



## DEMO TEST-2

### JEE MAIN PATTERN

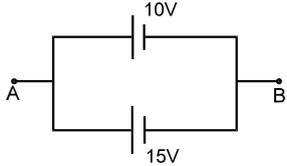
Time: 3 Hours

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.  $\frac{1}{4}$  (**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**

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|--|--|
| <p>1. Two isotopes P and Q of atomic weight 10 and 20, respectively are mixed in equal amount by weight. After 20 days their weight ratio is found to be 1 : 4. Isotope P has a half-life of 10 days. The half-life of isotope Q is<br/>                 (1) zero (2) 5 days<br/>                 (3) 20 days (4) infinite</p> <p>2. In a uranium reactor whose thermal power is <math>P = 100</math> MW, if the average number of neutrons liberated in each nuclear splitting is 2.5. Each splitting is assumed to release an energy <math>E = 200</math> MeV. The number of neutrons generated per unit time is -<br/>                 (1) <math>4 \times 10^{18} \text{ s}^{-1}</math> (2) <math>8 \times 10^{23} \text{ s}^{-1}</math><br/>                 (3) <math>8 \times 10^{19} \text{ s}^{-1}</math> (4) <math>\frac{125}{16} \times 10^{18} \text{ s}^{-1}</math></p> <p>3. Two separate monochromatic light beams A and B of the same intensity (energy per unit area per unit time) are falling normally on a unit area of a metallic surface. Their wavelength are <math>\lambda_A</math> and <math>\lambda_B</math> respectively. Assuming that all the incident light is used in ejecting the photoelectrons, the ratio of the number of photoelectrons from beam A to that from B is<br/>                 (1) <math>\left(\frac{\lambda_A}{\lambda_B}\right)</math> (2) <math>\left(\frac{\lambda_B}{\lambda_A}\right)</math><br/>                 (3) <math>\left(\frac{\lambda_A}{\lambda_B}\right)^2</math> (4) <math>\left(\frac{\lambda_B}{\lambda_A}\right)^2</math></p> | <p>4. Water rises in a capillary tube to a height h. it will rise to a height more than h<br/>                 (1) on the surface of sun<br/>                 (2) in a lift moving with acceleration in downward direction<br/>                 (3) at the poles<br/>                 (4) in a lift moving acceleration in upward direction.</p> <p>5. In a potentiometer wire experiment the emf of a battery in the primary circuit is 20 volt and its internal resistance is <math>5\Omega</math>. There is a resistance box (in series with the battery and the potentiometer wire) whose resistance can be varied from <math>120\Omega</math> to <math>170\Omega</math>. Resistance of the potentiometer wire is <math>75\Omega</math>. The following potential differences can not be measured using this potentiometer<br/>                 (1) 5V (2) 6V<br/>                 (3) 7V (4) 8V</p> <p>6. Two cells of e.m.f. 10 V &amp; 15 V are connected in parallel to each other between points A &amp; B. The cell of e.m.f. 10 V is ideal but the cell of e.m.f. 15 V has internal resistance <math>1 \Omega</math>. The equivalent e.m.f. between A and B is:<br/> <br/>                 (1) <math>\frac{25}{2}</math> V (2) not defined<br/>                 (3) 15 V (4) 10 V</p> |
|--|--|

Space for rough work

7. In a double slit experiment, the coherent sources are spaced  $2d$  apart and the screen is placed a distance  $D$  from the slits. If  $n^{\text{th}}$  bright fringe is formed on the screen exactly opposite to a slit, the value of  $n$  must be

- (1)  $\frac{d^2}{2\lambda D}$                       (2)  $\frac{2d^2}{\lambda D}$   
(3)  $\frac{d^2}{\lambda D}$                         (4)  $\frac{d^2}{4\lambda D}$

8. A luminous point object is moving along the principal axis of a concave mirror of focal length  $12\text{ cm}$  towards it. When its distance from the mirror is  $20\text{ cm}$  its velocity is  $4\text{ cm/s}$ . The velocity of the image in  $\text{cm/s}$  at that instant is

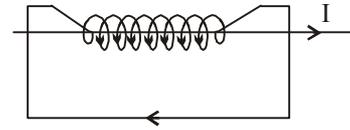
- (1)  $6$ , towards the mirror  
(2)  $6$ , away from the mirror  
(3)  $9$ , away from the mirror  
(4)  $9$ , towards the mirror

9. To decrease the cut-off wavelength of continuous X-ray by  $25\%$  the potential difference across the X-ray tube must be

- (1) increased by  $\frac{100}{3}\%$   
(2) decreased by  $20\%$   
(3) increased by  $25\%$   
(4) decreased by  $25\%$

10. In the diagram shown, a wire carries current  $I$ . What is the value of the  $\oint \vec{B} \cdot d\vec{l}$  (as in Ampere's law) on the helical loop shown in the figure? The

integration is done in the sense shown. The loop has  $N$  turns and part of helical loop on which arrows are drawn is outside the plane of paper.

