NUCLEUS EDUCATION
Centre of excellence

DEMO TEST-1

JEE MAIN PATTERN

Time: 3 Hours **Maximum Marks: 360**

Please read the instructions carefully. You are allotted 5 minutes specifically for this purpose.

1. This booklet contains **15** printed pages.
2. The Test Booklet consists of 90 questions. The maximum marks are 360.
3. There are three parts in the question paper A, B, C consisting of Physics, Mathematics and Chemistry having 30 questions in each part of equal weightage. Each question is allotted 4 (four) marks for correct response.
4. Candidates will be awarded marks as stated above in instruction No. 3 for correct response of each question. **¼ (one-fourth)** marks of the total marks allotted to the question (i.e. 1 mark) 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.
5. There is only one correct response for each question. Filling up more than one response in any question will be treated as wrong response and marks for wrong response will be deducted accordingly as per instruction 5 above.
6. No candidate is allowed to carry any textual material, printed or written, bits of papers, pager, mobile phone, any electronic device, etc. except the Admit Card inside the examination room/ hall.
7. Rough work is to be done on the space provided for this purpose in the Test Booklet only. This space is given at the bottom of each page.

PART-A : PHYSICS

1. A steel rope of length L, area of cross-section A, Young's modulus Y, is hanging from a celling in equilibrium. The elastic potential energy per unit volume at a point L/3 from ceiling is [Density = d]

(1) $2(dgL)^2/9Y$ (2) $(dgL)^2/9Y$

(3) $2(dgL)/9AY$ (4) $2(dgL)^2/3Y$

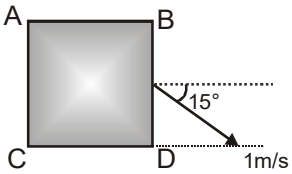
2. A box has square base ABCD of edge length each of 1m in the horizontal plane moving horizontally with speed 1 m/s as shown. A ball is to be given a velocity from C to reach B in $\sqrt{2}$ seconds. The velocity of ball in earth frame is

(1) 1 m/s

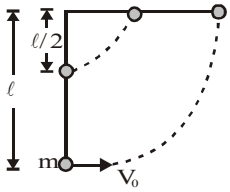
(2) $\sqrt{2}$ m/s

(3) $\sqrt{3}$ m/s

(4) 2 m/s



3. A light rod of length ℓ is pivoted at the upper end is free to move in vertical plane. Two masses (each m), are attached to the rod, one at the middle and the other at the free end. What horizontal velocity must be imparted to the lower end mass, so that the rod may just take up the horizontal ?



(1) $\sqrt{\frac{6\ell g}{5}}$ (2) $\sqrt{\frac{\ell g}{5}}$

(3) $\sqrt{\frac{12\ell g}{5}}$ (4) $\sqrt{\frac{2\ell g}{5}}$

4. The radius of gyration of a solid sphere of radius r about a certain axis is r. The distance of this axis from the centre of the sphere is

(1) r (2) 0.5r

(3) $\sqrt{0.6}$r (4) $\sqrt{0.4}$r

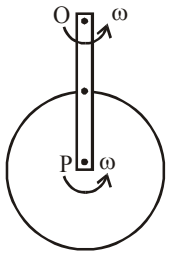
5. A rod of mass m and length 2R can rotate about an axis passing through O in vertical plane. A disc of mass m and radius R is hinged to the other end P of the rod and can freely rotate about P. When disc is at lowest point both rod and disc has angular velocity ω. If rod rotates by maximum angle θ = 60° with downward vertical, the ω in terms of R and g will be (all hinges are smooth)

(1) $\sqrt{\frac{9g}{16R}}$

(2) $\sqrt{\frac{3g}{23R}}$

(3) $\frac{1}{3}\sqrt{\frac{g}{R}}$

(4) None of these



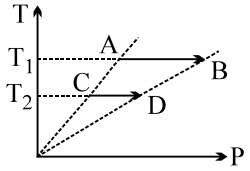
Space for rough work

6. A particle of mass M is at a distance a from surface of a thin spherical shell of equal mass and having radius a.
(1) Gravitational field and potential both are zero at centre of the shell.
(2) Gravitational field is zero not only inside the shell but at a point outside the shell also.
(3) Inside the shell, gravitational field alone is zero.
(4) Neither gravitational field nor gravitational potential is zero inside the shell.

