + 27 = 0$

(3) $4x^2 - 24x + 27 = 0$

(4) $4x^2 + 24x - 27 = 0$

20: The domain of the function $f(x) = \frac{1}{\sqrt{\lfloor x \rfloor^2 - 3\lfloor x \rfloor - 10}}$**, where** $\lfloor x \rfloor$ **denotes the greatest integer less than or equal to** x**, is:**

(1) $(-\infty, -3] \cup [6, \infty)$

(2) $(-\infty, -2) \cup (5, \infty)$

(3) $(-\infty, -3] \cup (5, \infty)$

(4) $(-\infty, -2) \cup [6, \infty)$

Section B

21: If A **is the area in the first quadrant enclosed by the curve** $C : 2x^2 - y + 1 = 0$**, the tangent to** C **at the point** $(1, 3)$**, and the line** $x + y = 1$**, then the value of** $60A$ **is _____:**

22: Let $A = \{1, 2, 3, 4, 5\}$ and $B = \{1, 2, 3, 4, 5, 6\}$. **Then the number of functions** $f : A \rightarrow B$ **satisfying** $f(1) + f(2) = f(4) - 1$ **is equal to** ____.

23: Let the tangent to the parabola $y^2 = 12x$ **at the point** $(3, \alpha)$ **be perpendicular to the line** $2x + 2y = 3$. **Then the square of the distance of the point** $(6, -4)$ **from the normal to the hyperbola** $\alpha^2 x^2 - 9y^2 = 9\alpha^2$ **at its point** $(\alpha - 1, \alpha + 2)$ **is equal to** _____.

24: For $k \in \mathbb{N}$, **if the sum of the series** $1 + \frac{4}{k} + \frac{8}{k^2} + \frac{13}{k^3} + \frac{19}{k^4} + \ldots$ **is 10, then the value of** k **is** _____.

25. Let the line $\ell : x = \frac{1-y}{-2} = \frac{z-3}{\lambda}$, $\lambda \in \mathbb{R}$ **meet the plane** $P : x + 2y + 3z = 4$ **at the point** (α, β, γ). **If the angle between the line** ℓ **and the plane** P **is** $\cos^{-1}\left(\frac{\sqrt{5}}{\sqrt{14}}\right)$, **then** $\alpha + 2\beta + 6\gamma$ **is equal to** ____.

26: The number of points where the curve $f(x) = e^{8x} - e^{6x} - 3e^{4x} - e^{2x} + 1, x \in \mathbb{R}$ **cuts the** x**-axis, is equal to** ____.

27: If the line $l_1 : 3y - 2x = 3$ **is the angular bisector of the line** $l_2 : x - y + 1 = 0$ **and** $l_3 : \alpha x + \beta y + 17 = 0$, **then** $\alpha^2 + \beta^2 - \alpha - \beta$ **is equal to** _____.

28: Let the probability of getting a head for a biased coin be $\frac{1}{4}$. **It is tossed repeatedly until a head appears. Let** N **be the number of tosses required. If the probability that the equation** $64x^2 + 5Nx + 1 = 0$ **has no real root is** $\frac{p}{q}$, **where** p **and** q **are co-prime, then** $q - p$ **is equal to** ____.

29: Let $\vec{a} = \hat{i} + 2\hat{j} + 3\hat{k}$ **and** $\vec{b} = \hat{i} + \hat{j} - \hat{k}$. **If** $\vec{c}$ **is a vector such that** $\vec{a} \cdot \vec{c} = 11, \vec{b} \cdot (\vec{a} \times \vec{c}) = 27$ **and** $\vec{b} \cdot \vec{c} = -\sqrt{3}|\vec{b}|$, **then** $|\vec{a} \times \vec{c}|^2$ **is equal to** ____:

30: Let $S = \left\{ z \in \mathbb{C} - \{i, 2i\} : \frac{z^2 + 8iz - 15}{z^2 - 3iz - 2} \in \mathbb{R} \right\}$. If $\alpha - \frac{13}{11}i \in S$, $\alpha \in \mathbb{R} - \{0\}$, then $242\alpha^2$ is equal to _____.

