

FITJEE INTERNAL TEST

IIT – JEE 2019

PHASE – V_PAPER – I_SET – A

Time: 3 hours

Maximum Marks: 183

INSTRUCTIONS:

A. General

1. This booklet is your Question Paper containing 54 questions.
2. Blank papers, clipboards, log tables, slide rules, calculators, cellular phones, pagers and electronic gadgets in any form are not allowed to be carried inside the examination hall.
3. Fill in the boxes provided for Name and Enrolment No.
4. The answer sheet, a machine-readable Objective Response (ORS), is provided separately.
5. DO NOT TAMPER WITH / MULTILATE THE ORS OR THE BOOKLET.

B. Filling in the OMR:

6. The instructions for the OMR sheet are given on the OMR itself.

C. Question paper format & Marking Scheme

7. Each part has three sections as detailed in the following table:

Section	Question Type	Number of Questions	Category wise Marks Each Question				Maximum marks of the section
			Full Marks	Partial Marks	Zero Marks	Negative Marks	
1	One or more correct option (s)	7	+4 If only the bubble(s) corresponding to all the correct option(s) is(are) darkened	+1 For darkening a bubble corresponding to each correct option, provided NO incorrect option is darkened	0 If none of the bubbles is darkened	-2 In all other cases	28
2	Single digit integer (0-9)	5	+3 If only the bubble corresponding to the correct answer is darkened.	---	0 In all other cases	---	15
3	Single correct option	6	+3 If only the bubble corresponding to the correct option is darkened	---	0 If none of the bubbles is darkened	-1 In all other cases	18

Don't write / mark your answers in this question booklet.

If you mark the answers in question booklet, you will not be allowed to continue the exam.

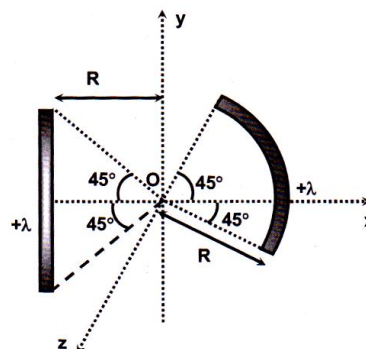
NAME:

ENROLLMENT NO.:

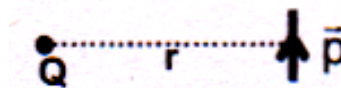
PAPER-I
PART I: PHYSICS
SECTION 1 (Maximum Marks: 28)

- * This section contains **SEVEN** questions.
- * Each question has **FOUR** options (A), (B), (C) and (D). **ONE OR MORE THAN ONE** of these four options is(are) correct.
- * For each question, darken the bubble(s) corresponding to all the correct option(s) in the ORS
- * For example, if (A), (C) and (D) are all the correct options for a question, darkening all these three will get +4 marks; darkening only (A) and (D) will get +2 marks; and darkening (A) and (B) will get -2 marks, as a wrong option is also darkened.

1. A rod having charge per unit length $\lambda = 2$ coulomb / meter lies parallel to y -axis and a quarter ring having same charge density lies in x- z plane as shown in the figure ($R = 2\text{m}$). Then
- (A) The magnitude of electric field due to the rod is more than the electric field due to the quarter ring at the point 'O'
- (B) The net electric field at point 'O' is zero
- (C) The magnitude of electric field due to the rod and due to the quarter ring at the point 'O' is same
- (D) The magnitude of electric field due to the ring at 'O' is $\frac{1}{2\sqrt{2}\pi\epsilon_0}$



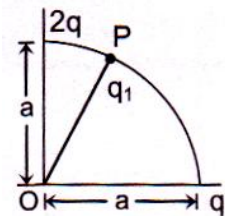
2. A point charge +Q is placed at a distance r from a dipole of dipole moment \vec{p} as shown in the figure. The line joining the point charge Q to the centre of dipole is perpendicular to the dipole moment. \vec{p} .
- Which of the following statement (s) is/are true ?
- (A) The net electrostatic force on the dipole is zero
- (B) The electrostatic force on the dipole is $\frac{QP}{4\pi\epsilon_0 r^3}$ and is acting along the dipole moment \vec{p}
- (C) Torque acting on the dipole is $\frac{QP}{4\pi\epsilon_0 r^2}$ in the inward direction
- (D) Torque acting on the dipole is $\frac{QP}{2\pi\epsilon_0 r^2}$ in the inward direction



Space for rough work

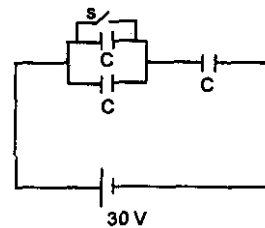
3. A positively charged thin metal ring of radius R is fixed in the xy plane, with its centre at the origin O . A negatively charged particle P is released from rest at the point $(0,0, z_0)$, where $z_0 > 0$. Then the motion of P is
- (A) periodic, for all value of z_0 satisfying $0 < z_0 < \infty$
 (B) simple harmonic, for all values of z_0 satisfying $0 < z_0 \leq R$
 (C) approximately simple harmonic, provided $z_0 \ll R$
 (D) Such that P crosses O and continues to move along the negative z - axis towards $z = -\infty$

4. Two point charges q and $2q$ are placed at $(a, 0)$ and $(0, a)$. A point charge q_1 is placed at a point P on the quarter circle of radius a as shown in the diagram so that the electric field at the origin becomes zero.



- (A) the point P is $\left(\frac{a}{\sqrt{3}}, \frac{\sqrt{2}a}{\sqrt{3}}\right)$ (B) the point $\left(\frac{a}{\sqrt{5}}, \frac{2a}{\sqrt{5}}\right)$
 (C) $q_1 = -\sqrt{5}q$ (D) None of these

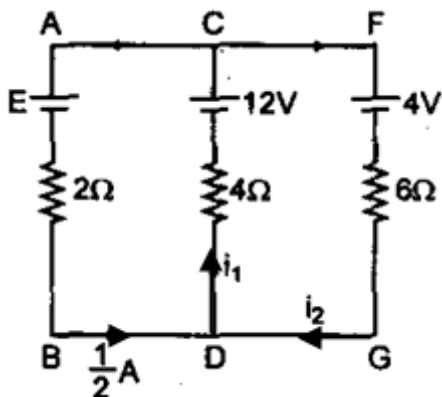
5. Three capacitors each having capacitance $C = 2\mu\text{F}$ are connected with a battery of emf 30 V as shown in figure. When the switch S is closed :



- (A) the amount of charge flown through the battery is $20\mu\text{C}$
 (B) the heat generated in the circuit is 0.6 mJ
 (C) the energy supplied by the battery is 0.6 mJ
 (D) the amount of charge flown through the switch S is $60\mu\text{C}$

Space for rough work

6. In the circuit shown in figure:



- (A) $E = 6.6V$ (B) $i_1 = 1.1 A$ (C) $i_2 = 0.6 A$ (D) $E = 4.4V$

7. A charge 'q' is undergoing S. H. M about point 'A' along the line AB at distance 'd' from the centre B of a conducting sphere of radius R. Amplitude of oscillation of charge is 'a' angular frequency is ω . The sphere is grounded through conducting wire CC'.

Choose the INCORRECT Statement (s)

(A) If $a \ll d$ the maximum value of current in wire CC' will

be $q\omega \left(\frac{Ra}{d^2} \right)$

(B) If $a \ll d$ the maximum value of current in wire CC' will

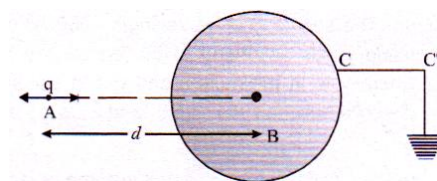
be $\left(\frac{q\omega Ra}{d^3} \right)$

(C) If $a \ll d$ the maximum value of current in wire CC' will

be $q\omega \left(\frac{2Ra}{d^2} \right)$

(D) If $a \ll d$ the maximum value of current in wire CC' will

be $\left(\frac{2q\omega Ra^2}{d^3} \right)$

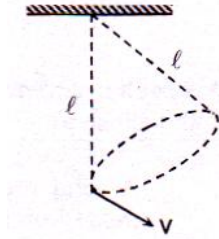


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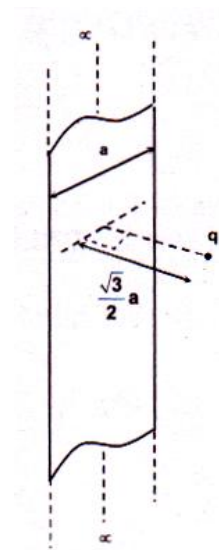
SECTION 2 (Maximum Marks: 15)

- * This section contains **FIVE** questions.
- * The answer to each question is a **SINGLE DIGIT INTEGER** ranging from 0 to 9, both inclusive.
- * For each question, darken the bubble corresponding to the correct integer the ORS.

8. A positively charged particle of charge q and mass m is suspended from a point by a string of length ℓ . In the entire space a uniform horizontal electric field E exists. The particle is drawn aside so that string becomes vertical and then it is projected horizontally with velocity v such that particle starts to move along a circle with same constant speed v . If v equals $\frac{nqE}{3m} \sqrt{\frac{\ell}{g}}$, find the value of n .



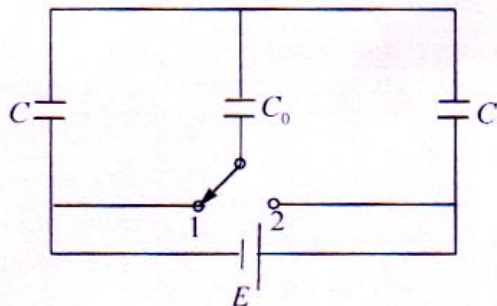
9. There is an infinite long straight surface having width 'a'. A point charge q is placed at a perpendicular distance $\frac{\sqrt{3}}{2}a$ from the surface symmetrically as shown in the figure. If the flux linked with this infinitely long surface due to charge q is $\frac{q}{k\epsilon_0}$. Then find the value of k .



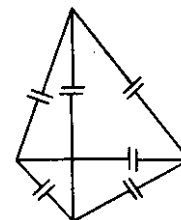
10. Four identical charges are fixed the corners of a square of side a . A fifth point charge $-Q$ lies a distance z along the line perpendicular to the plane of the square for $z \ll a$ the motion of $-Q$ is simple harmonic. The period of motion $T = 2\pi \sqrt{\frac{4\pi\epsilon_0 a^3 m}{4Qq2^x}}$, if the mass of $-Q$ is m (Neglect gravitational force). Then $2x = ?$

Space for rough work

11. What amount of heat in micro joule will be generated in the circuit, after the switch is shifted from position 1 to position 2 ? ($C = C_0 = 2\mu\text{F}, E = \sqrt{6}\text{ V}$)



12. If the capacitance of each capacitor is C , then effective capacitance of the shown network across any two junctions is $\frac{mc}{n}$ then find mn

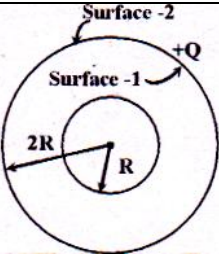
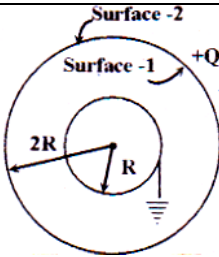
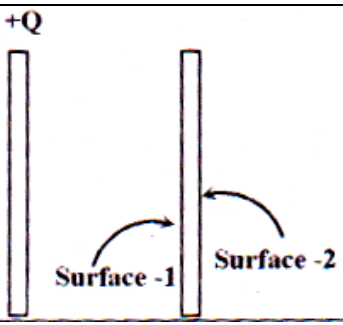
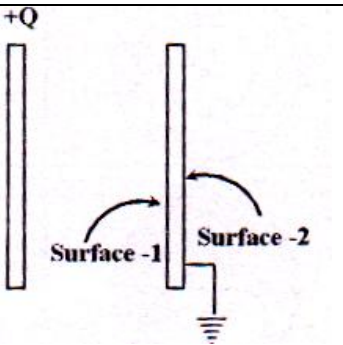


SECTION 3 (Maximum Marks: 18)

- * This section contains **SIX** questions of matching type.
- * This section contains **TWO** tables (each having 3 columns and 4 rows)
- * Based on the table, there are **THREE** questions
- * Each question has **FOUR** options (A), (B), (C) and (D). **ONLY ONE** of these four options is correct.
- * For each question, darken the bubble corresponding to the correct option in the ORS.