7. If 10 gram of ice at 0^0C is mixed with 10 gram of water at 40°C. The final mass of water in mixture is
(Latent heat of fusion of ice = 80 cal/gm; specific heat of water = 1 cal/gm °C)
(1) 10 gram (2) 15 gram
(3) 18 gram (4) 20 gram

8. A rod of length 2m rests on smooth horizontal floor. If the rod is heated from 0°C to 20°C. Find the longitudinal strain developed? ($1 = 5 \times 10^{-5}$/°C)
(1) 10^{-3} (2) 2×10^{-3}
(3) Zero (4) None

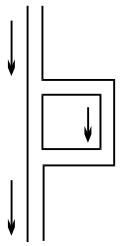
9. On a TP diagram, two moles of ideal gas perform process AB and CD. If the work done by the gas in the process AB is two times the work done in the process CD then what is the value of T_1/T_2?
(1) 1/2
(2) 1
(3) 2
(4) 4



10. A polyatomic gas with six degrees of freedom does 25J of work when it is expanded at constant pressure. The heat given to the gas is
(1) 100J (2) 150J
(3) 200J (4) 250J

11. A spring mass system performs S.H.M. If the mass is doubled keeping amplitude same, then the total energy of S.H.M. will become:
(1) double (2) half
(3) unchanged (4) 4 times

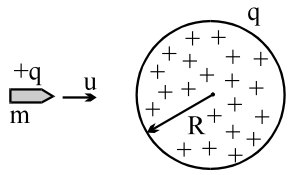
12. A sound consists of four frequencies → 300 Hz, 600 Hz, 1200 Hz and 2400 Hz. A sound 'filter' is made by passing this sound through a bifurcated pipe as shown. The sound waves have to travel a distance of 50 cm more in the right branch-pipe than in the straight pipe. The speed of sound in air is 300 m/s. Then, which of the following frequencies will be almost completely muffled or "silenced" at the outlet?



(1) 300 Hz (2) 600 Hz
(3) 1200 Hz (4) 2400 Hz

Space for rough work

13. A bullet of mass m and charge q is fired towards a solid uniformly charged sphere of radius R and total charge + q. If it strikes the surface of sphere with speed u, find the minimum speed u so that it can penetrate through the sphere.
(Neglect all resistance forces or friction acting on bullet except electrostatic forces)



(1) $\frac{q}{\sqrt{2\pi\varepsilon_0 mR}}$ (2) $\frac{q}{\sqrt{4\pi\varepsilon_0 mR}}$

(3) $\frac{q}{\sqrt{8\pi\varepsilon_0 mR}}$ (4) $\frac{\sqrt{3}q}{\sqrt{4\pi\varepsilon_0 mR}}$

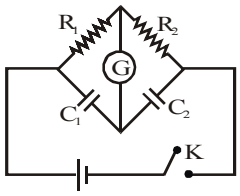
14. In the circuit, if no current flows through the galvanometer when the key K is closed, the bridge is balanced. The balancing condition for bridge is

(1) $\frac{C_1}{C_2} = \frac{R_1}{R_2}$

(2) $\frac{C_1}{C_2} = \frac{R_2}{R_1}$

(3) $\frac{C_1^2}{C_2^2} = \frac{R_1^2}{R_2^2}$

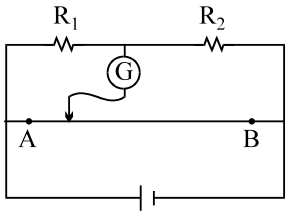
(4) $\frac{C_1^2}{C_2^2} = \frac{R_2}{R_1}$



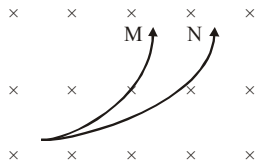
15. A capacitor of 2μF can withstand a maximum potential difference of 5V. It is connected with another capacitor of 5μF. The series combination can now withstand a potential difference of 7V. The maximum voltage that 5μF can withstand is
(1) 1 volt
(2) 2 volt
(3) more than or equal to 2 volt
(4) less than or equal to 2V.