Physics

Section A

31: Eight equal drops of water are falling through air with a steady speed of 10 cm/s. If the drops collapse, the new velocity is :-

(1) $10 cm/s$

(2) $40 cm/s$

(3) $16 cm/s$

(4) $5 cm/s$

32: Provided that below are two statements : One is labelled as Assertion A and the other is labelled as Reason R.

Assertion A: A bar magnet dropped through a metallic cylindrical pipe takes more time to come down compared to a non-magnetic bar with same geometry and mass.

Reason R: For the magnetic bar, Eddy currents are produced in the metallic pipe which oppose the motion of the magnetic bar.

In the light of the above statements, choose the correct answer from the options Provided that below:

(1) A is true but R is false

(2) Both A and R are true but R is **NOT** the correct explanation of A

(3) A is false but R is true

(4) Both A and R are true and R is the correct explanation of A

33: A space ship of mass 2×10^4 **kg is launched into a circular orbit close to the earth surface. The additional velocity to be imparted to the space ship in the orbit to overcome the gravitational pull will be (if** $g = 10$ **m/s**^{2} **and radius of earth = 6400 km):**

(1) $7.9(\sqrt{2} - 1)$ km/s

(2) $7.4(\sqrt{2} - 1)$ km/s

(3) $11.2(\sqrt{2} - 1)$ km/s

(4) $8(\sqrt{2} - 1)$ km/s

34: A projectile is projected at $30°$ **from horizontal with initial velocity** 40 **ms**$^{-1}$**. The velocity of the projectile at** $t = 2$ **s from the start will be :**

(Provided that $g = 10$ m/s^2)

(1) Zero

(2) $20\sqrt{3}$ ms^{-1}

(3) $40\sqrt{3}$ ms^{-1}

(4) 20 ms^{-1}

35: A plane electromagnetic wave of frequency 20 MHz propagates in free space along x-direction. At a particular space and time, $\vec{E} = 6.6\hat{j}$ **v/m. What is** $\vec{B}$ **at this point?**

(1) $-2.2 \times 10^{-8}\hat{k}$ T

(2) $-2.2 \times 10^{-8}\hat{i}$ T

(3) $2.2 \times 10^{-8}\hat{k}$ T

(4) $2.2 \times 10^{-8}\hat{i}$ T

36: A car P travelling at 20 **ms**$^{-1}$ **sounds its horn at a frequency of 400 Hz. Another car Q is travelling behind the first car in the same direction with a velocity** 40 **ms**$^{-1}$**. The frequency heard by the passenger of the car Q is approximately [Take, velocity of sound** $= 360$ **ms**$^{-1}$**]**

(1) $471 Hz$

(2) $514 Hz$

(3) $421 Hz$

(4) $485 Hz$

10

37: A body of mass 500 g moves along x-axis such that its velocity varies with displacement x according to the calculation $v = 10\sqrt{x}$ m/s the force acting on the body is :-

(1) $25N$

(2) $5N$

(3) $166N$

(4) $125N$

38: The ratio of the de-Broglie wavelengths of proton and electron having same Kinetic energy:

(Assume $m_p = m_e \times 1840$)

(1) $1 : 62$

(2) $1 : 30$

(3) $1 : 43$

(4) $2 : 43$

39: If force (F), velocity (V) and time (T) are considered as fundamental physical quantity, then dimensional formula of density will be :-

(1) $FV^{-2}T^2$

(2) FV^4T^{-6}

(3) $FV^{-4}T^{-2}$

(4) $F^2V^{-2}T^6$

40: An electron is allowed to move with constant velocity along the axis of current carrying straight solenoid.