Space for rough work

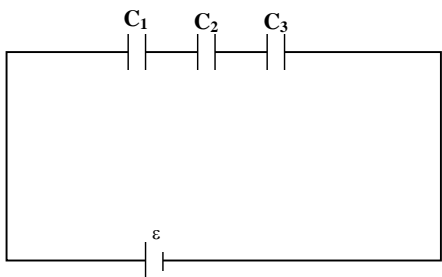
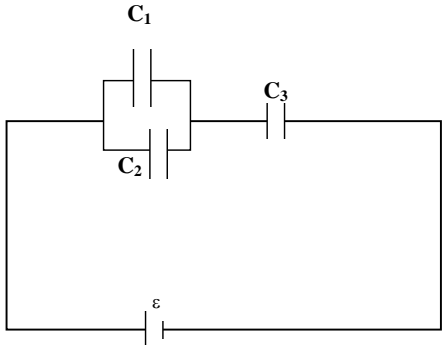
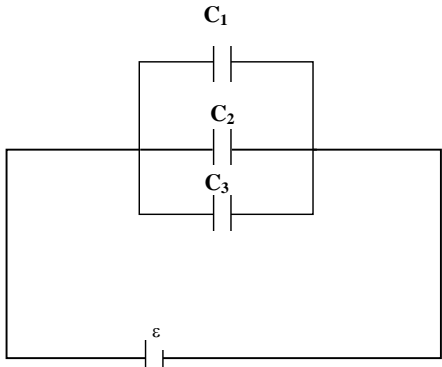

Figure shows total charge given to a conductor. Here, Column I represent arrangement of conductors
 Column 2 represent charge on surface – 1
 Column 3 represent charge on surface – 2

Column 1	Column 2	Column 3
(I) 	(i) $+Q$	(P) $+Q$
(II) 	(ii) Zero	(Q) $-Q$
(III) 	(iii) $+Q/2$	(R) $+Q/2$
(IV) 	(iv) $-Q/2$	(S) $-Q/2$

Space for rough work

13. For part (I) the correct combination is
 (A) I , i , P (B) I , ii , P (C) I , iii , R (D) I , iii , S
14. For part (II) the correct combination is
 (A) II , i , Q (B) II , iii , R (C) II , iii , S (D) II , i , R
15. For part (III) and (IV) the correct combination is
 (A) IV , iv , S (B) IV , iii , S (C) III , iv , R (D) III , iv , S

In Column – 1 circuits with 3 capacitors is given
 In Column 2 individual capacitance and their breakdown Voltage are given
 In Column 3 (break down voltage) maximum possible value of ϵ for which all the capacitors work.

Column 1	Column 2	Column 3
(I) 	(i) $C_1 = C, V_1 = 2V$ $C_2 = 2C, V_2 = V$ $C_3 = 4C, V_3 = \frac{V}{2}$	(P) 7V
(II) 	(ii) $C_1 = 2C, V_1 = 2V$ $C_2 = C, V_2 = 3V$ $C_3 = \frac{C}{2}, V_3 = 4V$	(Q) 1 V
(III) 	(iii) $C_1 = C, V_1 = V$ $C_2 = 2C, V_2 = 2V$ $C_3 = 3C, V_3 = 3V$	(R) $\frac{14V}{3}$
(IV) 	(iv) $C_1 = 4C, V_1 = 2V$ $C_2 = 2C, V_2 = V$ $C_3 = C, V_3 = \frac{V}{2}$	(S) 9V



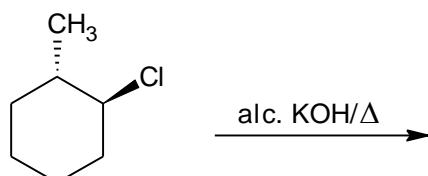
16. Which of the combinations is correct
 (A) I,ii,P (B) I, iii, P (C) I, i, P (D) I,iv,P
17. Which of the combination is correct
 (A) III, i, Q (B) III, ii,R (C) III, iii, Q (D) III, iv, P
18. Which of the following combination is correct
 (A) II,ii,R (B) I, iii, S (C) IV, iii, R (D) III, ii, R

Space for rough work

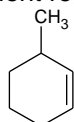
PART II: CHEMISTRY
SECTION 1 (Maximum Marks: 28)

- * This section contains **SEVEN** questions.
- * Each question has **FOUR** options (A), (B), (C) and (D). **ONE OR MORE THAN ONE** of these four options is(are) correct.
- * For each question, darken the bubble(s) corresponding to all the correct option(s) in the ORS
- * For example, if (A), (C) and (D) are all the correct options for a question, darkening all these three will get +4 marks; darkening only (A) and (D) will get +2 marks; and darkening (A) and (B) will get -2 marks, as a wrong option is also darkened.

19.

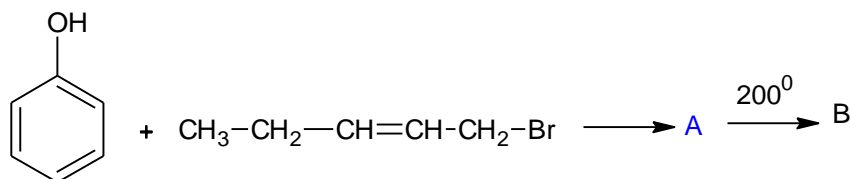


Identify the correct statement regarding the equation



- (A) The product formed is
 (B) E₂ elimination takes place
 (C) Saytzeff product is the major product
 (D) E₁ elimination takes place.

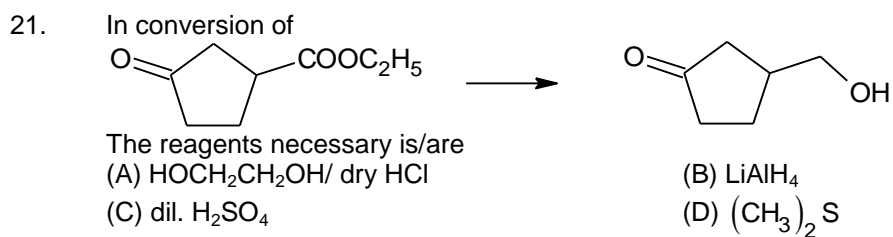
20.



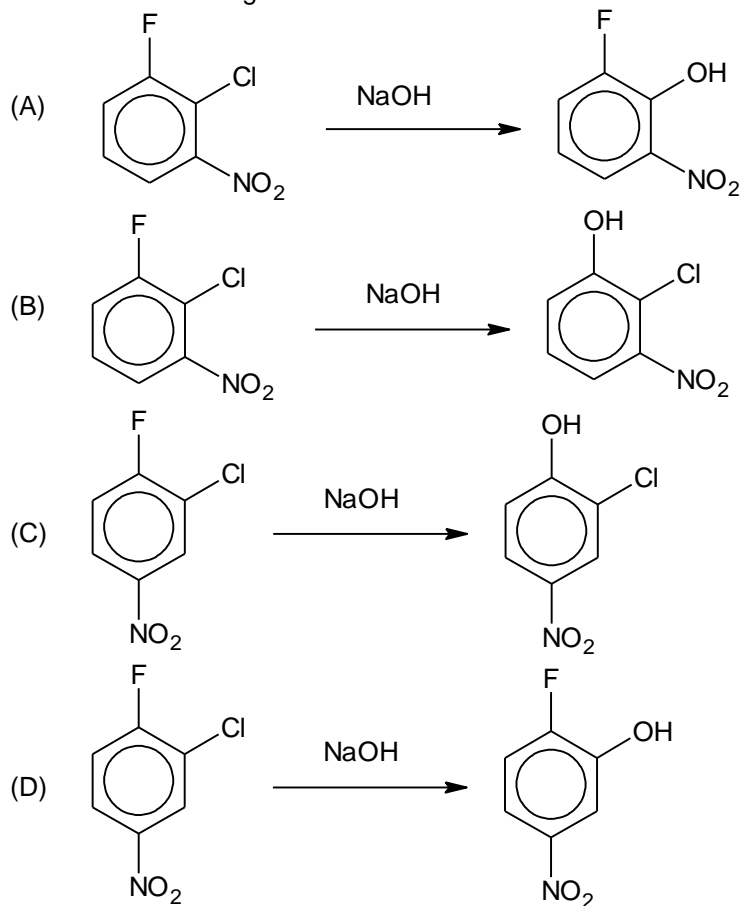
Identify the correct statement

- (A) Product A is substituted Phenol
 (B) Product B is functional isomer of A
 (C) Product A is Ether
 (D) Product B is ortho and para substituted Phenol

Space for rough work



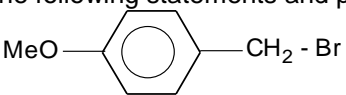
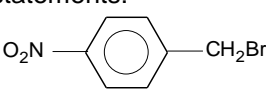
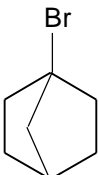
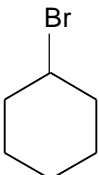
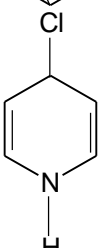
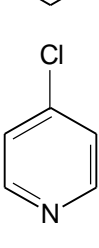
22. Which of the following reactions are correct



Space for rough work

23. In which of the following reactions Grignard reagent acting as a base.
 (A) $\text{CH}_3\text{MgCl} + \text{CH}_3\text{NH}_2 \rightarrow$ (B) $\text{C}_2\text{H}_5\text{MgBr} + \text{H}_2\text{S} \rightarrow$
 (C) $\text{PhMgCl} + \text{CH}_3\text{OH} \rightarrow$ (D) $\text{C}_2\text{H}_5\text{MgBr} + \text{PhCHO} \rightarrow$

24. Consider the following statements and pick up the correct statements:

- (A)  will react more readily than  for $\text{S}_{\text{N}}1$ reaction
- (B)  will react more readily than  for $\text{S}_{\text{N}}1$ reaction
- (C)  will react more readily than  for $\text{S}_{\text{N}}1$ reaction
- (D) $\text{S}_{\text{N}}1$ reaction occurs in polar protic solvent

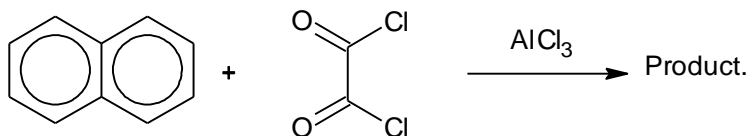
25. There are three alcohols X, Y & Z, each with 2, 1 & 0 alpha hydrogen atoms respectively. Which of the alcohols will respond to Lucas Reagent Test at room temperature.
 (A) X (B) Y
 (C) Z (D) all would not respond to the test

Space for rough work

SECTION 2 (Maximum Marks: 15)

- * This section contains **FIVE** questions.
 * The answer to each question is a **SINGLE DIGIT INTEGER** ranging from 0 to 9, both inclusive.
 * For each question, darken the bubble corresponding to the correct integer the ORS.