16. In the figure shown for gives values of R_1 and R_2 the balance point for Jockey is at 40 cm from A. When R_2 is shunted by a resistance of 10 Ω, balance shifts to 50 cm. R_1 and R_2 are (AB = 1 m):

(1) $\frac{10}{3}$ Ω, 5 Ω
(2) 20 Ω, 30 Ω
(3) 10 Ω, 15 Ω
(4) 5 Ω, $\frac{15}{2}$ Ω



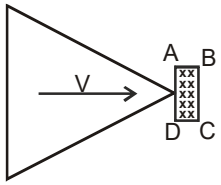
17. Two charged particle M and N are projected with same velocity in a uniform magnetic field then M and N respectively :-

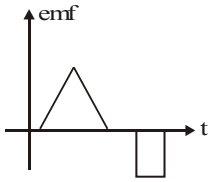


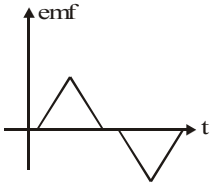
(1) an electron and a proton
(2) a deutron and a proton
(3) a deutron and an electron
(4) a proton and α particle

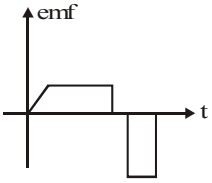
Space for rough work

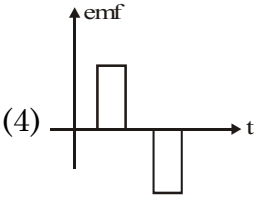
18. The magnetic field in a region ABCDA is as shown in the figure. A triangular loop is entered to this region at a constant speed (v) as shown. Then which graph represent the induced emf in loop w.r.t. time?



(1) 

(2) 

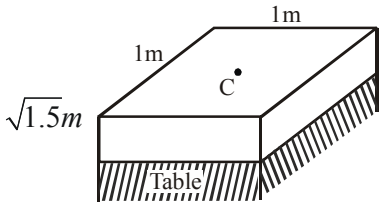
(3) 

(4) 

19. The "K_α" X-rays emission line of tungsten occurs at $\lambda = 0.021$ nm. The energy difference between K and L levels in this atom is about

(1) 0.51 MeV (2) 1.2 MeV
(3) 59 keV (4) 13.6 eV

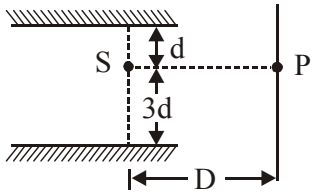
20. A glass slab of refractive index μ is placed on a table top of identical size as shown. A coin *C* is placed on the center of the top face. An eye placed adjacent to a lateral face and just below the level of table, is not able to see the image of coin through any lateral face. The minimum value of μ for this to happen is



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

(3) $\frac{5}{\sqrt{21}}$ (4) $\sqrt{3}$

21. Consider the optical system shown in the figure that follows. The point source of light S is having wavelength equal to λ. The light is reaching screen only after reflection. For point P to be 2nd maxima, the value of λ would be (D > > d and d > > λ)



(1) $\frac{12d^2}{D}$ (2) $\frac{6d^2}{D}$

(3) $\frac{8d^2}{D}$ (4) $\frac{24d^2}{D}$

Space for rough work

22. If the kinetic energy of a free electron triples, its de-Broglie wavelength changes by the ratio:-

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

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

23. Let the potential energy of a hydrogen atom in the ground state be zero. Then its energy in the first excited state will be ;

(1) 10.2eV (2) 13.6eV
(3) 23.8eV (4) 27.2 eV

24. A source contains two phosphorous radio nuclides $^{32}_{15}P$ ($T_{1/2} = T_1$) and $^{33}_{15}P$ ($T_{1/2} = T_2$). Initially 10% of the decays come from $^{33}_{15}P$. How long one must wait until 90% of decays come from $^{33}_{15}P$?

(1) $t = \frac{4\ell n3}{\ell n2\left(\frac{1}{T_1} - \frac{1}{T_2}\right)}$

(2) $t = \frac{4\ell n3}{\ell n2\left(\frac{1}{T_1} + \frac{1}{T_2}\right)}$

(3) $t = \frac{2\ell n3}{\ell n2\left(\frac{1}{T_1} - \frac{1}{T_2}\right)}$

(4) None of these

25. Two merucry drops (each of radius 'r') merge to form a bigger drop. The surface energy of the bigger drop, if $\frac{1}{\pi}$ is the surface tension (in SI unit), is :

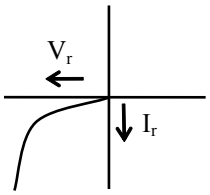
(1) $2^{5/3}r^2$ (2) $4r^2$

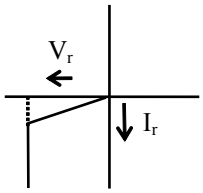
(3) $2r^2$ (4) $2^{8/3}r^2$

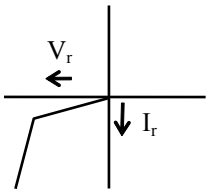
26. A compound microscope has a magnifying power of 100 when the image is formed at infinity. The objective has a focal length of 0.5 cm and the tube length is 6.5 cm, then the focal length of the eye-piece is -