A. The electron will experience magnetic force along the axis of the solenoid.

B. The electron will not experience magnetic force.

C. The electron will continue to move along the axis of the solenoid.

D. The electron will be accelerated along the axis of the solenoid.

E. The electron will follow parabolic path inside the solenoid.

Choose the correct answer from the options Provided that below:

(1) A and D only

(2) B, C and D only

(3) B and E only

(4) B and C only

41: The Thermodynamic process, in which internal energy of the system remains constant is

(1) Isobaric

(2) Isochoric

(3) Adiabatic

(4) Isothermal

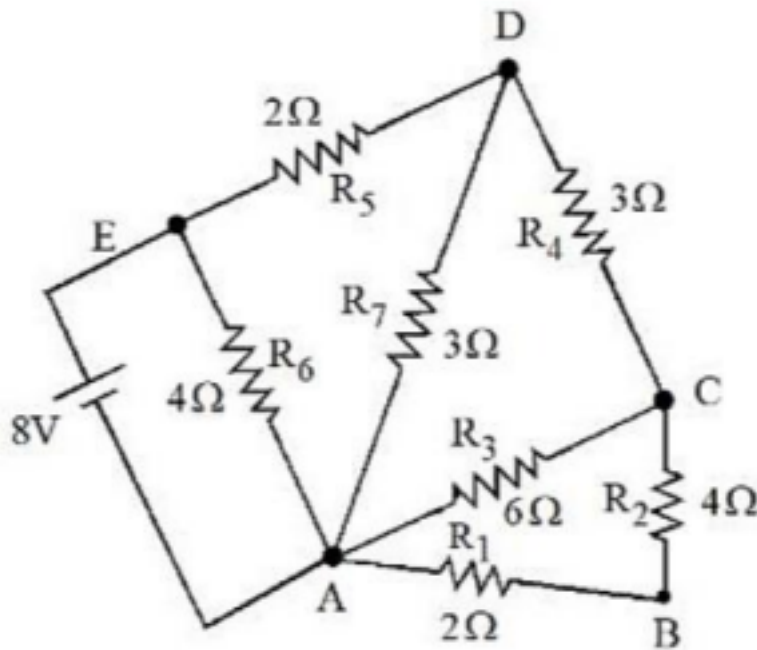**42: In satellite communication, the uplink frequency band used is:**

(1) $76 - 88$ MHz

(2) $420 - 890$ MHz

(3) $3.7 - 4.2$ GHz

(4) $5.925 - 6.425$ GHz

43: The logic operations performed by the Provided that digital circuit is equivalent to:
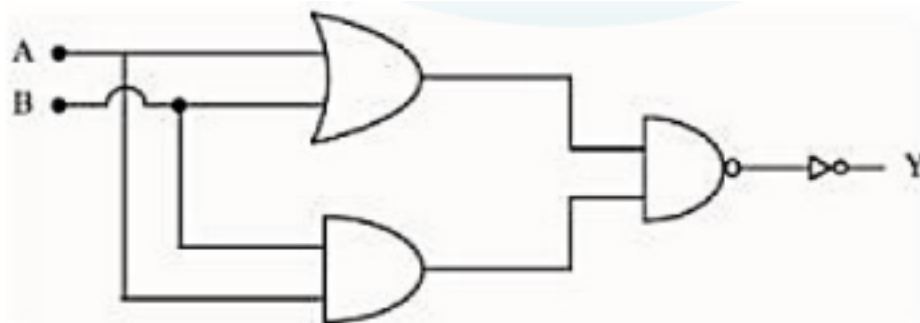
   (1) OR

(2) $NAND$

(3) NOR

(4) AND

44: The current flowing through R_2 is:

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

(2) $\frac{1}{4}$ A

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

(4) $\frac{1}{2}$ A

45: **When vector** $\vec{A} = 2\hat{i} + 3\hat{j} + 2\hat{k}$ **is subtracted from vector** $\vec{B}$**, it gives a vector equal to** $2\hat{j}$**. Then the magnitude of vector** $\hat{B}$ **will be:**

(1) 3

(2) $\sqrt{5}$

(3) $\sqrt{33}$

(4) $\sqrt{6}$

46: If V is the gravitational potential due to sphere of uniform density on it's surface, then it's value at the center of sphere will be:-

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

(2) V

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

(4) $\frac{V}{2}$

47: The root mean square speed of molecules of nitrogen gas at $27°$C is approximately : (Provided that mass of a nitrogen molecule $= 4.6 \times 10^{-26}$ kg and take Boltzmann constant $k_B = 1.4 \times 10^{-23}$ JK^{-1})