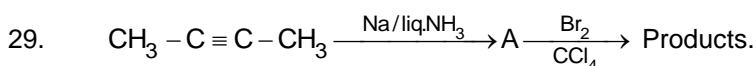
26.



If the degree of unsaturation in the product is Y . Then the value of $\frac{Y}{2} = ?$

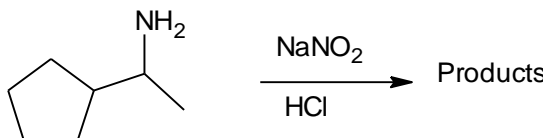
27. An aldehyde $\text{C}_{11}\text{H}_8\text{O}$ (A) which does not undergo self aldol-condensation gives benzaldehyde and two moles of (B) on ozonolysis. B on oxidation with silver ion gives oxalic acid. The number of sp^3 hybridised carbons in the compound 'A' is

28. The total no. of chlorine atoms present in one molecule of DDT (pesticide)



Total number of optically active isomers obtained in the product.

30.



If sum of total number of structural isomers and stereoisomers in the product is x. Then $\frac{x}{2}$ is

Space for rough work

SECTION 3 (Maximum Marks: 18)

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- * This section contains **TWO** tables (each having 3 columns and 4 rows)
- * Based on the table, there are **THREE** questions
- * Each question has **FOUR** options (A), (B), (C) and (D). **ONLY ONE** of these four options is correct.
- * For each question, darken the bubble corresponding to the correct option in the ORS.

	Column – I		Column – II		Column – III
(I)	S _N 1	(i)	(CH ₃) ₃ C–Br	(p)	Transition state is stabilized by π–p orbital conjugation
(II)	S _N 2	(ii)	(H ₃ C) ₃ C–CH ₂ Br	(q)	Carbocation rearrangement
(III)	E1	(iii)	H ₃ C–Br	(r)	Single step
(IV)	E2	(iv)	H ₂ C=CH–CH ₂ –Br	(s)	Weak base

31. The only **CORRECT** combination for substitution reaction is :
 (A) II (i) (r) (B) I (iii) (p) (C) II (iv) (p) (D) I (ii) (r)
32. The only **INCORRECT** combination for elimination reaction is
 (A) III (i) (s) (B) IV (i) (r) (C) III (ii) (q) (D) IV (ii) (s)
33. The only **CORRECT** combination for elimination reaction is
 (A) IV (iii) (r) (B) III (i) (s) (C) IV (ii) (q) (D) III (iv) (r)

Space for rough work

Answer Q.34, Q.35 and Q.36 by appropriately matching the information given in the three columns of the following table

Columns 1,2 and 3 contain starting materials, reaction conditions and type of reactions respectively.		
Column 1	Column 2	Column 3
(I) Toluene	(i) NaOH/Br ₂ (H ⁺)	(P) Condensation
(II) Acetophenone	(ii) Br ₂ /hν	(Q) Carboxylation
(III) Benzaldehyde	(iii) (CH ₃ CO) ₂ O/CH ₃ COOK (H ⁺ /H ₂ O)	(R) Substitution
(IV) Phenol	(iv) NaOH/CO ₂	(S) Haloform

34. The only CORRECT combination in which the reaction proceeds through radical mechanism is
 (A) (IV) (i) (Q) (B) (III) (ii) (P) (C) (II) (iii) (R) (D) (I) (ii) (R)
35. For the synthesis of benzoic acid, the only CORRECT combination is
 (A) (II) (i) (S) (B) (I) (iv) (Q) (C) (IV) (ii) (P) (D) (III) (iv) (R)
36. The only CORRECT combination that gives two different carboxylic acids is
 (A) (IV) (iii) (Q) (B) (II) (iv) (R) (C) (I) (i) (S) (D) (III) (iii) (P)

Space for rough work

PART III: MATHEMATICS

SECTION 1 (Maximum Marks: 28)

- * This section contains **SEVEN** questions.
 - * Each question has **FOUR** options (A), (B), (C) and (D). **ONE OR MORE THAN ONE** of these four options is(are) correct.
 - * For each question, darken the bubble(s) corresponding to all the correct option(s) in the ORS
 - * For example, if (A), (C) and (D) are all the correct options for a question, darkening all these three will get +4 marks; darkening only (A) and (D) will get +2 marks; and darkening (A) and (B) will get –2 marks, as a wrong option is also darkened.
-

37. The value of $\sum_{r=0}^{10} r {}^{10}C_r 3^r (-2)^{10-r}$ is
 (A) 20 (B) 10 (C) 300 (D) 30
38. If the quadratic equation $4x^2 - 2(a + c - 1)x + ac - b = 0$ ($a > b > c$)
 (A) both roots are greater than a (B) both roots are less than c
 (C) both roots lie between $\frac{c}{2}$ and $\frac{a}{2}$ (D) exactly one of the roots lie between $\frac{c}{2}$ and $\frac{a}{2}$
39. For the expansion $(x \sin p + x^{-1} \cos p)^{10}$, ($p \in \mathbb{R}$),
 (A) the greatest value of the term independent of x is $\frac{10!}{2^5 (5!)^2}$
 (B) the least value of sum of coefficient is zero
 (C) the greatest value of sum of coefficient is 32
 (D) the least value of the term independent of x occurs when $p = (2n + 1)\frac{\pi}{4}$, $n \in \mathbb{Z}$
40. Let S be the set of all non-zero real numbers α such that the quadratic equation $\alpha x^2 - x + \alpha = 0$ has two distinct real roots x_1 and x_2 satisfying the inequality $|x_1 - x_2| < 1$. Which of the following intervals is (are) a subset (s) of S ?
 (A) $\left(-\frac{1}{2}, -\frac{1}{\sqrt{5}}\right)$ (B) $\left(-\frac{1}{\sqrt{5}}, 0\right)$ (C) $\left(0, \frac{1}{\sqrt{5}}\right)$ (D) $\left(\frac{1}{\sqrt{5}}, \frac{1}{2}\right)$
-

Space for rough work

41. If the equations $4x^2 - x - 1 = 0$ and $3x^2 + (\lambda + \mu)x + \lambda - \mu = 0$ have a root common, then the rational values of λ and μ are
 (A) $\lambda = \frac{-3}{4}$ (B) $\lambda = 0$ (C) $\mu = \frac{3}{4}$ (D) $\mu = 0$
42. The circles $x^2 + y^2 + 2x + 4y - 20 = 0$ and $x^2 + y^2 + 6x - 8y + 10 = 0$
 (A) are such that the number of common tangents on them is 2
 (B) are orthogonal
 (C) are such that the length of their common tangent is $5\left(\frac{12}{5}\right)^{1/4}$
 (D) are such that length of their common chord is $5\sqrt{\frac{3}{2}}$
43. The equation of a circle of radius 1 touching the circles $x^2 + y^2 - 2|x| = 0$ is
 (A) $x^2 + y^2 + 2\sqrt{2}x + 1 = 0$ (B) $x^2 + y^2 - 2\sqrt{3}y + 2 = 0$
 (C) $x^2 + y^2 + 2\sqrt{3}y + 2 = 0$ (D) $x^2 + y^2 - 2\sqrt{2} + 1 = 0$

SECTION 2 (Maximum Marks: 15)

- * This section contains **FIVE** questions.
- * The answer to each question is a **SINGLE DIGIT INTEGER** ranging from 0 to 9, both inclusive.
- * For each question, darken the bubble corresponding to the correct integer the ORS.

44. If set of values of 'a' for which $f(x) = ax^2 - (3 + 2a)x + 6$, $a \neq 0$ is positive for exactly three distinct negative integral values of x is $(c, d]$, then the value of $(c^2 + 4|d|)$ is equal to
45. Suppose $a, b, c \in I$ such that greatest common divisor of $x^2 + ax + b$ and $x^2 + bx + c$ is $(x + 1)$ and the least common multiple of $x^2 + ax + b$ and $x^2 + bx + c$ is $(x^3 - 4x^2 + x + 6)$, then the value of $|a + b + c|$ is equal to

Space for rough work

46. $f: \mathbb{R} \rightarrow \mathbb{R}$, $f(x) = \frac{3x^2 + mx + n}{x^2 + 1}$. If the range of this function is $[-4, 3)$, then find the value of $|m + n|$ is
47. Sum of last three digits of the number $N = 7^{100} - 3^{100}$ is
48. If the circles $x^2 + y^2 + (3 + \sin \beta)x + (2 \cos \alpha)y = 0$ and $x^2 + y^2 + (2 \cos \alpha)x + 2cy = 0$ touch each other, then the maximum value of c is

SECTION 3 (Maximum Marks: 18)

- * This section contains **SIX** questions of matching type.
- * This section contains **TWO** tables (each having 3 columns and 4 rows)
- * Based on the table, there are **THREE** questions
- * Each question has **FOUR** options (A), (B), (C) and (D). **ONLY ONE** of these four options is correct.
- * For each question, darken the bubble corresponding to the correct option in the ORS.

49 – 51: By appropriately matching the information given in the three columns of the following table.

Column 1	Column 2	Column 3
(I) Sum of binomial coefficients of terms containing power of x more than x^{20} in $(1 + x)^{41}$	(i) is 2^{36}	(P) when divided by 3 leaves remainder 1
(II) Sum of binomial coefficients of rational terms in the expansion of $(1 + \sqrt{2})^{40}$	(ii) is 2^{39}	(Q) when divided by 3 leaves remainder 2
(III) If $\left(x + \frac{1}{x} + x^2 + \frac{1}{x^2}\right)^{21} = a_0x^{-42} + a_1x^{-41} + a_2x^{-40} + \dots + a_{84}x^{42}$, then $a_0 + a_2 + \dots + a_{84}$	(iii) is 2^{40}	(R) when divided by 7 leaves remainder 1
(IV) Sum of binomial coefficients in the expansion of $(1 + x)^{36}$	(iv) is 2^{41}	(S) when divided by 7 leaves remainder 4

49. Which of the following is the **CORRECT** combination ?
 (A) (I) (iii) (Q) (B) (II) (ii) (S) (C) (II) (ii) (R) (D) (IV) (i) (Q)
50. Which of the following options is **NOT CORRECT** combination ?
 (A) (I) (iii) (P) (B) (II) (ii) (Q) (C) (III) (iv) (Q) (D) (IV) (i) (S)
51. Which of the following options is **NOT** the **CORRECT** combination ?
 (A) (III) (iv) (S) (B) (IV) (i) (P) (C) (II) (iv) (P) (D) (IV) (i) (R)

Space for rough work

52 – 54: By observing column 1, column 2, column 3 establish the relation and answer to the questions below: Circle S_1 is touching the line $2x + 3y + 1 = 0$ at $(1, -1)$ and cutting orthogonally the circle S_2 having the segment joining $(0, 3)$ and $(-2, -1)$ as diameter.