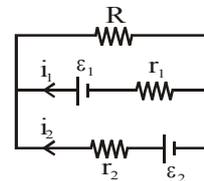


- (1)  $-\mu_0(NI)$                       (2)  $\mu_0(I)$   
(3)  $\mu_0(NI)$                         (4) Zero

11. The motion of a particle represented by  $y = \sin\omega t - \cos\omega t$  is :-

- (1) NOT S.H.M.  
(2) S.H.M. with period  $\frac{2\pi}{\omega}$ , amplitude  $\sqrt{2}$   
(3) S.H.M. with complicated period, amplitude  $1$   
(4) S.H.M. with period  $\frac{\sqrt{2}\pi}{\omega}$ , amplitude  $\sqrt{2}$

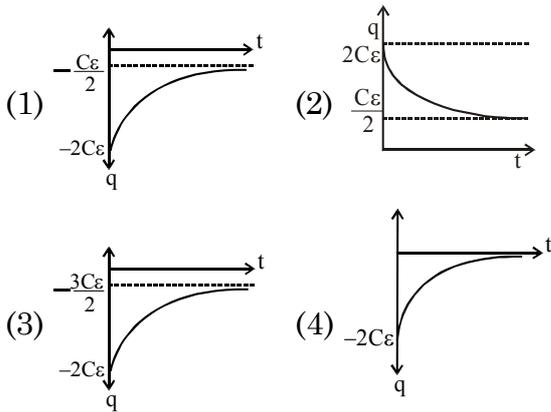
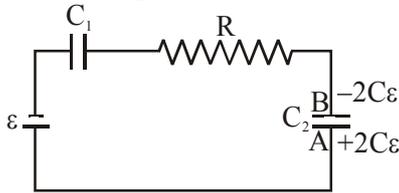
12. See the electrical circuit shown in this figure. Which of the following equations is a correct equation for it?



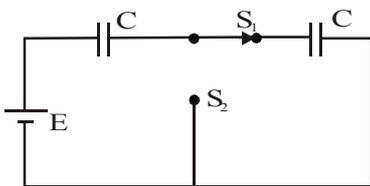
- (1)  $\varepsilon_1 - (i_1 + i_2)R + i_1 r_1 = 0$   
(2)  $\varepsilon_1 - (i_1 + i_2)R - i_1 r_1 = 0$   
(3)  $\varepsilon_2 - i_2 r_2 - \varepsilon_1 - i_1 r_1 = 0$   
(4)  $-\varepsilon_2 - (i_1 + i_2)R + i_2 r_2 = 0$

Space for rough work

13. The capacitance of  $C_1$  and  $C_2$  shown in the diagram is  $C$ .  $C_1$  is initially uncharged and  $C_2$  is given a charge  $2C\epsilon$  as shown. Which of the following graph represents charge on plate B of capacitor  $C_2$  as a function of time ?

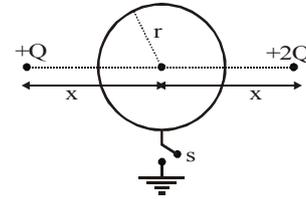


14. In the given circuit when switch is shifted from position  $S_1$  to position  $S_2$ , the additional energy supplied by battery is



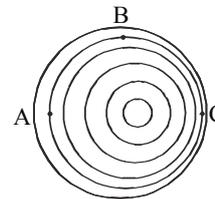
- (1)  $\frac{CE^2}{2}$                       (2)  $\frac{CE^2}{4}$   
(3)  $E^2C$                       (4)  $2CE^2$

15. Two particles having positive charges  $+Q$  and  $+2Q$  are fixed at equal distance  $x$  from centre of a conducting sphere having zero net charge and radius  $r$  as shown. Initially the switch  $S$  is open. After the switch  $S$  is closed, the net charge flowing out of sphere is



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

16. Three observers, A, B, and C are listening to a moving source of sound. The diagram below shows the location of the wavecrests of the moving source with respect to the three stationary observers. Which of the following is true?



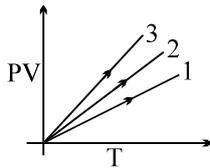
- (1) The wavefronts move faster at C than at A and B.  
(2) The frequency of the sound is highest at A.  
(3) The frequency of the sound is highest at B.  
(4) The frequency of the sound is highest at C.

Space for rough work

17. A charged particle of mass  $m$  and charge  $q$  is accelerated through a potential difference of  $V$  volt. It enters a region of uniform magnetic field  $B$  which is directed perpendicular to the direction of motion of the particle. The particle will move on a circular path of radius :-

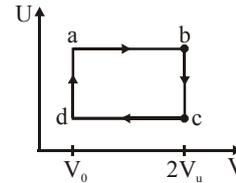
- (1)  $\sqrt{\frac{Vm}{qB^2}}$                       (2)  $\frac{2Vm}{qB^2}$   
 (3)  $\sqrt{\frac{2Vm}{q}} \left(\frac{1}{B}\right)$                       (4)  $\sqrt{\frac{Vm}{2q}} \left(\frac{1}{B}\right)$

18. PV versus T graph of equal masses of  $H_2$ , He and  $CO_2$  is shown in figure. Choose the correct alternative



- (1) 3 corresponds to  $H_2$ , 2 to He and 1 to  $CO_2$   
 (2) 1 corresponds to He, 2 to  $H_2$  and 3 to  $CO_2$   
 (3) 1 corresponds to He, 3 to  $H_2$  and 2 to  $CO_2$   
 (4) 1 corresponds to  $CO_2$ , 2 to  $H_2$  and 3 to He