(1) 1260 m/s

(2) 91 m/s

(3) 523 m/s

(4) 27.4 m/s

48: The energy of He$^+$ ion in its first excited state is, (The ground state energy for the Hydrogen atom is -13.6 eV):

(1) -13.6 eV

(2) -54.4 eV

(3) -27.2 eV

(4) -3.4 eV

49: When one light ray is reflected from a plane mirror with $30°$ angle of reflection, the angle of deviation of the ray after reflection is:

(1) $140°$

(2) $130°$

(3) $120°$

(4) $110°$

50: A capacitor of capacitance C is charge to a potential V. The flux of the electric field through a closed surface enclosing the positive plate of the capacitor is :

(1) Zero

(2) $\frac{CV}{\varepsilon_0}$

(3) $\frac{2CV}{\varepsilon_0}$

(4) $\frac{CV}{2\varepsilon_0}$

51: A coil has an inductance of 2H and resistance of 4Ω. A 10 V is applied across the coil. The energy stored in the magnetic field after the current has built up to its equilibrium value will be ____ $\times 10^{-2}$ **J.**

___

52: A metallic cube of side 15 cm moving along y-axis at a uniform velocity of 2 ms^{-1}. In a region of uniform magnetic field of magnitude 0.5T directed along z-axis. In equilibrium the potential difference between the faces of higher and lower potential developed because of the motion through the field will be _____ **mV.**

(0,0,0) – (2,0,0) – (2,2,0) – (0,2,0) – cycle; (0,0,2) – (2,0,2) – (2,2,2) – (0,2,2) – cycle; (0,0,0) – (0,0,2); (2,0,0) – (2,0,2); (2,2,0) – (2,2,2); (0,2,0) – (0,2,2); [-¿] (2,2,0) – (3,2,0) node[anchor=west] x; [-¿] (0,2,0) – (0,3,0) node[anchor=south] y; [-¿] (0,0,0) – (0,0,3) node[anchor=east] z; [-¿] (0.5,2.5,0) – (0.5,3,0) node[anchor=south west] $\vec{v}$; [-¿] (0,0,1.5) – (0.5,0,1.5) node[anchor=north east] $\vec{B}$;

___

53: In the Provided that circuit, $C_1 = 2$ μ**F,** $C_2 = 0.2$ μ**F,** $C_3 = 2$ μ**F,** $C_4 = 4$ μ**F,** $C_5 = 2$ μ**F,** $C_6 = 2$ μ**F.** The charge stored on capacitor C_4 is ____ μ**C.**

(0,0) to[battery1, l=10V] (0,2) to[C, l=C_1] (2,2) to[C, l=C_3] (4,2) to[C, l=C_4] (4,0) to[C, l=C_5] (2,0) to[C, l=C_6] (0,0) (2,0) to[C, l=C_2] (2,2) ;

___

54: A nucleus disintegrates into two nuclear parts, in such a way that ratio of their nuclear sizes is $1 : 2^{1/3}$. Their respective speed have a ratio of n : 1. The value of n is ____.

___

55: The surface tension of soap solution is 3.5×10^{-2} **Nm**$^{-1}$. The amount of work done required to increase the radius of soap bubble from 10 cm to 20 cm is ____ $\times 10^{-4}$ **J.** (take $\pi = 22/7$)

___

56: A circular plate is rotating horizontal plane, about an axis passing through its center perpendicular to the plate, with an angular velocity ω. A person sits at the center having two

dumbbells in his hands. When he stretches out his hands, the moment of inertia of the system becomes triple. If E be the initial Kinetic energy of the system, then final Kinetic energy will be $\frac{E}{x}$. The value of x is _____.