Column 1	Column 2	Column 3
(I) Radius of the circle S_1 is $\frac{1}{4}\sqrt{117}$	(i) Normal to circle S_1 which goes through origin is $x - 2y = 0$	(P) Length of tangent drawn from origin to S_1 is $\sqrt{\frac{1}{2}}$
(II) Intercept of circle S_1 on x-axis is $\sqrt{23}$	(ii) Two tangents can be drawn from the point $(1, 1)$ to S_1	(Q) Chord $2x - 5y - 6 = 0$ of S_1 through $(3, 0)$ is farthest from the centre
(III) Intercept of circle S_1 on y-axis is $\sqrt{17}$	(iii) Equation of common chord of circles S_1 and S_2 is $14x + y - 7 = 0$	(R) The part of the circle S_1 does not lie in the third quadrant.
(IV) Centre of the circle lies in the first quadrant	(iv) The other end of diameter of circle S_1 through $(1, -1)$ is $\left(3, \frac{7}{2}\right)$	(S) Equation of tangent to S_1 having slope $-\frac{2}{3}$ is $4x + 6y - 35 = 0$

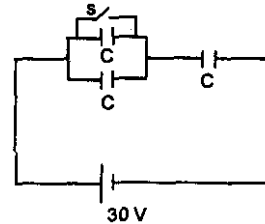
52. Which of the following is the only **CORRECT** combination ?
 (A) (I) (i) (S) (B) (II) (iii) (R) (C) (III) (i) (P) (D) (IV) (ii) (Q)
53. Which of the following is the only **INCORRECT** combination ?
 (A) (I) (iii) (P) (B) (II) (iii) (Q) (C) (IV) (ii) (R) (D) (I) (iii) (Q)
54. Which of the following options is the **INCORRECT** combination ?
 (A) (II) (iii) (P) (B) (I) (i) (Q) (C) (IV) (i) (R) (D) none of these

Space for rough work

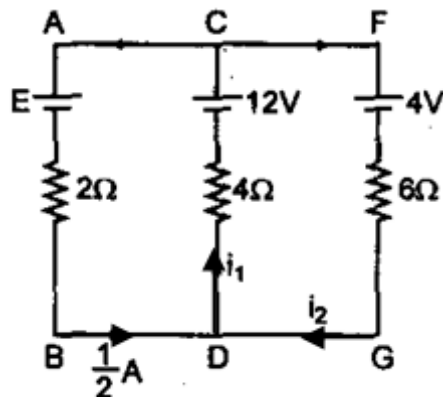
PAPER-I
PART I: PHYSICS
SECTION 1 (Maximum Marks: 28)

- * This section contains **SEVEN** questions.
- * Each question has **FOUR** options (A), (B), (C) and (D). **ONE OR MORE THAN ONE** of these four options is(are) correct.
- * For each question, darken the bubble(s) corresponding to all the correct option(s) in the ORS
- * For example, if (A), (C) and (D) are all the correct options for a question, darkening all these three will get +4 marks; darkening only (A) and (D) will get +2 marks; and darkening (A) and (B) will get -2 marks, as a wrong option is also darkened.

1. Three capacitors each having capacitance $C = 2\mu\text{F}$ are connected with a battery of emf 30 V as shown in figure. When the switch S is closed :



- (A) the amount of charge flow through the battery is $20\mu\text{C}$
 (B) the heat generated in the circuit is 0.6 mJ
 (C) the energy supplied by the battery is 0.6 mJ
 (D) the amount of charge flow through the switch S is $60\mu\text{C}$
2. In the circuit shown in figure:



- (A) $E = 6.6\text{V}$ (B) $i_1 = 1.1\text{ A}$ (C) $i_2 = 0.6\text{ A}$ (D) $E = 4.4\text{V}$

Space for rough work

3. A charge 'q' is undergoing S. H. M about point 'A' along the line AB at distance 'd' from the centre B of a conducting sphere of radius R. Amplitude of oscillation of charge is 'a' angular frequency is ω . The sphere is grounded through conducting wire CC'.

Choose the INCORRECT Statement (s)

- (B) If $a \ll d$ the maximum value of current in wire CC' will

be $q\omega \left(\frac{Ra}{d^2} \right)$

- (B) If $a \ll d$ the maximum value of current in wire CC' will

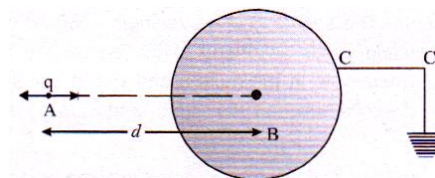
be $\left(\frac{q\omega Ra}{d^3} \right)$

- (C) If $a \ll d$ the maximum value of current in wire CC' will

be $q\omega \left(\frac{2Ra}{d^2} \right)$

- (D) If $a \ll d$ the maximum value of current in wire CC' will

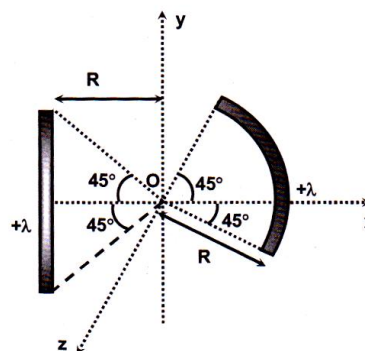
be $\left(\frac{2q\omega Ra^2}{d^3} \right)$



4. A rod having charge per unit length $\lambda = 2$ coulomb / meter lies parallel to y-axis and a quarter ring having same charge density lies in x-z plane as shown in the figure ($R = 2m$). Then

- (A) The magnitude of electric field due to the rod is more than the electric field due to the quarter ring at the point 'O'
 (B) The net electric field at point 'O' is zero
 (C) The magnitude of electric field due to the rod and due to the quarter ring at the point 'O' is same
 (D) The magnitude of electric field due to the ring at 'O' is

$$\frac{1}{2\sqrt{2} \pi \epsilon_0}$$



Space for rough work

5. A point charge $+Q$ is placed at a distance r from a dipole of dipole moment \vec{p} as shown in the figure. The line joining the point charge Q to the centre of dipole is perpendicular to the dipole moment. \vec{p} .

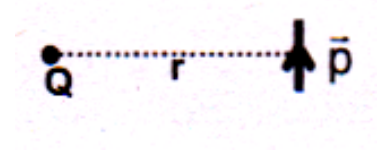
Which of the following statement (s) is/are true ?

(A) The net electrostatic force on the dipole is zero

(B) The electrostatic force on the dipole is $\frac{QP}{4\pi\epsilon_0 r^3}$ and is acting along the dipole moment \vec{p}

(C) Torque acting on the dipole is $\frac{QP}{4\pi\epsilon_0 r^2}$ in the inward direction

(D) Torque acting on the dipole is $\frac{QP}{2\pi\epsilon_0 r^2}$ in the inward direction



6. A positively charged thin metal ring of radius R is fixed in the xy plane, with its centre at the origin O . A negatively charged particle P is released from rest at the point $(0,0,z_0)$, where $z_0 > 0$. Then the motion of P is

(A) periodic, for all value of z_0 satisfying $0 < z_0 < \infty$

(B) simple harmonic, for all values of z_0 satisfying $0 < z_0 \leq R$

(C) approximately simple harmonic, provided $z_0 \ll R$

(D) Such that P crosses O and continues to move along the negative z - axis towards $z = -\infty$

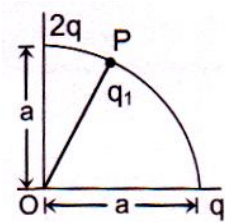
7. Two point charges q and $2q$ are placed at $(a, 0)$ and $(0, a)$. A point charge q_1 is placed at a point P on the quarter circle of radius a as shown in the diagram so that the electric field at the origin becomes zero.

(A) the point P is $\left(\frac{a}{\sqrt{3}}, \frac{\sqrt{2}a}{\sqrt{3}}\right)$

(B) the point $\left(\frac{a}{\sqrt{5}}, \frac{2a}{\sqrt{5}}\right)$

(C) $q_1 = -\sqrt{5}q$

(D) None of these

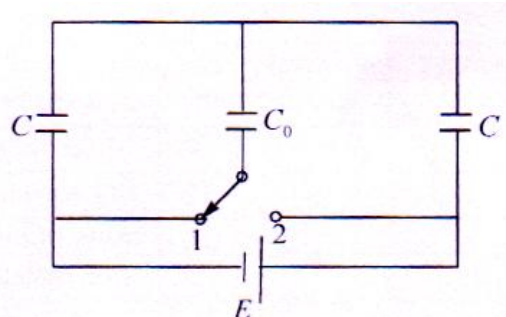


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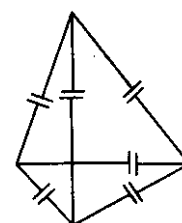
SECTION 2 (Maximum Marks: 15)

- * This section contains **FIVE** questions.
- * The answer to each question is a **SINGLE DIGIT INTEGER** ranging from 0 to 9, both inclusive.
- * For each question, darken the bubble corresponding to the correct integer the ORS.

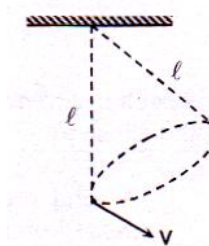
8. What amount of heat in micro joule will be generated in the circuit, after the switch is shifted from position 1 to position 2 ? ($C = C_0 = 2\mu\text{F}, E = \sqrt{6}\text{ V}$)



9. If the capacitance of each capacitor is C, then effective capacitance of the shown network across any two junctions is $\frac{mc}{n}$ then find mn

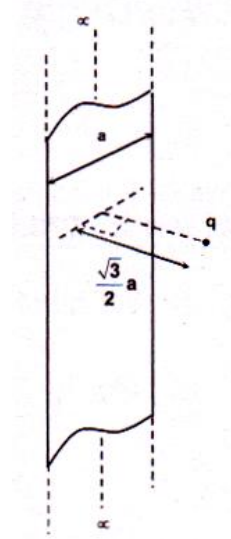


10. A positively charged particle of charge q and mass m is suspended from a point by a string of length ℓ . In the entire space a uniform horizontal electric field E exists. The particle is drawn aside so that string becomes vertical and then it is projected horizontally with velocity v such that particle starts to move along a circle with same constant speed v. If v equals $\frac{nqE}{3m} \sqrt{\frac{\ell}{g}}$, find the value of n.



Space for rough work

11. There is an infinite long straight surface having width 'a'. A point charge q is placed at a perpendicular distance $\frac{\sqrt{3}}{2}a$ from the surface symmetrically as shown in the figure. If the flux linked with this infinitely long surface due to charge q is $\frac{q}{k\epsilon_0}$. Then find the value of k.



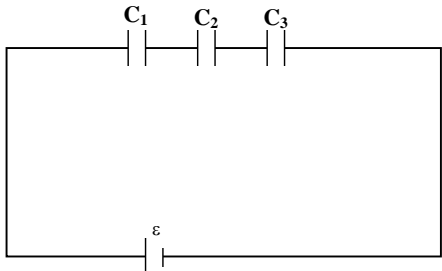
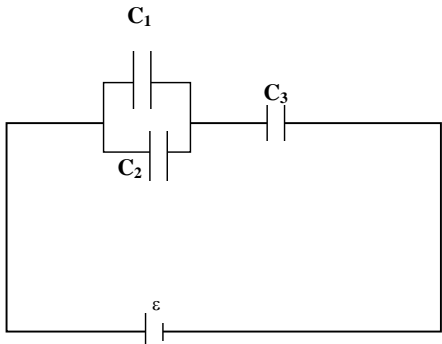
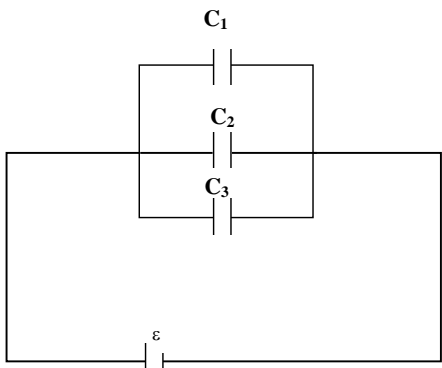

12. Four identical charges are fixed the corners of a square of side a. A fifth point charge $-Q$ lies a distance z along the line perpendicular to the plane of the square for $z \ll a$ the motion of $-Q$ is simple harmonic. The period of motion $T = 2\pi\sqrt{\frac{4\pi\epsilon_0 a^3 m}{4Qq2^x}}$, if the mass of $-Q$ is m (Neglect gravitational force). Then $2x = ?$