19. The figure given below shows the variation in the internal energy  $U$  with volume  $V$  of 2.0 mole of an ideal gas in a cyclic process a b c d a. The temperatures of the gas during the processes a b and c d are 500K and 300K respectively, the net heat absorbed by the gas during the complete process is :- (Take  $R = 8.3 \text{ J/mol-K}$  and  $\ln 2 = 0.69$ )



- (1) 3200 J                      (2) Zero  
 (3) 2100 J                      (4) 2291 J

20. A steel ring of radius  $r$  and cross-sectional area  $A$  is fitted on to a wooden disc of radius  $R$  ( $R > r$ ). If Young's modulus be  $Y$ , then the force with which the steel ring is expanded is

- (1)  $AY \left(\frac{R}{r}\right)$                       (2)  $AY \left(\frac{R-r}{r}\right)$   
 (3)  $\frac{Y}{A} \left(\frac{R-r}{r}\right)$                       (4)  $\frac{Yr}{AR}$

21. Two stars X and Y emit yellow and blue lights. Out of these whose temperature will be more?

- (1) that of Y  
 (2) that of X  
 (3) that of both  
 (4) sometimes X and sometimes Y

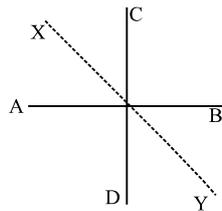
Space for rough work

22. A satellite is fired from the surface of the moon of mass  $M$  and radius  $R$ , with speed  $v_0$  at  $30^\circ$  with the vertical. The satellite reaches a maximum distance of  $\frac{5R}{2}$  from the centre of the moon. The value of  $v_0$  is-

- (1)  $\sqrt{\frac{2GM}{R}}$                       (2)  $\sqrt{\frac{5GM}{2R}}$   
 (3)  $\sqrt{\frac{5GM}{4R}}$                       (4)  $\sqrt{\frac{2GM}{37R}}$

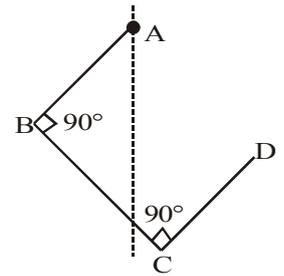
23.  $AB$  and  $CD$  are two identical rods each of length  $L$  and mass  $M$  joined to form a cross. Find the M.I. of the system about a bisector of the angle between the rods ( $XY$ )

- (1)  $\frac{ML^2}{12}$   
 (2)  $\frac{ML^2}{6}$   
 (3)  $\frac{ML^2}{3}$   
 (4)  $\frac{4ML^2}{3}$



24. Three identical rods are hinged at point  $A$  as shown. The angle made by rod  $AB$  with vertical is

- (1)  $\tan^{-1}\left(\frac{1}{\sqrt{3}}\right)$   
 (2)  $\tan^{-1}\left(\frac{3}{4}\right)$   
 (3)  $\tan^{-1}(1)$   
 (4)  $\tan^{-1}\left(\frac{4}{3}\right)$



25. A travelling microscope has a main scale graduated in  $\frac{1}{2}$  mm. 50 vernier divisions coincide with 49 main scale divisions. What will be the reading if the main scale reads 7.45 cm and the 29<sup>th</sup> division of the vernier coincides with the main scale division?

- (1) 7.459 cm                      (2) 7.453 cm  
 (3) 7.479 cm                      (4) 7.48 cm

26. A recent high precision method of determining  $g$  has quoted an error of 6 parts in  $10^9$ . The increase in height at the surface due to change in  $g$  equal to this error is (Take radius of earth as 6400 km)

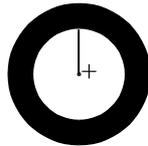
- (1) 38.4 mm                      (2) 19.2 mm  
 (3) 3.84 mm                      (4) 1.92 mm

27. A transverse wave is passing through a stretched string with a speed of 20 m/s. The tension in the string is 20 N. At a certain point  $P$  on the string, it is observed that energy is being transferred at a rate of 40 mW at a given instant. Find the speed of point  $P$ .

- (1) 40 cm/s                      (2) 20 cm/s  
 (3) 2 mm/s                      (4) 20 mm/s

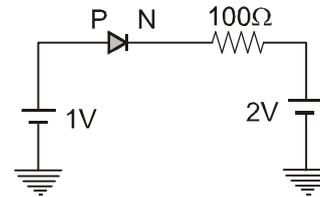
Space for rough work

28. An electrically isolated hollow (initially uncharged), conducting sphere has a small positively charged ball suspended by an insulating rod from its inside surface, see diagram. This causes the inner surface of the sphere to become negatively charged. When the ball is centered in the sphere the electric field outside the conducting sphere is approximately.



- (1) zero
- (2) the same as if the sphere wasn't there
- (3) twice what it would be if the sphere wasn't there
- (4) equal in magnitude but opposite in direction to what it would be if the sphere wasn't there

29. The current through an ideal PN-junction shown in the following circuit diagram will be



- (1) Zero
- (2) 1 mA
- (3) 10 mA
- (4) 30 mA

30. The transfer ratio  $\beta$  of a transistor is 50. the input resistance of the transistor when used in the common emitter configuration is 1 k $\Omega$ . The peak value of the collector AC current for an AC input voltage of 0.01 V peak is :