57: A block of mass 5 kg starting from rest pulled up on a smooth incline plane making an angle of $30°$ with horizontal with an affective acceleration of 1 ms^{-2}. The power delivered by the pulling force at $t = 10$ s from the starts is _____ W.   [use $g = 10$ ms^{-2}] (Evaluate the nearest integer value)

58: As shown in the figure, a plane mirror is fixed at a height of 50 cm from the bottom of tank containing water $\left(\mu = \frac{4}{3}\right)$. The height of water in the tank is 8 cm. A small bulb is placed at the bottom of the water tank. The distance of image of the bulb formed by mirror from the bottom of the tank is _____ cm.
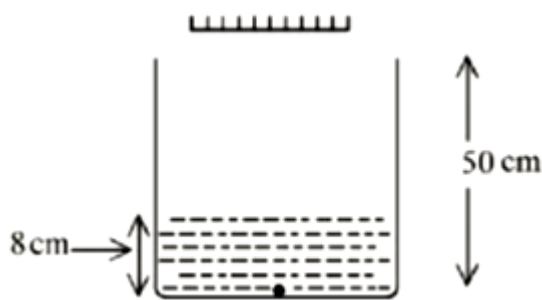
59: Two identical cells each of emf 1.5 V are connected in series across a 10 Ω resistance. An ideal voltmeter connected across 10 Ω resistance reads 1.5 V. The internal resistance of each cell is ____ Ω.

60: A wire of density 8×10^3 kg/m^3 is stretched between two clamps 0.5 m apart. The extension developed in the wire is 3.2×10^{-4} m. If $Y = 8 \times 10^{10}$ N/m^2, the fundamental frequency of vibration in the wire will be _____ Hz.

Chemistry

Section A

61: The magnetic moment is measured in Bohr Magneton (BM). Spin only magnetic moment of Fe in $[Fe(H_2O)_6]^{3+}$ and $[Fe(CN)_6]^{3-}$ complexes respectively is:

(1) 3.87 B.M. and 1.732 B.M.

(2) 6.92 B.M. in both

(3) 5.92 B.M. and 1.732 B.M.

(4) 4.89 B.M. and 6.92 B.M.

62: Which one of the following pairs is an example of polar molecular solids?

(1) $SO_2(s), CO_2(s)$

(2) $SO_2(s), NH_3(s)$

(3) $MgO(s), SO_2(s)$

(4) $HCl(s), AlN(s)$

63: Match List I with List II

	List I		List II
	Complex		**Colour**
A.	Mg(NH$_4$)PO$_4$	I.	Brown
B.	K$_3$[Co(NO$_2$)$_6$]	II.	White
C.	MnO(OH)$_2$	III.	Yellow
D.	Fe$_4$[Fe(CN)$_6$]$_3$	IV.	blue

Choose the correct answer from the options Provided that below:

(1) A – II, B – III, C – IV, D – I

(2) A – II, B – IV, C – I, D – III

(3) A – III, B – IV, C – II, D – I

(4) A – II, B – III, C – I, D – IV

64: A solution is prepared by adding 2 g of "X" to 1 mole of water. Mass percent of "X" in the solution is ___.

(1) 5%

(2) 20%

(3) 2%

(4) 10%

65: If Ni^{2+} is replaced by Pt^{2+} in the complex $[NiCl_2Br_2]^{2-}$, which of the following properties are expected to get changed?

A. Geometry

B. Geometrical isomerism

C. Optical isomerism

D. Magnetic properties

(1) A, B and C

(2) A and D

(3) B and C

(4) A, B and D

66: Provided that below are two statements :

Statement I: In the metallurgy process, sulphide ore is converted to oxide before reduction.

Statement II: Oxide ores in general are easier to reduce.

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

(1) Both Statement I and Statement II are correct

(2) Statement I is correct but Statement II is incorrect

(3) Statement I is incorrect but Statement II is correct

(4) Both Statement I and Statement II are incorrect

67: Product [X] formed in the above reaction is:

18

$$H_3C-CH_2-CH-CH_3 \xrightarrow[\text{(iii)}D_2O]{\substack{\text{(i) NaI, } H_3PO_4 \\ \text{(ii) Mg, Dry ether}}} \begin{array}{c} [X] \\ \text{Product} \end{array}$$

with OH on the CH carbon.
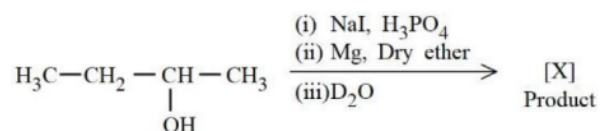
(1) $CH_3 - CH_2 - CH(D) - CH_3$

(2) $CH_3 - CH_2 - CH = CH_2$

(3) $CH_3 - CH = CH - CH_3$

(4) $CH_3 - CH_2 - C(OH)(H) - CH_3$

68: Provided that below are two statements :

Statement I : Ethene at 333 to 343 K and 6-7 atm pressure in the presence of $AlEt_3$ and $TiCl_4$ undergoes addition polymerization to give LDP.