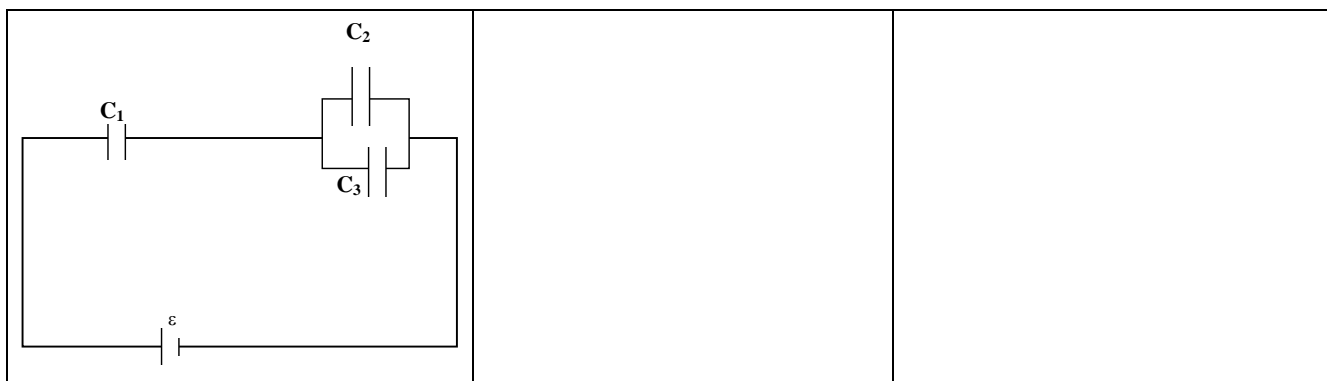
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SECTION 3 (Maximum Marks: 18)

- * This section contains **SIX** questions of matching type.
- * This section contains **TWO** tables (each having 3 columns and 4 rows)
- * Based on the table, there are **THREE** questions
- * Each question has **FOUR** options (A), (B), (C) and (D). **ONLY ONE** of these four options is correct.
- * For each question, darken the bubble corresponding to the correct option in the ORS.

In Column – 1 circuits with 3 capacitors is given
 In Column 2 individual capacitance and their breakdown Voltage are given
 In Column 3 (break down voltage) maximum possible value of ϵ for which all the capacitors work.

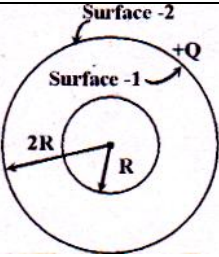
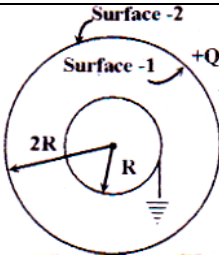
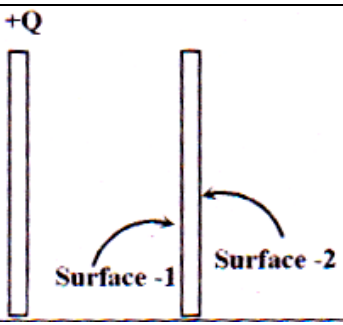
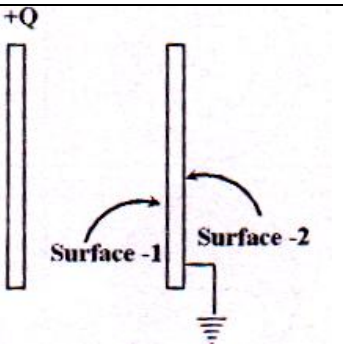
Column 1	Column 2	Column 3
(I) 	(i) $C_1 = C, V_1 = 2V$ $C_2 = 2C, V_2 = V$ $C_3 = 4C, V_3 = \frac{V}{2}$	(P) 7V
(II) 	(ii) $C_1 = 2C, V_1 = 2V$ $C_2 = C, V_2 = 3V$ $C_3 = \frac{C}{2}, V_3 = 4V$	(Q) 1 V
(III) 	(iii) $C_1 = C, V_1 = V$ $C_2 = 2C, V_2 = 2V$ $C_3 = 3C, V_3 = 3V$	(R) $\frac{14V}{3}$
(IV) 	(iv) $C_1 = 4C, V_1 = 2V$ $C_2 = 2C, V_2 = V$ $C_3 = C, V_3 = \frac{V}{2}$	(S) 9V



13. Which of the combinations is correct
 (A) I,ii,P (B) I, iii, P (C) I, i, P (D) I,iv,P
14. Which of the combination is correct
 (A) III, i, Q (B) III, ii,R (C) III, iii, Q (D) III, iv, P
15. Which of the following combination is correct
 (A) II,ii,R (B) I, iii, S (C) IV, iii, R (D) III, ii, R

Space for rough work

Figure shows total charge given to a conductor. Here, Column I represent arrangement of conductors
 Column 2 represent charge on surface – 1
 Column 3 represent charge on surface – 2

Column 1	Column 2	Column 3
(I) 	(i) +Q	(P) +Q
(II) 	(ii) Zero	(Q) -Q
(III) 	(iii) +Q/2	(R) +Q/2
(IV) 	(iv) -Q/2	(S) -Q/2

Space for rough work

16. For part (I) the correct combination is
 (A) I , i , P (B) I , ii , P (C) I , iii , R (D) I , iii , S
17. For part (II) the correct combination is
 (A) II , i , Q (B) II , iii , R (C) II , iii , S (D) II , i , R
18. For part (III) and (IV) the correct combination is
 (A) IV , iv , S (B) IV , iii , S (C) III , iv , R (D) III , iv , S

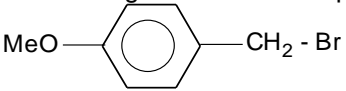
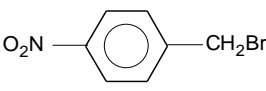
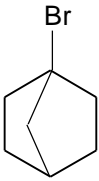
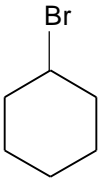
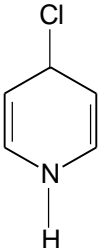
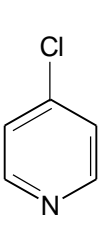
PART II: CHEMISTRY

SECTION 1 (Maximum Marks: 28)

- * This section contains **SEVEN** questions.
- * Each question has **FOUR** options (A), (B), (C) and (D). **ONE OR MORE THAN ONE** of these four options is(are) correct.
- * For each question, darken the bubble(s) corresponding to all the correct option(s) in the ORS
- * For example, if (A), (C) and (D) are all the correct options for a question, darkening all these three will get +4 marks; darkening only (A) and (D) will get +2 marks; and darkening (A) and (B) will get -2 marks, as a wrong option is also darkened.

19. In which of the following reactions Grignard reagent acting as a base.
 (A) $\text{CH}_3\text{MgCl} + \text{CH}_3\text{NH}_2 \rightarrow$ (B) $\text{C}_2\text{H}_5\text{MgBr} + \text{H}_2\text{S} \rightarrow$
 (C) $\text{PhMgCl} + \text{CH}_3\text{OH} \rightarrow$ (D) $\text{C}_2\text{H}_5\text{MgBr} + \text{PhCHO} \rightarrow$

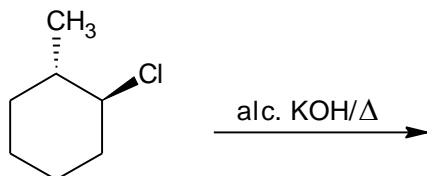
20. Consider the following statements and pick up the correct statements:

- (A)  will react more readily than  for $\text{S}_{\text{N}}1$ reaction
- (B)  will react more readily than  for $\text{S}_{\text{N}}1$ reaction
- (C)  will react more readily than  for $\text{S}_{\text{N}}1$ reaction
- (D) $\text{S}_{\text{N}}1$ reaction occurs in polar protic solvent

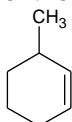
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21. There are three alcohols X, Y & Z, each with 2, 1 & 0 alpha hydrogen atoms respectively. Which of the alcohols will respond to Lucas Reagent Test at room temperature.
 (A) X (B) Y
 (C) Z (D) all would not respond to the test

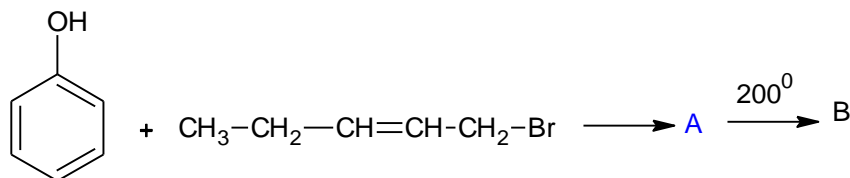
22.



Identify the correct statement regarding the equation



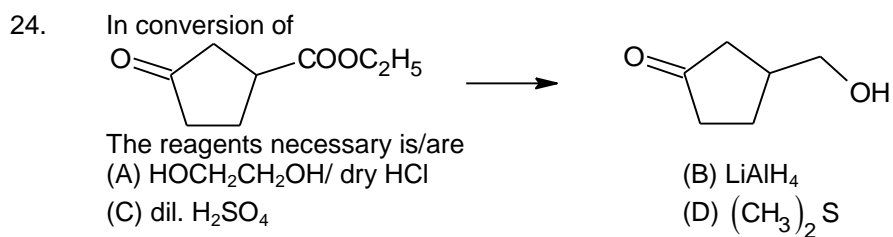
23.



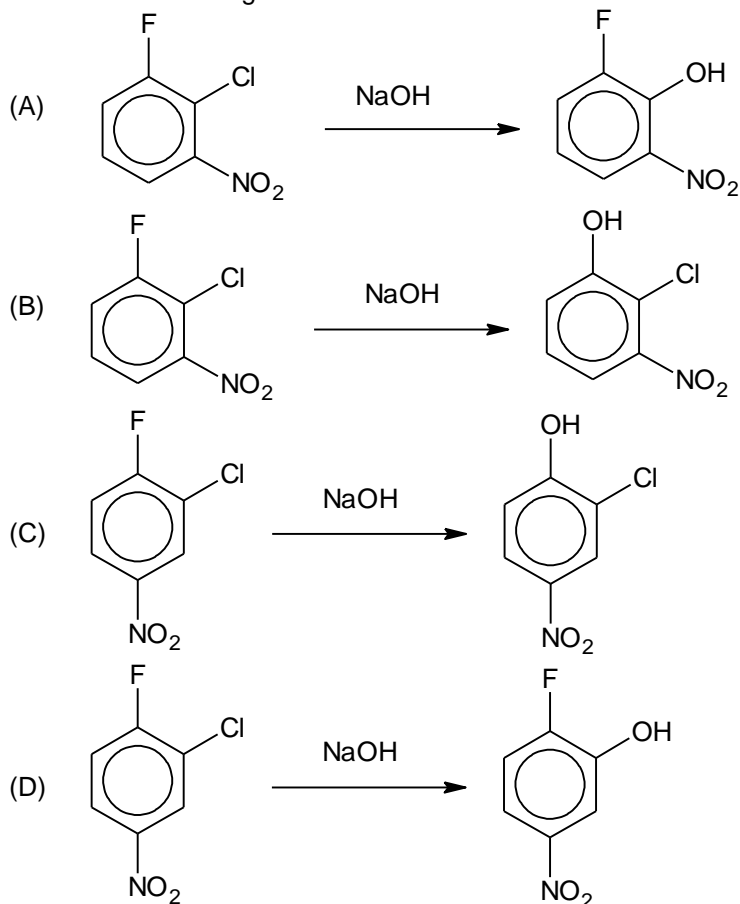
Identify the correct statement

- (A) Product A is substituted Phenol (B) Product B is functional isomer of A
 (C) Product A is Ether (D) Product B is ortho and para substituted Phenol

Space for rough work



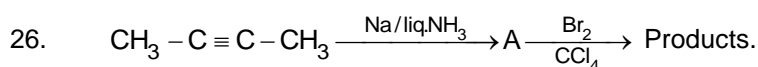
25. Which of the following reactions are correct



Space for rough work

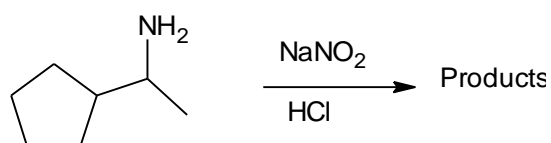
SECTION 2 (Maximum Marks: 15)

- * This section contains **FIVE** questions.
 * The answer to each question is a **SINGLE DIGIT INTEGER** ranging from 0 to 9, both inclusive.
 * For each question, darken the bubble corresponding to the correct integer the ORS.