- (1) 100  $\mu$ A
- (2) 0.01 mA
- (3) 0.25 mA
- (4) 500  $\mu$ A

Space for rough work

**PART-B : MATHEMATICS**

31. The range of function

$$f(x) = \log_2 \left( \frac{\pi + 2 \sin^{-1} \left( \frac{3-x}{7} \right)}{\pi} \right)$$

is equal to

- (1)  $(-\infty, 1)$                       (2)  $(1, \infty)$   
(3)  $(-\infty, 1]$                       (4)  $[1, \infty)$

32. If  $\sum_{r=1}^n T_r = 3^n - 1$ , then  $\sum_{r=1}^n \frac{1}{T_r}$  is equal to

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

33. If  $\alpha, \beta$  are roots of equation

$$x^2 + px - \frac{1}{2p^2} = 0 \quad (p \in \mathbb{R} \text{ and } p \neq 0),$$

then the minimum value of  $(\alpha^4 + \beta^4)$  is equal to

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

34. A variable line L is drawn through O (0, 0) to meet the lines

$$L_1 : y - x - 10 = 0 \quad \text{and}$$

$$L_2 : y - x - 20 = 0 \quad \text{at the points A and B respectively. A point P is taken on}$$

L such that  $\frac{2}{OP} = \frac{1}{OA} + \frac{1}{OB}$  and P, A, B lies on same side of origin O.

The locus of P is

- (1)  $3x + 3y = 40$                       (2)  $3x + 3y + 40 = 0$   
(3)  $3x - 3y = 40$                       (4)  $3y - 3x = 40$

35. The function

$f(x) = \sqrt{x + 2\sqrt{2x - 4}} + \sqrt{x - 2\sqrt{2x - 4}}$  is differentiable at all points of its domain except at  $x =$

- (1) 2                                      (2) 3  
(3) 4                                      (4) 10

36. Which of the following statement is true?

(1) The equation  $\sin x - x = 0$

has a real root in  $\left(\frac{\pi}{4}, \frac{\pi}{2}\right)$ .

(2) The equation  $\tan x - x = 0$  has a real root in  $\left(\frac{\pi}{6}, \frac{\pi}{3}\right)$ .

(3) If  $f(x)$  is a real-valued continuous function in  $[0, 2]$  then there exist some  $c \in \mathbb{R}$  such that  $f(x) \geq c$  for all  $x \in [0, 2]$ .

(4) If  $g(x)$  is a real-valued function defined on  $[3, 5]$  and  $g(3) \cdot g(5) < 0$  then there exist some  $\alpha \in (3, 5)$  such that  $g(\alpha) = 0$ .

Space for rough work

37. The sum of all roots of the equation  $\sin\left(\pi \log_3\left(\frac{1}{x}\right)\right) = 0$  in  $x \in (0, \pi)$  is
- (1)  $\frac{3}{2}$  (2) 4  
(3)  $\frac{13}{3}$  (4)  $\frac{9}{2}$
38. If the function  $f(x) = \begin{cases} \left(\cot\left(x + \frac{\pi}{4}\right)\right)^{\frac{1}{x}}, & x \in \left(\frac{-1}{2}, \frac{1}{2}\right) - \{0\} \\ k, & x = 0 \end{cases}$  is continuous at  $x=0$ , then  $k$  is equal to
- (1)  $e^{-3}$  (2)  $e^{-2}$   
(3)  $e^2$  (4)  $e^3$
39. Let  $f : (-2, 2) \rightarrow \mathbb{R}$  be a differentiable function such that  $f(0) = -1$  and  $f'(0) = 1$ . If  $g(x) = (f(2f(x)+2))^2$  then  $g'(0)$  is equal to
- (1) -4 (2) 0  
(3) -2 (4) 4
40. The value of  $\lim_{x \rightarrow 0} \frac{1 - \cos(\sqrt{x - \sin x})}{\sqrt{1+x^3} - 1}$  is equal to
- (1) 0 (2)  $\frac{1}{2}$   
(3)  $\frac{1}{6}$  (4) non existent
41. Let  $A$  be a  $3 \times 3$  matrix whose entries are all integers. If  $A$  is invertible and all entries of  $A^{-1}$  are integers then sum of all possible values of  $\det.A$  is
- (1) 0 (2) 1  
(3) 2 (4) none
42. Set  $A$  contains 4 distinct elements and set  $B$  contains 5 distinct elements. Number of many one functions which can be defined from  $A \rightarrow B$ , is
- (1) 505 (2) 904  
(3) 625 (4) 1024
43.  $\int_{\pi/2}^{\pi} (x^{\sin x})(1 + x \cos x / \ln x + \sin x) dx$  is equal to
- (1)  $\frac{\pi^2}{2}$  (2)  $\frac{\pi}{2}$   
(3)  $\frac{4\pi - \pi^2}{4}$  (4)  $\frac{\pi}{2} - 1$
44. Let  $P_1 : 2x - 2y + z = 0$  and  $P_2 = x - y + 2z = 4$  be two planes. If the line  $L$  lies in the plane  $P_1$  and is perpendicular to the line  $P_1 = 0 = P_2$ , then the vector along the line is
- (1)  $\hat{i} - \hat{j} - 4\hat{k}$  (2)  $2\hat{i} + \hat{j} - 2\hat{k}$   
(3)  $3\hat{i} + \hat{j} - 4\hat{k}$  (4)  $\hat{i} + 2\hat{j} + 2\hat{k}$