Statement II : Caprolactam at 533-543 K in H_2O through step growth polymerizes to give Nylon 6.

In the light of the above statements, choose the correct answer from the options Provided that below:

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

(2) Both Statement I and Statement II are true

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

(4) Both Statement I and Statement II are false

69: For a chemical reaction A + B → Product, the order is 1 with respect to A and B.

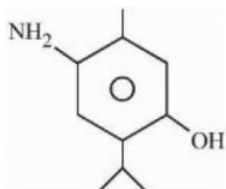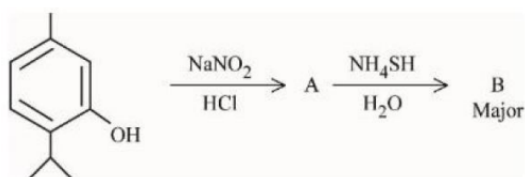| Rate $molL^{-1}S^{-1}$	[A] $molL^{-1}$	[B] $molL^{-1}$
0.10	20	0.5
0.40	x	0.5
0.80	40	Y

What is the value of x and y?

(1) 80 and 2

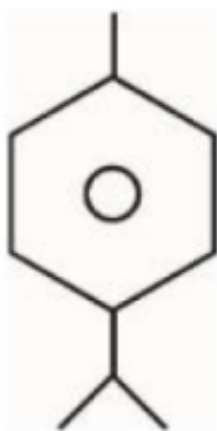(2) 40 and 4

(3) 80 and 4

19

(4) 160 and 4

70: Which of the following compounds is an example of Freon?

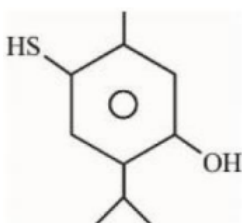(1) C_2F_4

(2) C_2HF_3

(3) $C_2Cl_2F_2$

(4) $C_2H_2F_2$

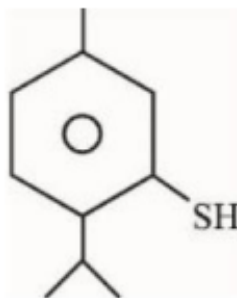
71: Compound 'B' is ____.

(1)

(2)

(3)

20

(4)

72: Provided that below are two statements, one is labelled as Assertion A and the other is labelled as Reason R.

Assertion A: C(=[2]O)-C(-[6]Cl) can be subjected to Wolff-Kishner reduction to give $CH_2 - C(-[6]Cl)(-H)(-H)$

Reason R: Wolff-Kishner reduction is used to convert C(=[2]O) into CH_2

In the light of the above statements, choose the correct answer from the options Provided that below:

(1) Both A and R are true and R is the correct explanation of A

(2) A is true but R is false

(3) Both A and R are true but R is NOT the correct explanation of A

(4) A is false but R is true

73: Provided that below are two statements, one is labelled as Assertion A and the other is labelled as Reason R.

Assertion A : $[CoCl(NH_3)_5]^{2+}$ absorbs at lower wavelength of light wrt- $[CoCl(NH_3)_5(H_2O)]^{3+}$

Reason R : It is because the wavelength of the light absorbed depends on the oxidation state of the metal ion.