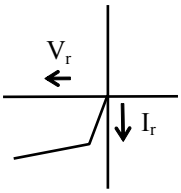
(1) 0.2 cm (2) 2.5 cm
(3) 2 cm (4) 4.0 cm

27. Which one is showing the characteristics of a zener diode ?

(1) 

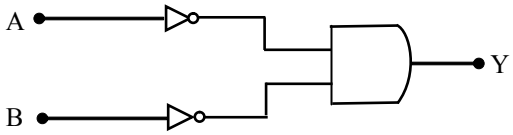
(2) 

(3) 

(4) 

Space for rough work

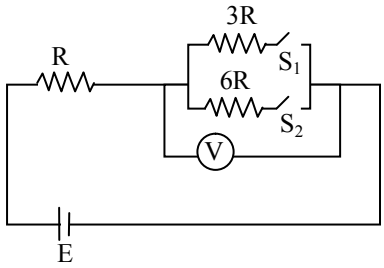
28. What is out put Y of the gate circuit shown in figure?



(1) $\overline{A.B}$ (2) $\overline{A} \cdot \overline{B}$

(3) $\overline{\overline{A}.\overline{B}}$ (4) A . B

29. In the circuit shown in figure reading of voltmeter is V_1 when only S_1 is closed, reading of voltmeter is V_2 when only S_2 is closed and reading of voltmeter is V_3 when both S_1 and S_2 are closed. Then-



(1) $V_3 > V_2 > V_1$ (2) $V_2 > V_1 > V_3$

(3) $V_3 > V_1 > V_2$ (4) $V_1 > V_2 > V_3$

30. Relative permittivity and permeability of a material ε_r and μ_r, respectively. Which of the following values of these quantities are allowed for a diamagnetic material ?

(1) $\varepsilon_r = 0.5, \mu_r = 1.5$
(2) $\varepsilon_r = 1.5, \mu_r = 0.5$
(3) $\varepsilon_r = 0.5, \mu_r = 0.5$
(4) $\varepsilon_r = 1.5, \mu_r = 1.5$

Space for rough work

PART-B : MATHEMATICS

31. If the centre of smallest circle passing through origin lies on $y = x + 1$ is (a, b) then the value of $(a + b)$ is

(1) -1 (2) 0

(3) 2 (4) -2

32. Equation of the plane containing the lines $L_1 : \frac{x-1}{2} = \frac{y+1}{-1} = \frac{z-1}{3}$ and

$L_2 : \frac{x-3}{-4} = \frac{z-2}{2} = \frac{z-1}{-5}$, is

(1) $9x - 6y - 8z = 7$

(2) $-x + y + z = 7$

(3) $x - y - z = 3$

(4) $2x - y - z = 5$

33. The area bounded by the curve $y = \frac{e^x + e^{-x}}{2}$ and the lines $y = 0$, $x = \ell n\, 2$ and $x = \ell n \frac{1}{2}$ is

(1) $\frac{3}{4}$ (2) $\frac{5}{4}$

(3) $\frac{3}{2}$ (4) $\frac{5}{2}$

34. Let $f(x) = \int_0^{x^2} \left(\sin\sqrt{t}\right) dt$. The value of $f'\left(\frac{\pi}{3}\right)$, is

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

(3) $\frac{\pi\sqrt{3}}{3}$ (4) $\frac{\pi\sqrt{3}}{2}$

35. If $\int_1^y x\, \ell n\, x\, dx = \frac{1}{4}$, then the value of y is equal to

(1) $-\sqrt{e}$ (2) $\sqrt{e}$

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

36. Range of values of a for which the equation $x^2 - 2ax + 2a^2 - 1 = 0$ has exactly one positive and one negative solution, is

(1) $-1 \le a \le 1$

(2) $-1 < a < 1$

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

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

Space for rough work

37. If one root of the quadratic equation $(a-b)x^2 + ax + 1 = 0$ is double the other where $a \in R$, then the greatest value of b is

(1) $\frac{7}{6}$ (2) $\frac{8}{7}$

(3) $\frac{9}{8}$ (4) $\frac{10}{9}$

38. If y(t) is the solution of $(1+t)\frac{dy}{dt} - ty = 1$ and $y(0) = -1$ then y(1) is equal to

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

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

39. If $P(\theta) = \begin{bmatrix} 1 & \cot\theta \\ -\cot\theta & 1 \end{bmatrix}$ and PQ = I, then $(\text{cosec}^2\theta)$ Q is given by
(where I is an identity matrix of 2×2 order)