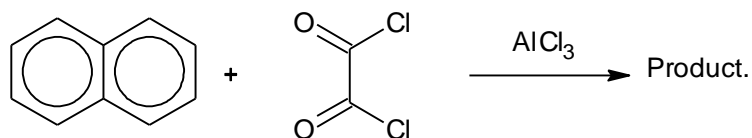
Total number of optically active isomers obtained in the product.

27.



If sum of total number of structural isomers and stereoisomers in the product is x. Then $\frac{x}{2}$ is

28.



If the degree of unsaturation in the product is Y . Then the value of $\frac{Y}{2} = ?$

29. An aldehyde $\text{C}_{11}\text{H}_8\text{O}$ (A) which does not undergo self aldol–condensation gives benzaldehyde and two moles of (B) on ozonolysis. B on oxidation with silver ion gives oxalic acid. The number of sp^3 hybridised carbons in the compound 'A' is
30. The total no. of chlorine atoms present in one molecule of DDT (pesticide)

Space for rough work

SECTION 3 (Maximum Marks: 18)

- * This section contains **SIX** questions of matching type.
- * This section contains **TWO** tables (each having 3 columns and 4 rows)
- * Based on the table, there are **THREE** questions
- * Each question has **FOUR** options (A), (B), (C) and (D). **ONLY ONE** of these four options is correct.
- * For each question, darken the bubble corresponding to the correct option in the ORS.

Answer Q.31, Q.32 and Q.33 by appropriately matching the information given in the three columns of the following table

Columns 1,2 and 3 contain starting materials, reaction conditions and type of reactions respectively.		
Column 1	Column 2	Column 3
(I) Toluene	(i) NaOH/Br ₂ (H ⁺)	(P) Condensation
(II) Acetophenone	(ii) Br ₂ /hν	(Q) Carboxylation
(III) Benzaldehyde	(iii) (CH ₃ CO) ₂ O/CH ₃ COOK (H ⁺ /H ₂ O)	(R) Substitution
(IV) Phenol	(iv) NaOH/CO ₂	(S) Haloform

31. The only CORRECT combination in which the reaction proceeds through radical mechanism is
 (A) (IV) (i) (Q) (B) (III) (ii) (P) (C) (II) (iii) (R) (D) (I) (ii) (R)
32. For the synthesis of benzoic acid, the only CORRECT combination is
 (A) (II) (i) (S) (B) (I) (iv) (Q) (C) (IV) (ii) (P) (D) (III) (iv) (R)
33. The only CORRECT combination that gives two different carboxylic acids is
 (A) (IV) (iii) (Q) (B) (II) (iv) (R) (C) (I) (i) (S) (D) (III) (iii) (P)

Space for rough work

	Column – I		Column – II		Column – III
(I)	S _N 1	(i)	(CH ₃) ₃ C–Br	(p)	Transition state is stabilized by π–p orbital conjugation
(II)	S _N 2	(ii)	(H ₃ C) ₃ C–CH ₂ Br	(q)	Carbocation rearrangement
(III)	E1	(iii)	H ₃ C–Br	(r)	Single step
(IV)	E2	(iv)	H ₂ C=CH–CH ₂ –Br	(s)	Weak base

34. The only CORRECT combination for substitution reaction is
 (A) II (i) (r) (B) I (iii) (p) (C) II (iv) (p) (D) I (ii) (r)
35. The only INCORRECT combination for elimination reaction is
 (A) III (i) (s) (B) IV (i) (r) (C) III (ii) (q) (D) IV (ii) (s)
36. The only CORRECT combination for elimination reaction is
 (A) IV (iii) (r) (B) III (i) (s) (C) IV (ii) (q) (D) III (iv) (r)

PART III: MATHEMATICS

SECTION 1 (Maximum Marks: 28)

- * This section contains **SEVEN** questions.
- * Each question has **FOUR** options (A), (B), (C) and (D). **ONE OR MORE THAN ONE** of these four options is(are) correct.
- * For each question, darken the bubble(s) corresponding to all the correct option(s) in the ORS
- * For example, if (A), (C) and (D) are all the correct options for a question, darkening all these three will get +4 marks; darkening only (A) and (D) will get +2 marks; and darkening (A) and (B) will get –2 marks, as a wrong option is also darkened.

37. If the equations $4x^2 - x - 1 = 0$ and $3x^2 + (\lambda + \mu)x + \lambda - \mu = 0$ have a root common, then the rational values of λ and μ are
 (A) $\lambda = \frac{-3}{4}$ (B) $\lambda = 0$ (C) $\mu = \frac{3}{4}$ (D) $\mu = 0$

Space for rough work

38. The circles $x^2 + y^2 + 2x + 4y - 20 = 0$ and $x^2 + y^2 + 6x - 8y + 10 = 0$
 (A) are such that the number of common tangents on them is 2
 (B) are orthogonal
 (C) are such that the length of their common tangent is $5\left(\frac{12}{5}\right)^{1/4}$
 (D) are such that length of their common chord is $5\sqrt{\frac{3}{2}}$
39. The equation of a circle of radius 1 touching the circles $x^2 + y^2 - 2|x| = 0$ is
 (A) $x^2 + y^2 + 2\sqrt{2}x + 1 = 0$ (B) $x^2 + y^2 - 2\sqrt{3}y + 2 = 0$
 (C) $x^2 + y^2 + 2\sqrt{3}y + 2 = 0$ (D) $x^2 + y^2 - 2\sqrt{2} + 1 = 0$
40. The value of $\sum_{r=0}^{10} r {}^{10}C_r 3^r (-2)^{10-r}$ is
 (A) 20 (B) 10 (C) 300 (D) 30
41. If the quadratic equation $4x^2 - 2(a + c - 1)x + ac - b = 0$ ($a > b > c$)
 (A) both roots are greater than a (B) both roots are less than c
 (C) both roots lie between $\frac{c}{2}$ and $\frac{a}{2}$ (D) exactly one of the roots lie between $\frac{c}{2}$ and $\frac{a}{2}$
42. For the expansion $(x \sin p + x^{-1} \cos p)^{10}$, ($p \in \mathbb{R}$),
 (A) the greatest value of the term independent of x is $\frac{10!}{2^5 (5!)^2}$
 (B) the least value of sum of coefficient is zero
 (C) the greatest value of sum of coefficient is 32
 (D) the least value of the term independent of x occurs when $p = (2n + 1)\frac{\pi}{4}$, $n \in \mathbb{Z}$
43. Let S be the set of all non-zero real numbers α such that the quadratic equation $\alpha x^2 - x + \alpha = 0$ has two distinct real roots x_1 and x_2 satisfying the inequality $|x_1 - x_2| < 1$. Which of the following intervals is (are) a subset (s) of S?
 (A) $\left(-\frac{1}{2}, -\frac{1}{\sqrt{5}}\right)$ (B) $\left(-\frac{1}{\sqrt{5}}, 0\right)$ (C) $\left(0, \frac{1}{\sqrt{5}}\right)$ (D) $\left(\frac{1}{\sqrt{5}}, \frac{1}{2}\right)$

Space for rough work

SECTION 2 (Maximum Marks: 15)

* This section contains **FIVE** questions.

* The answer to each question is a **SINGLE DIGIT INTEGER** ranging from 0 to 9, both inclusive.

* For each question, darken the bubble corresponding to the correct integer the ORS.

44. Sum of last three digits of the number $N = 7^{100} - 3^{100}$ is
45. If the circles $x^2 + y^2 + (3 + \sin \beta)x + (2 \cos \alpha)y = 0$ and $x^2 + y^2 + (2 \cos \alpha)x + 2cy = 0$ touch each other, then the maximum value of c is
46. If set of values of 'a' for which $f(x) = ax^2 - (3 + 2a)x + 6$, $a \neq 0$ is positive for exactly three distinct negative integral values of x is $(c, d]$, then the value of $(c^2 + 4|d|)$ is equal to
47. Suppose $a, b, c \in I$ such that greatest common divisor of $x^2 + ax + b$ and $x^2 + bx + c$ is $(x + 1)$ and the least common multiple of $x^2 + ax + b$ and $x^2 + bx + c$ is $(x^3 - 4x^2 + x + 6)$, then the value of $|a + b + c|$ is equal to
48. $f: R \rightarrow R$, $f(x) = \frac{3x^2 + mx + n}{x^2 + 1}$. If the range of this function is $[-4, 3)$, then find the value of $|m + n|$ is
-

Space for rough work

SECTION 3 (Maximum Marks: 18)

- * This section contains **SIX** questions of matching type.
- * This section contains **TWO** tables (each having 3 columns and 4 rows)
- * Based on the table, there are **THREE** questions
- * Each question has **FOUR** options (A), (B), (C) and (D). **ONLY ONE** of these four options is correct.
- * For each question, darken the bubble corresponding to the correct option in the ORS.

49 – 51: By observing column 1, column 2, column 3 establish the relation and answer to the questions below:
 Circle S_1 is touching the line $2x + 3y + 1 = 0$ at $(1, -1)$ and cutting orthogonally the circle S_2 having the segment joining $(0, 3)$ and $(-2, -1)$ as diameter.

Column 1	Column 2	Column 3
(I) Radius of the circle S_1 is $\frac{1}{4}\sqrt{117}$	(i) Normal to circle S_1 which goes through origin is $x - 2y = 0$	(P) Length of tangent drawn from origin to S_1 is $\sqrt{\frac{1}{2}}$
(II) Intercept of circle S_1 on x-axis is $\sqrt{23}$	(ii) Two tangents can be drawn from the point $(1, 1)$ to S_1	(Q) Chord $2x - 5y - 6 = 0$ of S_1 through $(3, 0)$ is farthest from the centre
(III) Intercept of circle S_1 on y-axis is $\sqrt{17}$	(iii) Equation of common chord of circles S_1 and S_2 is $14x + y - 7 = 0$	(R) The part of the circle S_1 does not lie in the third quadrant.
(IV) Centre of the circle lies in the first quadrant	(iv) The other end of diameter of circle S_1 through $(1, -1)$ is $\left(3, \frac{7}{2}\right)$	(S) Equation of tangent to S_1 having slope $-\frac{2}{3}$ is $4x + 6y - 35 = 0$

49. Which of the following is the only **CORRECT** combination ?
 (A) (I) (i) (S) (B) (II) (iii) (R) (C) (III) (i) (P) (D) (IV) (ii) (Q)
50. Which of the following is the only **INCORRECT** combination ?
 (A) (I) (iii) (P) (B) (II) (iii) (Q) (C) (IV) (ii) (R) (D) (I) (iii) (Q)
51. Which of the following options is the **INCORRECT** combination ?
 (A) (II) (iii) (P) (B) (I) (i) (Q) (C) (IV) (i) (R) (D) none of these

Space for rough work

52 – 54: By appropriately matching the information given in the three columns of the following table.