In the light of the above statements, choose the correct answer from the options Provided that below:

(1) Both A and R are true but R is NOT the correct explanation of A

(2) A is true but R is false

(3) Both A and R are true and R is the correct explanation of A

(4) A is false but R is true

74: Compound from the following that will not produce precipitate on reaction with AgNO$_3$ is:

(1)

Br

(2)

Br

(3)

Br

(4)

$-CH=CH-CH_2-Br$
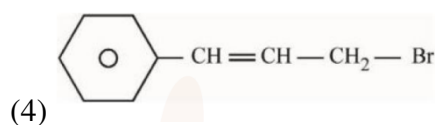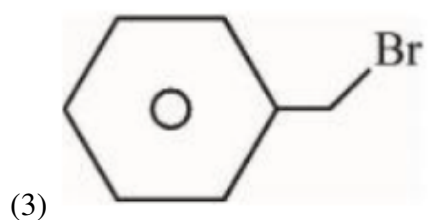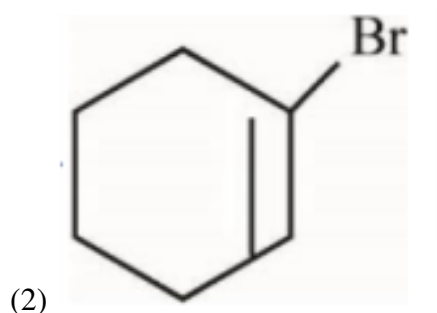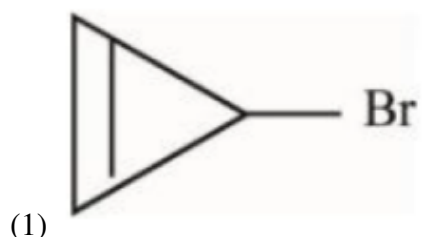
75: Provided that below are two statements, one is labelled as Assertion A and the other is labelled as Reason R.

Assertion A : A solution of the product obtained by heating a mole of glycine with a mole of chlorine in presence of red phosphorous generates chiral carbon atom.

Reason R : A molecule with 2 chiral carbons is always optically active.

In the light of the above statements, choose the correct answer from the options Provided that below:

(1) A is false but R is true

(2) Both A and R are true but R is NOT the correct explanation of A

(3) A is true but R is false

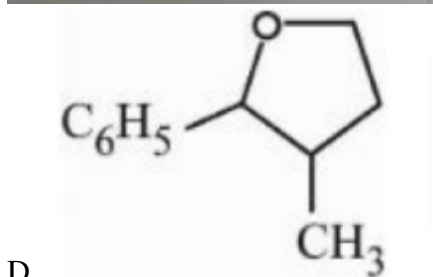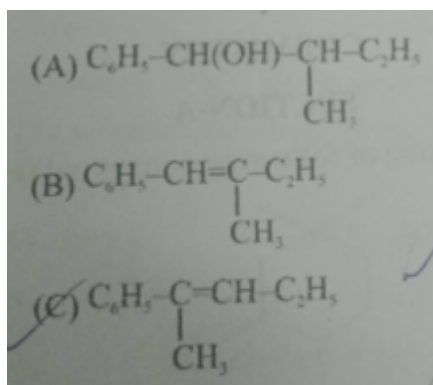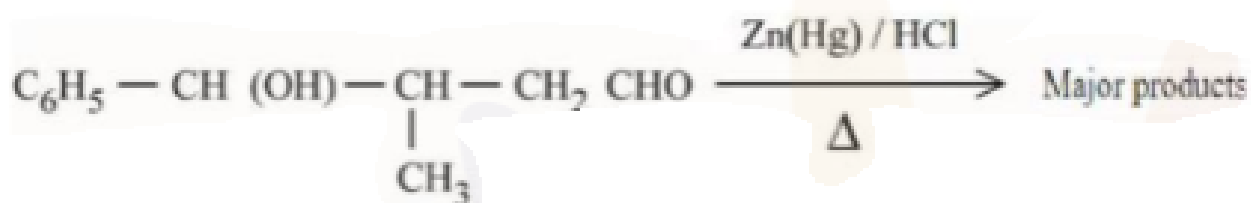(4) Both A and R are true and R is the correct explanation of A

76: Alkali metal from the following with least melting point is:

(1) K

(2) Cs

(3) Rb

(4) Na

77: Which hydride among the following is less stable?