(1) $P(\theta)$ (2) $P(-\theta)$
(3) $P(2\theta)$ (4) I

40. If system of equations $kx + 2y - z = 2$, $(k-1)x + ky + z = 1$, $x + (k-1)y + kz = 3$ has only one solution, then number of possible real value(s) of k is -

(1) 0 (2) 1
(3) 2 (4) infinite

41. Let $\alpha, \beta, \gamma, \delta$ are distinct imaginary roots of $z^5 = 1$, then value of

$$\begin{vmatrix} e^{\alpha} & e^{2\alpha} & e^{3\alpha+1} - e^{-\delta} \\ e^{\beta} & e^{2\beta} & e^{3\beta+1} - e^{-\delta} \\ e^{\gamma} & e^{2\gamma} & e^{3\gamma+1} - e^{-\delta} \end{vmatrix}$$ is

(1) 0 (2) e
(3) 1 (4) e^5

42. Mr. A has six children and atleast one child is a girl, then probability that Mr. A has 3 boys and 3 girls, is -

(1) $\frac{20}{63}$ (2) $\frac{1}{6}$

(3) $\frac{5}{11}$ (4) $\frac{1}{32}$

43. Coefficient of t^{12} in $(1 + t^2)^6(1 + t^6)(1 + t^{12})$ is -

(1) 24 (2) 21
(3) 22 (4) 23

44. The number of solution(s) of the equation $\ell n(\ell nx) = \log_x e$ is -

(1) 0 (2) 1
(3) 2 (4) infinite

Space for rough work

45. If m and σ^2 are the mean and variance of random varibale x, whose distribution is given by

X = x	0	1	2	3	4
P(X = x)	$\frac{1}{3}$	$\frac{1}{2}$	0	$\frac{1}{6}$	0

then
(1) $m = \sigma^2 = 2$ (2) $m = 1, \ \sigma^2 = 2$
(3) $m = \sigma^2 = 1$ (4) $m = 2, \ \sigma^2 = 1$

46. Length of common chord of the ellipse $\frac{(x-2)^2}{9}+\frac{(y+2)^2}{4}=1$ and the circle $x^2 + y^2 - 4x + 2y + 4 = 0$ is -
(1) 0 (2) $\frac{1}{\sqrt{2}}$
(3) 1 (4) $\sqrt{2}$

47. If $\frac{(3x-4y-1)^2}{100}-\frac{(4x+3y-1)^2}{225}=1$, then length of latusrectum of hyperbola is
(1) $\frac{9}{2}$ (2) $\frac{40}{3}$
(3) 9 (4) $\frac{8}{3}$

48. The values of parameter 'a' such that the line $(\log_2(1+5a-a^2))\,x - 5y - (a^2-5) = 0$ is a normal to the curve xy = 1, may lie in the interval
(1) $(-\infty, 0)$ (2) (0, 5)
(3) (5, 10) (4) $(10, \infty)$

49. If y = y(x) and it follows the relation $4xe^{xy} = y + 5\sin^2 x$, then y'(0) is equal to
(1) 3 (2) 4
(3) 6 (4) 8

50. If $\lim\limits_{x\to 1} \sin^{-1}\left(\frac{k}{\ell n\, x}-\frac{k}{x-1}\right)$ exist, then the number of integers in the range of k, is
(1) 3 (2) 4
(3) 5 (4) 6

51. If $f(x) = \text{sgn}\left((x^2-kx+6)\left(\sin x-\frac{1}{2}\right)\right)$ (where k > 0) has exactly 4 points of discontinuity in (0, 6) then maximum integral value of k is :-
(1) 4 (2) 5
(3) 6 (4) 7

52. The contrapositive of $(p \wedge q) \Rightarrow r$ is
(1) $\sim r \Rightarrow (p \vee q)$
(2) $r \Rightarrow (p \vee q)$
(3) $\sim r \Rightarrow (\sim p \vee \sim q)$
(4) $p \Rightarrow (q \vee r)$

53. For what values of "a" the equation $||x| - 1| = a$ has four solutions
(1) $0 \le a \le 1$ (2) $0 < a < 1$
(3) $a > 1$ (4) $a \ge 1$