Column 1	Column 2	Column 3
(I) Sum of binomial coefficients of terms containing power of x more than x^{20} in $(1+x)^{41}$	(i) is 2^{36}	(P) when divided by 3 leaves remainder 1
(II) Sum of binomial coefficients of rational terms in the expansion of $(1+\sqrt{2})^{40}$	(ii) is 2^{39}	(Q) when divided by 3 leaves remainder 2
(III) If $\left(x + \frac{1}{x} + x^2 + \frac{1}{x^2}\right)^{21} = a_0x^{-42} + a_1x^{-41} + a_2x^{-40} + \dots + a_{84}x^{42}$, then $a_0 + a_2 + \dots + a_{84}$	(iii) is 2^{40}	(R) when divided by 7 leaves remainder 1
(IV) Sum of binomial coefficients in the expansion of $(1+x)^{36}$	(iv) is 2^{41}	(S) when divided by 7 leaves remainder 4

52. Which of the following is the **CORRECT** combination ?
 (A) (I) (iii) (Q) (B) (II) (ii) (S) (C) (II) (ii) (R) (D) (IV) (i) (Q)
53. Which of the following options is **NOT CORRECT** combination ?
 (A) (I) (iii) (P) (B) (II) (ii) (Q) (C) (III) (iv) (Q) (D) (IV) (i) (S)
54. Which of the following options is **NOT** the **CORRECT** combination ?
 (A) (III) (iv) (S) (B) (IV) (i) (P) (C) (II) (iv) (P) (D) (IV) (i) (R)

Space for rough work

FITJEE INTERNAL TEST

IIT – JEE 2019

PHASE – V_PAPER – I_SET-A

ANSWERS

PHYSICS

1. B,C,D	2. B,C	3. A,C	4. B,C
5. A,C,D	6. A,B,C	7. B,C,D	8. 3
9. 6	10. 3	11. 4	12. 2
13. B	14. B	15. C	16. A
17. C	18. A		

CHEMISTRY

19. A, B	20. B, C	21. A, B, C	22. A, C
23. A, B, C	24. A, C, D	25. B, C	26. 5
27. 0	28. 5	29. 0	30. 5
31. C	32. D	33. B	34. D
35. A	36. D		

MATHEMATICS

37. D	38. D	39. ABC	40. AD
41. AD	42. ABCD	43. BC	44. 4
45. 6	46. 4	47. 0	48. 1
49. C	50. D	51. C	52. B
53. C	54. D		

FIITJEE INTERNAL TEST

IIT – JEE 2019

PHASE – V_PAPER – I_SET-B

ANSWERS

PHYSICS

1.	A,C,D	2.	A,B,C	3.	B,C,D	4.	B,C,D
5.	B,C	6.	A,C	7.	B,C	8.	4
9.	2	10.	3	11.	6	12.	3
13.	A	14.	C	15.	A	16.	B
17.	B	18.	C				

CHEMISTRY

19.	A, B, C	20.	A, C, D	21.	B, C	22.	A, B
23.	B, C	24.	A, B, C	25.	A, C	26.	0
27.	5	28.	5	29.	0	30.	5
31.	D	32.	A	33.	D	34.	C
35.	D	36.	B				

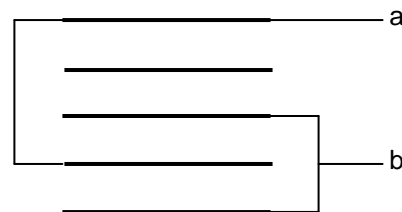
MATHEMATICS

37.	AD	38.	ABCD	39.	BC	40.	D
41.	D	42.	ABC	43.	AD	44.	0
45.	1	46.	4	47.	6	48.	4
49.	B	50.	C	51.	D	52.	C
53.	D	54.	C				

PAPER–I
PART I: PHYSICS
SECTION 1 (Maximum Marks: 28)

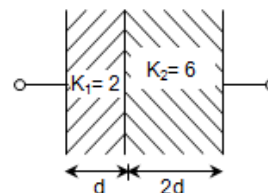
- * This section contains **SEVEN** questions.
- * Each question has **FOUR** options (A), (B), (C) and (D). **ONLY ONE** of these four options is correct.
- * For each question, darken the bubble corresponding to all the correct option in the ORS.

1. Five identical metal plates are placed at equal gap 'd' has cross section area A shown in figure. If the equivalent capacitance between a and b is $\frac{n\epsilon_0 A}{2d}$; find the value of n



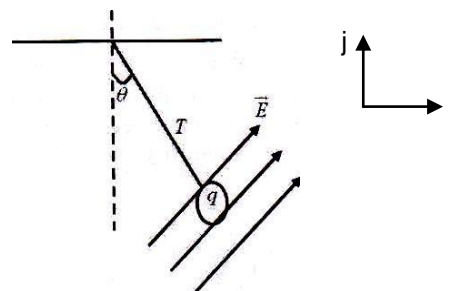
- (A) $\frac{5\epsilon_0 A}{2d}$ (B) $\frac{2\epsilon_0 A}{d}$ (C) $\frac{\epsilon_0 A}{2d}$ (D) $\frac{2\epsilon_0 A}{5d}$

2. A parallel plate capacitor has two layers of dielectrics as shown in figure. This capacitor is connected across a battery, then the ratio of potential difference across first and second the dielectric layers is



- (A) 1:3 (B) 3:1 (C) 2:3 (D) 3:2

3. A charged cork ball of mass 1g is suspended on a light string in the presence of a uniform electric field $\vec{E} = (3\hat{i} + 5\hat{j}) \times 10^5 \text{ NC}^{-1}$ so that the ball is in equilibrium at

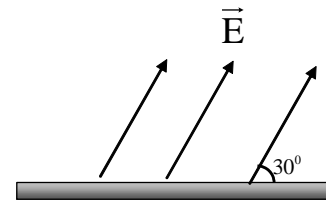


$\theta = 37^\circ$. If 'q' is charge on ball and T in tension is the string then ($g = 10\text{ms}^{-2}$)

- (A) $q = 10\text{nC}$ (B) $q = 12\text{nC}$
(C) $T = 5.55\text{mN}$ (D) $T = 4.55\text{mN}$

Space for rough work

4. In a region, a uniform electric field of intensity 15 N/C making an angle of 30° with the horizontal plane is present. A ball having charge of 2C, mass 3 kg and coefficient of restitution with ground 0.5 is projected at an angle of 30° with the horizontal in the direction of electric field with speed 20 m/s. If the horizontal distance travelled by ball between the instances of first and second collision is ($g = 10 \text{ ms}^{-2}$)



- (A) $70\sqrt{3}$ (B) $\frac{70}{\sqrt{3}}$ (C) $140\sqrt{3}$ (D) $\frac{140}{\sqrt{3}}$

5. An electric field given by $\vec{E} = 4\hat{i} - 3(y^2 + 2)\hat{j}$ pierces Gaussian cube of side 1m placed at origin such that its three sides represents x, y and z axes. The net charge enclosed within the cube is $n\epsilon_0$, then find the value of n?

- (A) ϵ_0 (B) $2\epsilon_0$ (C) $3\epsilon_0$ (D) $4\epsilon_0$

6. N identical drops of mercury have identical potential of 10 volts. They are combined to form one large drop, and the potential was found to be 40V, then N is?

- (A) 4 (B) 6 (C) 8 (D) 16

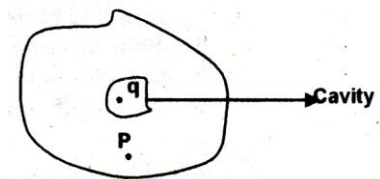
7. When a current I is set up in a wire of radius r, then drift velocity is V_d . If the same current is set up through a wire of same material, of radius 2r, then drift velocity will be

- (A) $\frac{V_d}{2}$ (B) $2V_d$ (C) $4V_d$ (D) $\frac{V_d}{4}$

SECTION 2 (Maximum Marks: 15)

- * This section contains **SEVEN** questions.
- * Each question has **FOUR** options (A), (B), (C) and (D). **ONE OR MORE THAN ONE** of these four options is(are) correct.
- * For each question, darken the bubble(s) corresponding to all the correct option(s) in the ORS.
- * For example, if (A), (C) and (D) are all the correct options for a question, darkening all these three will get +4 marks; darkening only (A) and (D) will get +2 marks; and darkening (A) and (B) will get -2 marks, as a wrong option is also darkened.

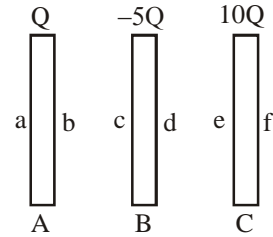
8. Inside an electrical conductor there is a cavity and a charge q is suspended fixed inside the cavity space without any electrical contact with conductor. Let E_1 be the electrostatic field due to charge q at P. E_2 be the electrostatic field at P due to induced charge on the inner surface of cavity. E_3 be the electrostatic field at P due to the induced charge on the outer surface of conductor then



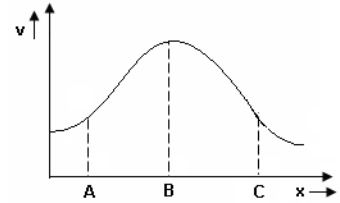
- (A) $\vec{E}_1 + \vec{E}_2 + \vec{E}_3 = 0$ (B) $\vec{E}_1 + \vec{E}_2 = 0$ (C) $\vec{E}_1 + \vec{E}_3 \neq 0$ (D) $\vec{E}_3 \neq 0$

Space for rough work

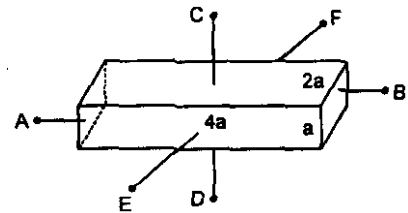
9. Three very large plates are given charges as shown in the figure. If the cross-sectional area of each plate is the same, then the final charge distribution on the surface of the plates a, b, c, d, e, f is
 (A) $7Q$ on surface e and $3Q$ on surface f
 (B) $-2Q$ on surface b and $3Q$ on surface a
 (C) $-7Q$ on surface d and $2Q$ on surface c
 (D) the magnitude of charges at surfaces b, c, d, e is equal



10. Variation of electrostatic potential along x-direction is shown in the graph. The correct statement about electric field strength is
 (A) x component at point B is maximum.
 (B) x component at point A is towards negative x-axis
 (C) x component at point C is along negative x-axis
 (D) x component at point C is along positive x-axis

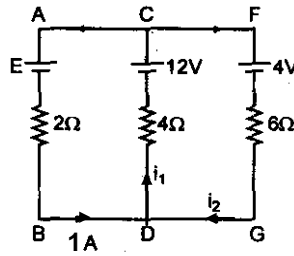


11. A conductor with rectangular cross section has dimensions $(a \times 2a \times 4a)$ as shown in figure. Then choose the correct statement:



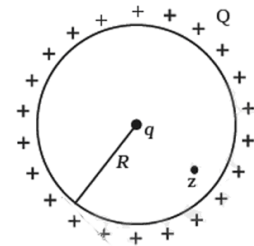
- (A) If a battery is to be connected across two opposite faces of the conductor then it must be connected across EF to get maximum current
 (B) If a battery is to be connected across two opposite faces of the conductor then it must be connected across CD to get maximum current
 (C) If a battery is to be connected across two opposite faces of the conductor then it must be connected across CD to get minimum current
 (D) If a battery is to be connected across two opposite faces of the conductor then it must be connected across AB to get minimum current

12. In the circuit shown in figure:
 (A) $E = 6.6 \text{ V}$ (B) $E = 4.4 \text{ V}$
 (C) $I_1 = 1.4 \text{ A}$ (D) $I_1 = 2.4 \text{ A}$



Space for rough work

13. A positive charge Q is uniformly distributed along a circular ring of radius R . A small test charge q is placed at the centre of the ring (Fig.). Then which of the following statements are correct



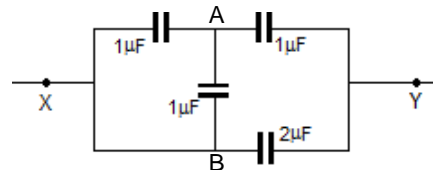
- (A) If $q > 0$ and is displaced away from the centre in the plane of the ring, it will be pushed back towards the centre.
 (B) If $q < 0$ and is displaced away from the centre in the plane of the ring, it will never return to the centre and will continue moving till it hits the ring.
 (C) If $q < 0$, it will perform SHM for small displacement along the axis of the ring.
 (D) q at the centre of the ring is in an unstable equilibrium within the plane of the ring for $q < 0$
14. A capacitor of capacitance C is connected to a battery V and charged. Then it is disconnected from the battery and reconnected in reverse polarity, i.e., the positive plate of the capacitor is connected to the negative terminal of the battery. Choose correct options:
 (A) The work done after by the battery after reconnection will be CV^2
 (B) The work done after by the battery after reconnection will be $2CV^2$
 (C) The change in energy stored in the capacitor after reconnection compared to energy stored before reconnection will be zero
 (D) the loss of energy after reconnection will be equal to $2CV^2$

SECTION 3 (Maximum Marks: 18)

- * This section contains **TWO** paragraphs.
- * Based on each paragraph, there are **TWO** questions.
- * Each question has **FOUR** options (A), (B), (C) and (D). **ONLY ONE** of these four options is correct.
- * For each question, darken the bubble corresponding to the correct option in the ORS.