(1) HF

(2) NH_3

(3) BeH_2

(4) LiH

78: The major product formed in the following reaction is _____.

$$C_6H_5 - CH\ (OH) - \underset{\underset{CH_3}{|}}{CH} - CH_2\ CHO \xrightarrow[\Delta]{Zn(Hg)/HCl} \text{Major products}$$

(A) $C_6H_5-CH(OH)-\underset{\underset{CH_3}{|}}{CH}-C_2H_5$

(B) $C_6H_5-CH=\underset{\underset{CH_3}{|}}{C}-C_2H_5$

(C) $C_6H_5-\underset{\underset{CH_3}{|}}{C}=CH-C_2H_5$

D.

Choose the correct answer from the options Provided that below:

(1) C only

(2) A only

(3) B only

(4) D only

79: One mole of P_4 reacts with 8 moles $SOCl_2$ to give 4 moles of A, x mole of SO_2 and 2 moles of B. A, B and x respectively are ____.

(1) $POCl_3$, S_2Cl_2 and 4

(2) $POCl_3$, S_2Cl_2 and 2

(3) PCl_3, S_2Cl_2 and 4

(4) PCl_3, S_2Cl_2 and 2

80: What weight of glucose must be dissolved in 100 g of water to lower the vapour pressure by 0.20 mmHg? (Assume dilute solution is being formed)

   Provided that : Vapour pressure of pure water is 54.2 mmHg at room temperature. Molar mass of glucose is 180g mol^{-1}

(1) 2.59 g

(2) 3.59 g

(3) 3.69 g

(4) 4.69 g

Section B

81: The total number of intensive properties from the following is ____.

Mole, Volume, Molar heat capacity, Molarity, E° cell, Gibbs free energy change, Molar mass, Mole

---

82: The volume of hydrogen liberated at STP by treating 2.4 g of magnesium with excess of hydrochloric acid is ____ $\times 10^{-2}$ L.

   Provided that: Molar volume of gas is 22.4 L at STP. Molar mass of magnesium is 24 g mol^{-1}

83: The number of correct statements about modern adsorption theory of heterogeneous catalysis from the following is ____.

A. The catalyst is diffused over the surface of reactants.

B. Reactants are adsorbed on the surface of the catalyst.

C. Occurrence of chemical reaction on the catalyst's surface through formation of an intermediate.

D. It is a combination of intermediate compound formation theory and the old adsorption theory.

E. It explains the action of the catalyst as well as those of catalytic promoters and poisons.

84: The number of correct statements from the following is ____.

A. For 1 s orbital, the probability density is maximum at the nucleus

B. For 2 s orbital, the probability density first increases to maximum and then decreases sharply to zero.

C. Boundary surface diagrams of the orbitals encloses a region of 100% probability of finding the electron.

D. p and d-orbitals have 1 and 2 angular nodes respectively

E. probability density of p-orbital is zero at the nucleus

85: The number of correct statements from the following is ____.

A. E_{cell} is an intensive parameter

B. A negative E° means that the redox couple is a stronger reducing agent than the H^+/H_2 couple.

C. The amount of electricity required for oxidation or reduction depends on the stoichiometry of the electrode reaction.

D. The amount of chemical reaction which occurs at any electrode during electrolysis by a current is proportional to the quantity of electricity passed through the electrolyte.

86: $Mg(NO_3)_2 \cdot XH_2O$ and $Ba(NO_3)_2 \cdot YH_2O$, represent formula of the crystalline forms of nitrate salts. Sum of X and Y is ____.

87: The number of possible isomeric products formed when 3-chloro-1-butene reacts with HCl through carbocation formation is _____.

88: 4.5 moles each of hydrogen and iodine is heated in a sealed ten litre vessel. At equilibrium, 3 moles of HI were found. The equilibrium constant for $H_2(g) + I_2(g) \rightleftharpoons 2HI(g)$ is _____.

89: Number of compounds from the following which will not produce orange red precipitate with Benedict solution is _____.

Glucose, maltose, sucrose, ribose, 2-deoxyribose, amylose, lactose

---

90: The maximum number of lone pairs of electrons on the central atom from the following species is _____.

ClO_3^-, XeF_4, SF_4, and I_3^-