Space for rough work

- 45.** The equation of common tangent to the parabola  $x^2 - y + 2 = 0$  and ellipse  $4x^2 + 9y^2 = 36$ , is  
 (1)  $y = 2$  (2)  $y = -2$   
 (3)  $y = x + \sqrt{3}$  (4)  $y = x - \sqrt{3}$
- 46.** If the perpendicular distance of the point (2, 3, 1) from the line  $3x + 2y + z = 0 = x + 2y + 3z$  is  $\frac{N}{\sqrt{2}}$ , then N equals  
 (1) 1 (2) 2  
 (3) 4 (4) 5
- 47.** The area enclosed by circle  $x^2 + y^2 = 4$ , parabola  $y = x^2 + x + 1$ , the curve  $y = \left[ \sin^2 \frac{x}{4} + \cos \frac{x}{4} \right]$  and x-axis (where [.] denotes greatest integer function), is equal to  
 (1)  $\sqrt{3} - \frac{2\pi}{3}$  (2)  $\frac{\pi}{6} - \frac{\sqrt{3}}{4} + \frac{1}{6}$   
 (3)  $\frac{2\pi}{6} + \sqrt{3} - \frac{1}{6}$  (4)  $\frac{2\pi}{3} - \frac{1}{6}$
- 48.** Let  $f : \mathbb{R} \rightarrow \mathbb{R}$  be defined by  $f(x) = \begin{cases} b - 2x, & \text{if } x \leq -1 \\ 2x + 3, & \text{if } x > -1 \end{cases}$   
 If  $f$  has a local minimum at  $x = -1$ , then a possible value of  $b$  is equal to  
 (1) 0 (2)  $-\frac{1}{2}$   
 (3) -1 (4) 1
- 49.** 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
- 50.** Let  $f : \mathbb{R} \rightarrow \mathbb{R}$ ,  $f(x) = \max.\{|\tan^{-1}x|, \cot^{-1}x\}$ . Consider the following statements :  
 I. Function is continuous and derivable  $\forall x \in \mathbb{R}$   
 II. Range of function is  $\left[ \frac{\pi}{4}, \pi \right]$   
 III.  $f(x)$  is many one-into.  
 Identify the correct option -  
 (1) All 3 statements are wrong.  
 (2) Exactly one of above statements is correct.  
 (3) Exactly two of above statements are correct.  
 (4) All 3 statements are correct.
- 51.** If  $\vec{a} = 2\hat{i} + 3\hat{j} + \hat{k}$ ,  $\vec{b} = \hat{i} - \hat{j} + \hat{k}$ ,  $\vec{c} = \hat{i} + \hat{j} + \hat{k}$  and let  $\vec{d}$  be such that  $\vec{a} \times \vec{b} = \vec{d} \times \vec{b}$ ,  $\vec{d} \cdot \vec{c} = 8$ , then value of  $\vec{d} \cdot \vec{b}$  is  
 (1) 6 (2) -6  
 (3) 3 (4) -3

Space for rough work

52. Let  $R = \{(3, 3), (5, 5), (9, 9), (12, 12), (5, 12), (3, 9), (3, 12), (3, 5)\}$  be a relation on the set  $A = \{3, 5, 9, 12\}$ . Then  $R$  is  
 (1) reflexive, transitive but not symmetric  
 (2) reflexive, symmetric but not transitive  
 (3) symmetric, transitive but not reflexive  
 (4) an equivalence relation

53. If an equation of a tangent to the curve  $y = \cos(x + y)$ ,  $-1 \leq x \leq 1 + \pi$ , is  $x + 2y = k$ , then  $k$  is equal to  
 (1) 1 (2)  $\frac{\pi}{4}$   
 (3)  $\frac{\pi}{2}$  (4) 2

54. Locus of mid points of chords of hyperbola  $x^2 - y^2 = a^2$  which are tangents to the parabola  $x^2 = 4by$  will be -  
 (1) dependent on both  $a$  and  $b$ .  
 (2) independent of both  $a$  and  $b$ .  
 (3) dependent on  $a$  but independent of  $b$ .  
 (4) independent of  $a$  but dependent on  $b$ .

55. A, B, C try to hit a target simultaneously but independently. Their respective probabilities of hitting the target are  $\frac{3}{4}$ ,  $\frac{1}{2}$ ,  $\frac{5}{8}$ . The probability that the target is hit by A or B but not by C, is  
 (1)  $\frac{9}{64}$  (2)  $\frac{21}{64}$   
 (3)  $\frac{7}{8}$  (4)  $\frac{7}{32}$

56.  $\int \frac{\log x - \log^2 x + x^2}{x^3} dx$  is

- (1)  $\frac{\log x + 2x \log x}{2x^2} + C$   
 (2)  $\log^2 x + 2x \log x + C$   
 (3)  $\frac{\log^2 x + 2x^2 \log x}{2x^2} + C$   
 (4)  $\frac{\log x + 2x^2 \log x}{2x^2} + C$

(where  $C$  is constant of integration)

57. Two tour guides are leading seven tourists. The guides decide to split up. Each tourist must choose one of the guides, but with the condition that each guide must take atleast one tourist. Number of different groupings of guides and tourist are