Space for rough work

54. Number of solutions of the equation

$$\sec^{-1}\left(\frac{2}{\frac{1}{x}+x}\right) + \pi \cos \pi x = 0$$

(1) 0 (2) 1

(3) 2 (4) infinite

55. Let $\vec{r}, \vec{a}, \vec{b}$ and $\vec{c}$ be four non-zero vectors such that $\vec{r} \cdot \vec{a} = 0$, $|\vec{r} \times \vec{b}| = |\vec{r}|\ |\vec{b}|$, $|\vec{r} \times \vec{c}| = |\vec{r}|\ |\vec{c}|$, then $[\vec{a}\ \vec{b}\ \vec{c}]$ is

(1) 0 (2) $2\vec{r}$

(3) $2|\vec{r}|$ (4) none of these

56. Equation of a straight line passing through the point (3, 2) which is forming a triangle of area 12 units with the positive coordinate axes, is

(1) $2x + 3y = 12$ (2) $2x + 3y + 12 = 0$

(3) $3x + 2y = 13$ (4) $x + 2y = 7$

57. Number of ways in which 5 different toys can be distributed in 5 children if exactly one child does not get any toy

(1) 1200 (2) 2400

(3) 240 (4) 300

58. Mean deviation of a distribution is least when deviations are taken about

(1) mean

(2) median

(3) mode

(4) It is same for all central tendencies

59. If PP′ is a focal chord of a parabola such that PS = 3 and P′S = 6, then its latus rectum is

(where S is focus of the parabola)

(1) 8 (2) 14

(3) 9 (4) 6

60. Number of solution(s) of the equation $\sin 2\theta + \cos 2\theta = -\frac{1}{2}$, $\theta \in \left[0, \frac{\pi}{2}\right]$, is

(1) 0 (2) 1

(3) 2 (4) 3

Space for rough work

PART-C : CHEMISTRY

61. An ideal gas undergoes isothermal expansion. During the process :
(1) enthalpy increases but entropy decreases.
(2) enthalpy remains constant but entropy increases.
(3) enthalpy decreases but entropy increases.
(4) Both enthalpy and entropy remain constant.

62. 50 mL of 0.2 M ammonia solution is treated with 25 mL of 0.2 M HCl. If pK_b of ammonia solution is 4.75, the pH of the mixture will be :
(1) 3.75 (2) 4.75
(3) 8.25 (4) 9.25

63. The electron in the hydrogen atom undergoes transition from higher orbitals to orbital of radius 211.6 pm. This transition is associated with :
(1) Lyman series (2) Balmer series
(3) Paschen series (4) Brackett series

64. At 300 K, the density of a certain gaseous molecule at 2 bar is double to that of dinitrogen (N_2) at 4 bar. The molar mass of gaseous molecule is :
(1) 28 g mol^{-1}
(2) 56 g mol^{-1}
(3) 112 g mol^{-1}
(4) 224 g mol^{-1}

65. What quantity (in mL) of a 45% (w/v) acid solution of a mono-protic strong acid must be mixed with a 20% (w/v) solution of the same acid to produce 800 mL of a 30% (w/v) acid solution ?
(1) 320 (2) 325
(3) 316 (4) 330

66. To find the standard potential of M^{3+}/M electrode, the following cell is constituted $Pt/M/M^{3+}(0.001 \text{ mol } L^{-1}) \| \| Ag^{+}(0.01 \text{ mol } L^{-1}) / Ag$
The emf of the cell is found to be 0.421 volt at 298 K. The standard potential of half reaction
$M^{3+} + 3e^{-} \rightarrow M$ at 298 K will be :
(Given $E^{\ominus}_{Ag^{+}/Ag}$ at 298 K = 0.80 Volt)
(1) 0.38 Volt (2) 0.32 Volt
(3) 1.28 Volt (4) 0.66 Volt

67. A gas undergoes change from state A to state B. In this process, the heat absorbed and work done by the gas is 5 J and 8 J, respectively. Now gas is brought back to A by another process during which 3 J of heat is evolved. In this reverse process of B to A :
(1) 10 J of the work will be done by the gas.
(2) 6 J of the work will be done by the gas.
(3) 10 J of the work will be done by the surrounding on gas.
(4) 6 J of the work will be done by the surrounding on gas.

Space for rough work

68. Adsorption of a gas on a surface follows Freundlich adsorption isotherm. Plot of $\log\frac{x}{m}$ versus log p gives a straight line with slope equal to 0.5, then :

($\frac{x}{m}$ is the mass of the gas adsorbed per gram of adsorbent)

(1) Adsorption is independent of pressure.
(2) Adsorption is proportional to the pressure.
(3) Adsorption is proportional to the square root of pressure.
(4) Adsorption is proportional to the square of pressure.