- (1) 120 (2) 124  
 (3) 126 (4) 127

58. The minimum value of  $|z_1 - z_2|$  as  $z_1$  and  $z_2$  vary over the curve

$$|\sqrt{3}(1 - 2z) + 2i| = 2\sqrt{7}$$

and  $|\sqrt{3}(-1 - z) - 2i| = |\sqrt{3}(9 - z) + 18i|$  respectively, is

- (1)  $\frac{7\sqrt{7}}{2\sqrt{3}}$  (2)  $\frac{5\sqrt{7}}{2\sqrt{3}}$   
 (3)  $\frac{14\sqrt{7}}{\sqrt{3}}$  (4)  $\frac{7\sqrt{7}}{5\sqrt{3}}$

Space for rough work

59. Let  $p$  and  $q$  be any two logical statements and  $r : p \rightarrow (\sim p \vee q)$ . If  $r$  has a truth value  $F$ , then the truth values of  $p$  and  $q$  are respectively
- (1)  $F, F$                       (2)  $T, T$   
(3)  $F, T$                       (4)  $T, F$
60. In a set of  $2n$  observations, half of them are equal to ' $\alpha$ ' and the remaining half are equal to ' $-\alpha$ '. If the standard deviation of all the observations is  $2$ , then the value of  $|\alpha|$  is equal to
- (1)  $2$                               (2)  $\sqrt{2}$   
(3)  $2\sqrt{2}$                       (4)  $4$

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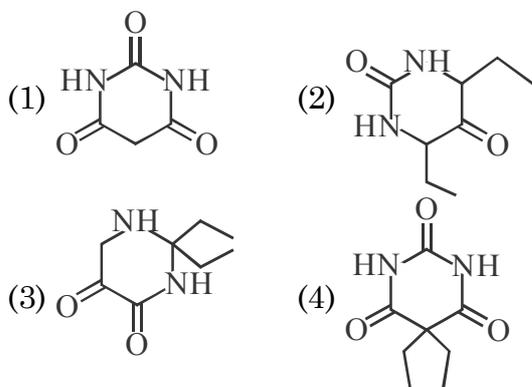
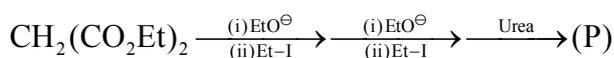
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**PART-C : CHEMISTRY**

61. Which among the following electron transition ( $n_2 \rightarrow n_1$ ) in H-atom, minimum change in its orbit radius ( $r_2 \rightarrow r_1$ ) is observed-

- (1)  $4 \rightarrow 1$                       (2)  $5 \rightarrow 4$   
(3)  $6 \rightarrow 5$                       (4)  $4 \rightarrow 2$

62. Barbiturates are hypnotic agents. Veronal is derivative of barbituric acid. It can be synthesis by following sequence, then structure of veronal (P) is



63. Between the molecules FNO and  $\text{FNO}_2$  one has dipole moment of  $\mu = 1.81\text{D}$  and the other has  $\mu = 0.47\text{D}$  on the basis of VSEPR considerations assign the shapes and dipole moments to the two molecules.

- (1) FNO is angular with  $0.47\text{D}$  dipole moment while  $\text{FNO}_2$  is pyramidal with dipole moment  $1.81\text{D}$ .

(2) FNO is linear with  $1.81\text{D}$  dipole moment while  $\text{FNO}_2$  is planar triangular dipole moment  $0.47\text{D}$ .

(3) FNO is angular with  $1.81\text{D}$  dipole moment while  $\text{FNO}_2$  is planar trigonal shape with  $0.47\text{D}$  dipole moment.

(4) FNO is angular with  $1.81\text{D}$  while  $\text{FNO}_2$  is pyramidal with dipole moment  $0.47\text{D}$ .

64. The hypothetical reaction :  $2\text{A} + \text{B} \rightarrow \text{C} + \text{D}$  is catalyzed by E as indicated in the possible mechanism below -

Step-I :  $\text{A} + \text{E} \rightleftharpoons \text{AE}$  (fast equilibrium)

Step-2 :  $\text{AE} + \text{A} \longrightarrow \text{A}_2 + \text{E}$  (slow)

Step-3 :  $\text{A}_2 + \text{B} \longrightarrow \text{C} + \text{D}$  (fast)

what rate law best agrees with this mechanism

- (1)  $r = k[\text{A}][\text{B}]$                       (2)  $r = k[\text{A}][\text{E}]$   
(3)  $r = k[\text{A}]^2[\text{E}]$                       (4)  $r = k[\text{A}]^2[\text{B}]$

65. Which of the following option is correctly matched ?

**List-I**

**List-II**

- |                 |                   |
|-----------------|-------------------|
| (A) Bithional   | (P) Analgesics    |
| (B) Morphine    | (Q) Tranquilizer  |
| (C) Nardil      | (R) Antihistamine |
| (D) Terfenadine | (S) Antispetic    |

(1)  $\text{A} \rightarrow \text{S}, \text{B} \rightarrow \text{P}, \text{C} \rightarrow \text{R}, \text{D} \rightarrow \text{Q}$

(2)  $\text{A} \rightarrow \text{S}, \text{B} \rightarrow \text{P}, \text{C} \rightarrow \text{Q}, \text{D} \rightarrow \text{R}$

(3)  $\text{A} \rightarrow \text{P}, \text{B} \rightarrow \text{S}, \text{C} \rightarrow \text{R}, \text{D} \rightarrow \text{Q}$

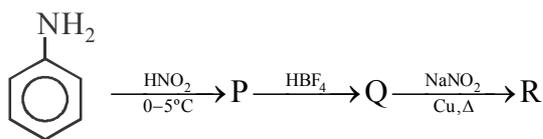
(4)  $\text{A} \rightarrow \text{R}, \text{B} \rightarrow \text{P}, \text{C} \rightarrow \text{Q}, \text{D} \rightarrow \text{S}$

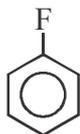
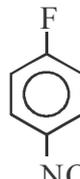
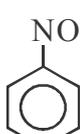
Space for rough work

66. Polarization may be called the distortion of the shape of an anion by an adjacently placed cation. Which of the following statements is correct ?  
 (1) Minimum polarization is brought about by a cation of low radius.  
 (2) A large cation is likely to bring about a large degree of polarization.  
 (3) Maximum polarization is brought about by a cation of high charge.  
 (4) A small anion is likely to undergo a large degree of polarization.
67. During electrolysis of NaCl, if 3mole of H<sub>2</sub>O are electrolysed then how much charge is required if current efficiency is 75% -  
 (1) 1 F                      (2) 2 F  
 (3) 4 F                      (4) 8 F
68. Condensation polymer (Q) produced in following sequence is:
- $$\text{Cyclohexanone} \xrightarrow[\text{(ii) H}_2\text{SO}_4, \Delta]{\text{(i) NH}_2\text{-OH}} \text{P} \xrightarrow[533-543\text{K}]{\text{H}_2\text{O}} \text{Q}$$
- (1) Nylone-6,6                      (2) Nylon-4,6  
 (3) Nylon-6                      (4) Nylon-2 Nylon-6
69. Which of the following is a correct statement about s-block compounds ?  
 (1) Stability of metal chlorides decreases down the alkali metal group  
 (2) Lattice energy of M<sub>2</sub>O<sub>2</sub> is greater than that of M<sub>2</sub>O  
 (3) Stability of peroxide increases with the increase in size of alkaline earth metal ion  
 (4) The water of crystallization is greater in alkali metal salts than in alkaline earth metal salts
70. Select the incorrect option -  
 (1) Gas is more compressible, if repulsive forces dominate over attractive forces between molecules.  
 (2) At extremely low pressure and high temperature gases behave ideally.  
 (3) At Boyle's temperature gases behave ideally in low pressure region.  
 (4) If a gas is kept at T > T<sub>c</sub>, it can never be liquefied.
71. Which of the following is non-aromatic?  
 (1) Pyrrole                      (2) Thiophene  
 (3) Furan                      (4) Pyran
72. When a saturated solution of magnesium sulphate is treated with NH<sub>4</sub>Cl and NH<sub>3</sub>, followed by the addition of disodium hydrogen phosphate, a white precipitate is formed. This on heating gives  
 (1) Mg<sub>2</sub>P<sub>2</sub>O<sub>7</sub>  
 (2) Mg<sub>3</sub>(PO<sub>4</sub>)<sub>2</sub>  
 (3) Mg(NH<sub>4</sub>)PO<sub>4</sub>  
 (4) Mg(NH<sub>4</sub>)HPO<sub>4</sub>
73. What is the maximum mass of Na<sub>2</sub>SO<sub>4</sub> which should be added in 400 ml of 2 × 10<sup>-4</sup> M BaCl<sub>2</sub> solution, without any precipitation of BaSO<sub>4</sub> ?  
 Assume no change in the volume of solution. [Given : K<sub>sp</sub> of BaSO<sub>4</sub> = 8 × 10<sup>-8</sup>].  
 (1) 4 × 10<sup>-4</sup> gm                      (2) 1.6 × 10<sup>-4</sup> gm  
 (3) 22.72 mg                      (4) 56.8 mg

Space for rough work

74. Major product (R) of following reaction is :



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

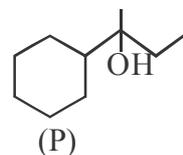
75.  $\text{AlCl}_3$  is more volatile than  $\text{NaCl}$ ; this is because

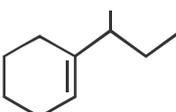
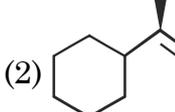
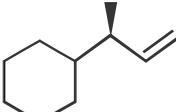
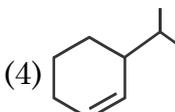
- (1) The  $\text{AlCl}_3$  molecules are held by weak van der Waals forces whereas the  $\text{NaCl}$  species are held by strong ionic forces in a giant lattice.  
 (2)  $\text{AlCl}_3$  unlike  $\text{NaCl}$  is dimerized.  
 (3) Sodium is more metallic than aluminium.  
 (4)  $\text{NaCl}$  unlike  $\text{AlCl}_3$  is a natural product.