69. The rate of a reaction quadruples when the temperature changes from 300 to 310 K. The activation energy of this reaction is :
(Assume activation energy and pre exponential factor are independent of temperature; ln 2=0.693; R = 8.314 J mol^{-1} K^{-1})
(1) 107.2 kJ mol^{-1}
(2) 53.6 kJ mol^{-1}
(3) 26.8 kJ mol^{-1}
(4) 214.4 kJ mol^{-1}

70. A solution is prepared by mixing 8.5 g of CH_2Cl_2 and 11.95 g of $CHCl_3$. If vapour pressure of CH_2Cl_2 and $CHCl_3$ at 298 K are 415 and 200 mmHg respectively, the mole fraction of $CHCl_3$ in vapour form is :
(Molar mass of Cl=35.5 g mol-1)
(1) 0.162 (2) 0.675
(3) 0.325 (4) 0.486

71. The electronic configuration with the highest ionization enthalpy is :
(1) [Ne] $3s^2$ $3p^1$ (2) [Ne] $3s^2$ $3p^2$
(3) [Ne] $3s^2$ $3p^3$ (4) [Ar] $3d^{10}$ $4s^2$ $4p^3$

72. The following reaction occurs in the Blast Furnace where iron ore is reduced to iron metal :
$Fe_2O_3(s) + 3CO(g) \rightleftharpoons 2Fe(\ell) + 3CO_2(g)$
Using the Le Chatelier's principle, predict which one of the following will not disturb the equilibrium ?
(1) Removal of CO
(2) Removal of CO_2
(3) Addition of CO_2
(4) Addition of Fe_2O_3

73. Which one of the following is an oxide ?
(1) KO_2 (2) BaO_2
(3) SiO_2 (4) CsO_2

74. Which of the following is a set of green house gases ?
(1) CH_4, O_3, N_2, SO_2
(2) O_3, N_2, CO_2, NO_2
(3) O_3, NO_2, SO_2, Cl_2
(4) CO_2, CH_4, N_2O, O_3

Space for rough work

75. The group having triangular planar structures is :

(1) BF_3, NF_3, CO_3^{2-} (2) CO_3^{2-}, NO_3^-, SO_3

(3) NH_3, SO_3, CO_3^{2-} (4) NCl_3, BCl_3, SO_3

76. XeF_6 on partial hydrolysis with water produces a compound 'X'. The same compound 'X' is formed when XeF6 reacts with silica. The compound 'X' is :

(1) XeF_2 (2) XeF_4

(3) $XeOF_4$ (4) XeO_3

77. The number of P-OH bonds and the oxidation state of phosphorus atom in pyrophosphoric acid ($H_4P_2O_7$) respectively are :

(1) four and four (2) five and four

(3) five and five (4) four and five

78. Extraction of zinc from zinc blende is achieved by

(1) Electrolytic reduction

(2) Roasting followed by reduction with carbon

(3) Roasting followed by reduction with another metal

(4) Roasting followed by self-reduction

79. The correct sequence of decreasing number of π-bonds in the structures of H_2SO_3, H_2SO_4 and $H_2S_2O_7$ is:

(1) $H_2SO_3 > H_2SO_4 > H_2S_2O_7$

(2) $H_2SO_4 > H_2S_2O_7 > H_2SO_3$

(3) $H_2S_2O_7 > H_2SO_4 > H_2SO_3$

(4) $H_2S_2O_7 > H_2SO_3 > H_2SO_4$

80. $[Co_2(CO)_8]$ displays :

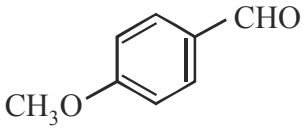
(1) one Co-Co bond, six terminal CO and two bridging CO

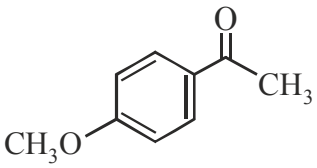
(2) one Co-Co bond, four terminal CO and four bridging CO

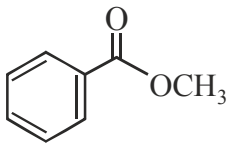
(3) no Co-Co bond, six terminal CO and two bridging CO

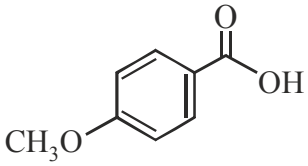
(4) no Co-Co bond, four terminal CO and four bridging CO

81. A compound of molecular formula $C_8H_8O_2$ reacts with acetophenone to form a single cross-aldol product in the presence of base. The same compound on reaction with conc. NaOH forms benzyl alcohol as one of the products. The structure of the compound is :

(1) 

(2) 

(3) 

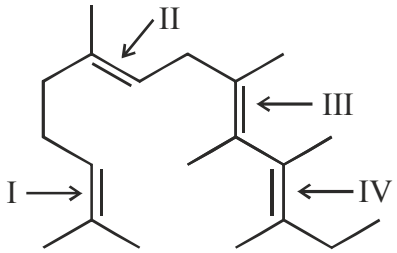
(4) 

Space for rough work

82. Which of the following compounds is most reactive to an aqueous solution of sodium carbonate ?

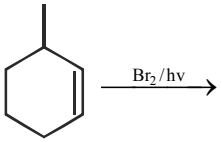
(1) 
(2) 
(3) 
(4) 

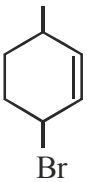
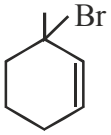
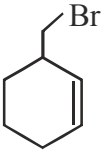
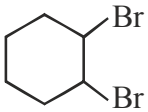
83. In the following structure, the double bonds are marked as I, II, III and IV



Geometrical isomerism is not possible at site (s) :
(1) III (2) I
(3) I and III (4) III and IV

84. The major product of the following reaction is :



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

85. The incorrect statement among the following is :
(1) α-D-glucose and β-D-glucose are anomers.
(2) The penta acetate of glucose does not react with hydroxyl amine.
(3) Cellulose is a straight chain polysaccharide made up of only β-D-glucose units.
(4) α-D-glucose and β-D-glucose are enantiomers.

86. Which of the following is a biodegradable polymer ?

(1) $\left[HN-(CH_2)_5CONH-CH_2-\overset{O}{\overset{\|}{C}} \right]_n$

(2) $\left[HN-(CH_2)_5-\overset{O}{\overset{\|}{C}} \right]_n$

(3) $\left[HN-(CH_2)_6NHCO-(CH_2)_4-\overset{O}{\overset{\|}{C}} \right]_n$

(4) $\left[\overset{O}{\overset{\|}{C}}-C_6H_4-COO-(CH_2)_2-O \right]_n$

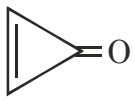
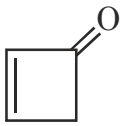
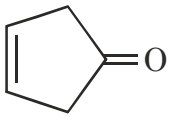
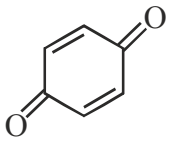
87. The increasing order of the boiling points for the following compounds is :

$\underset{(I)}{C_2H_5OH}$ $\underset{(II)}{C_2H_5Cl}$ $\underset{(III)}{C_2H_5CH_3}$ $\underset{(IV)}{C_2H_5OCH_3}$

(1) (III) < (IV) < (II) < (I)
(2) (IV) < (III) < (I) < (II)
(3) (II) < (III) < (IV) < (I)
(4) (III) < (II) < (I) < (IV)

Space for rough work

88. Which of the following compounds will show highest dipole moment ?

(I)  (II)  (III)  (IV) 

(1) (I) (2) (II) (3) (III) (4) (IV)

89. In the following reaction sequence :

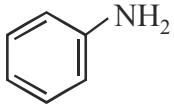
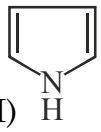
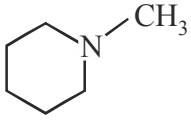
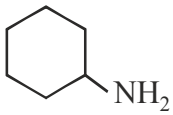
$$\underset{(C_3H_6Cl_2)}{I} \xrightarrow{KOH(aq)} II \xrightarrow[(ii)H_2O/H^+]{(i)CH_3MgBr} III \xrightarrow{Anhy.ZnCl_2+Con.HCl} \text{gives turbidity immediately}$$

The compound I is :

(1) $CH_2(Cl)-CH(Cl)-CH_3$ (2) $CH_2(Cl)-CH_2-CH_2(Cl)$

(3) $Cl-CH(Cl)-CH_2-CH_3$ (4) $CH_3-C(Cl)_2-CH_3$

90. Among the following compounds, the increasing order of their basic strength is :

(I)  (II)  (III)  (IV) 

(1) (I) < (II) < (IV) < (III) (2) (I) < (II) < (III) < (IV)

(3) (II) < (I) < (IV) < (III) (4) (II) < (I) < (III) < (IV)

Space for rough work