76. A 5% solution of cane sugar (molar mass 342) is isotonic with 1% of a solution of an unknown solute. The molar mass of unknown solute in g/mol is :-

- (1) 136.2 (2) 171.2  
 (3) 68.4 (4) 34.2

77. Which of the following option will not produce (P) as major product on reaction with dil.  $\text{H}_2\text{SO}_4$



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

78.  $d\pi - p\pi$  bonding is shown in

- (1)  $\text{NO}_3^-$ ,  $\text{NO}_2^-$ ,  $\text{N}^{3-}$ ,  $\text{CN}^-$   
 (2)  $\text{PF}_3$ ,  $\text{P}_2\text{O}_5$ ,  $\text{PO}_4^{3-}$   
 (3)  $\text{NH}_3$ ,  $\text{PH}_3$ ,  $\text{BiH}_3$   
 (4)  $\text{CO}$ ,  $\text{NO}$ ,  $\text{CO}_2$ ,  $\text{NO}_2$

79. Same metal exist in simple cubic as well as face centered cubic metallic crystal. The ratio of volume of a cubic void with respect to an octahedral void without disturbing the metallic crystal is :

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

Space for rough work

- |   |  |
|---|--|
| <p><b>80.</b> Choose the incorrect option ?</p> <p>(1) Cyclohexanone forms cyanohydrin in good yield but 2,2,6-trimethyl cyclohexanone does not</p> <p>(2) Tertiary amines have higher boiling point than primary amine</p> <p>(3) <math>pK_b</math> of aniline is more than that of methyl amine</p> <p>(4) PCC can oxidise <math>1^\circ</math> alcohol to aldehyde</p> | <p><b>84.</b> Consider the following coordination compounds</p> <p>(i) <math>Ni(CO)_4</math></p> <p>(ii) <math>[Co(CO)_4]^-</math></p> <p>(iii) <math>[Fe(CO)_4]^{2-}</math></p> <p>The stretching frequency of M – C bond (which is directly proportional to bond strength follows the order):</p> <p>(1) (ii) &gt; (iii) &gt; (i)      (2) (iii) &gt; (ii) &gt; (i)</p> <p>(3) (i) &gt; (ii) &gt; (iii)      (4) (i) &gt; (iii) &gt; (ii)</p>  |
| <p><b>81.</b> The number of isomers for the complex <math>[Co(en)Cl_2Br_2]^-</math> are</p> <p>(1) 2                                      (2) 3</p> <p>(3) 4                                      (4) 6</p>   | <p><b>85.</b> 4.48 litre of an ideal gas at 1atm &amp; 273K requires 12 calorie to raise the temperature by <math>15^\circ C</math> at constant volume. The <math>C_p</math> of the gas is -</p> <p>(1) 4 cal                                      (2) 6 cal</p> <p>(3) 2 cal                                      (4) 8 cal</p>   |
| <p><b>82.</b> 1.25 mg of Gum Arabica (Gold Number = 0.25) is added to 50 ml of standard gold sol. What maximum volume (in ml) of 10% NaCl solution can be added to this gold sol without causing coagulation.</p> <p>(1) 1 ml                                      (2) 10 ml</p> <p>(3) 5 ml                                      (4) 25 ml</p>                           | <p><b>86.</b> For the following compounds, choose the incorrect option ?</p> <p><math>CH_3 - NH_2</math>                                      <math>Ph - NH_2</math></p> <p>(P)    (Q)</p> <p>(1) (P) is more basic than (Q)</p> <p>(2) Both (P) and (Q) will give foul smelling compound with <math>CHCl_3</math>, KOH</p> <p>(3) Both (P) and (Q) will form base soluble sulphonamide with Hinsberg reagent</p> <p>(4) Both (P) and (Q) can be obtained by gabriel phthalimide synthesis</p> |
| <p><b>83.</b> Which of the following amino acid contains alcohol functional group ?</p> <p>(1) Valine                                      (2) Serine</p> <p>(3) Cysteine                                      (4) Alanine</p>  |  |

Space for rough work

87. Which of the following chemical changes is incorrect ?

- (1)  $\text{Hg}^{2+} + \text{Cu} \rightarrow \text{Hg} + \text{Cu}^{2+}$
- (2)  $\text{HgI}_2 + 2\text{I}^- \rightarrow [\text{HgI}_4]^{2-}$
- (3)  $\text{HgI}_2 + 2\text{Cl}^- \rightarrow \text{HgCl}_2 + 2\text{I}^-$
- (4)  $\text{Hg} + \text{Hg}^{2+} \rightarrow 2\text{Hg}_2^{2+}$

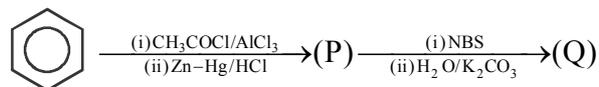
88. Find the value of  $\Delta_r H^\circ$  at 300K for the following process  $\text{X}(\text{g}) \rightleftharpoons \text{Y}(\text{g})$ , if van't Hoff equation for the same is given as

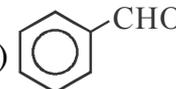
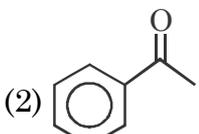
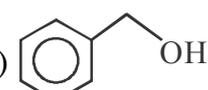
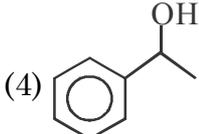
$$\ln K_p = 3 - \frac{2000}{T}$$

(Assume  $R = 2 \frac{\text{cal}}{\text{mol-K}}$ )

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

89. Major product (Q) of following sequence is



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

90.  $\text{Hg}_2\text{Cl}_2$  reacts with liquid ammonia to produce a black precipitate consisting of

- (1)  $\text{Hg}(\text{NH}_2)\text{Cl}$
- (2) Hg and  $\text{Hg}(\text{NH}_2)\text{Cl}$
- (3) Hg and HgCl
- (4)  $\text{Hg}(\text{NH}_3)_2\text{Cl}_2$  and  $\text{HgCl}_2$

Space for rough work