Paragraph-1

The figure shows a circuit of four capacitors.



15. The effective capacitance between X and Y is
 (A) $\frac{5}{6} \mu\text{F}$ (B) $\frac{7}{6} \mu\text{F}$ (C) $\frac{5}{3} \mu\text{F}$ (D) $\frac{8}{3} \mu\text{F}$
16. The effective capacitance between A and B is
 (A) $\frac{5}{6} \mu\text{F}$ (B) $\frac{7}{6} \mu\text{F}$ (C) $\frac{5}{3} \mu\text{F}$ (D) $\frac{8}{3} \mu\text{F}$

Space for rough work

Paragraph–2

A spherically symmetric charge distribution is given by $\rho = \rho_0 \left(1 - \frac{r}{a}\right)$ when $r \leq a$
 $\rho = 0$

17. The electric field due to charge distribution is given by

$$(A) E = \begin{cases} \frac{\rho_0}{\epsilon_0 \pi} \left(\frac{r}{3} - \frac{r^2}{4a} \right), & 0 \leq r \leq a \\ \frac{\rho_0 a^3}{12\pi\epsilon_0 r^2}, & a < r \end{cases}$$

$$(B) E = \begin{cases} \frac{\rho_0 a^3}{12\epsilon_0 \pi r^2} \left(\frac{r}{3} - \frac{r^2}{4a} \right), & 0 \leq r \leq a \\ \frac{\rho_0}{\epsilon_0} \left(\frac{r}{3} - \frac{r^2}{4a} \right), & a < r \end{cases}$$

$$(C) E = \begin{cases} \frac{\rho_0}{\epsilon_0} \left(\frac{r}{3} - \frac{r^2}{4a} \right), & 0 \leq r \leq a \\ \frac{\rho_0 a^3}{12\epsilon_0 r^2}, & a < r \end{cases}$$

$$(D) \text{ None}$$

18. For what value of r is the field maximum

$$(A) r = \frac{a}{\sqrt{2}} \quad (B) r = \frac{a}{\sqrt{3}} \quad (C) r = \frac{2a}{\sqrt{3}} \quad (D) r = \frac{2a}{3}$$

Space for rough work

PART II: CHEMISTRY
SECTION 1 (Maximum Marks: 28)

* This section contains **SEVEN** questions.

* Each question has **FOUR** options (A), (B), (C) and (D). **ONLY ONE** of these four options is correct.

* For each question, darken the bubble corresponding to all the correct option in the ORS.

19. Silver Mirror test is given by which one of the following compounds ?

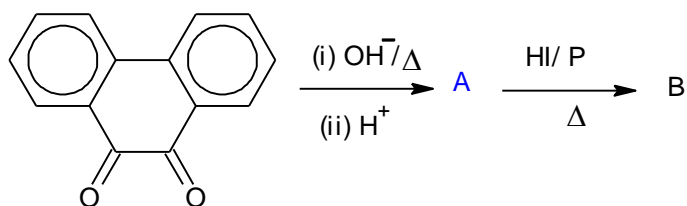
(A) Benzophenone

(B) Acetaldehyde

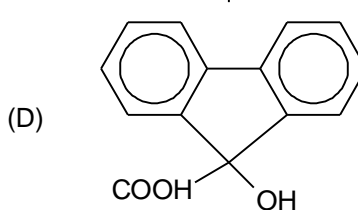
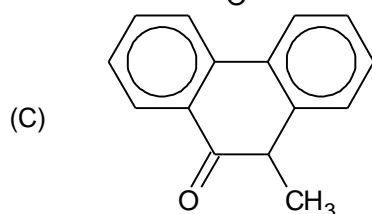
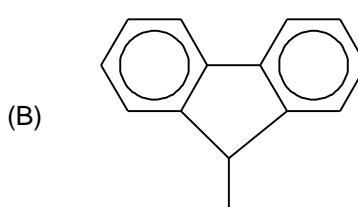
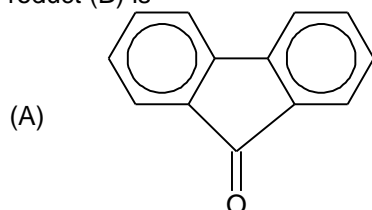
(C) Acetone

(D) Acetophenone

20.

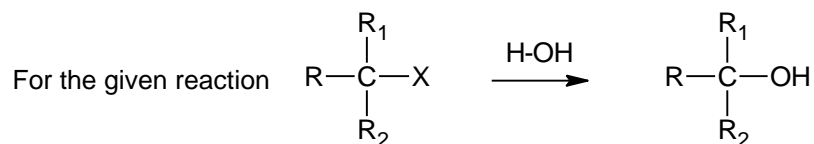


Product (B) is

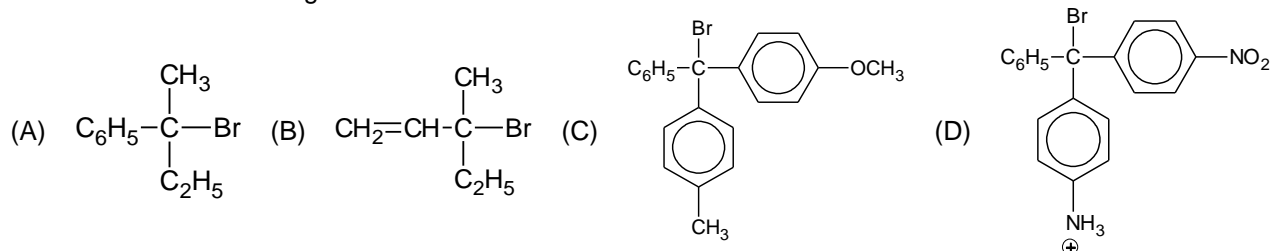


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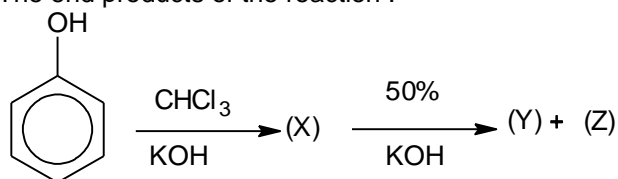
21.



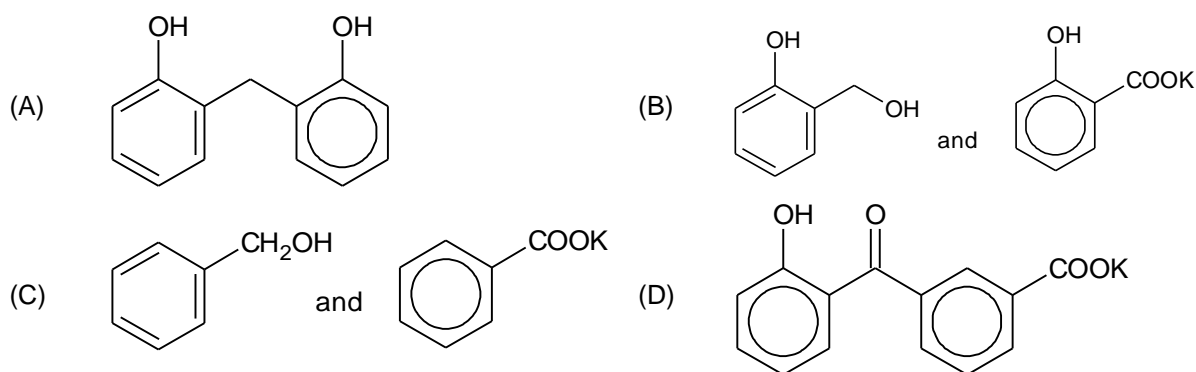
Which substrate will give maximum racemization ?



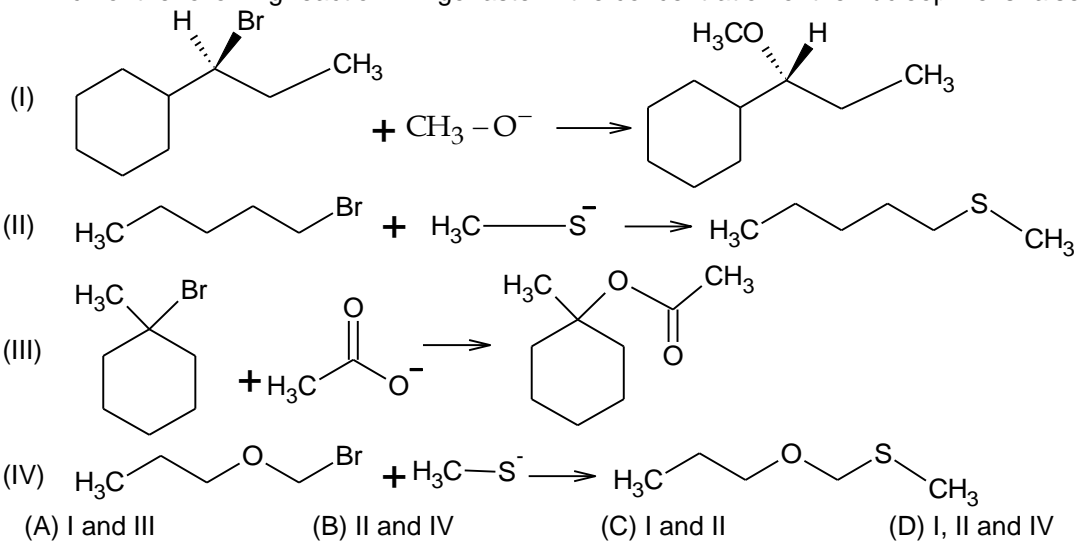
22. The end products of the reaction :



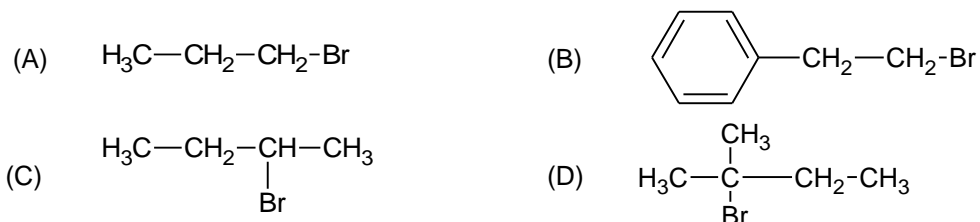
(Y) and (Z) are :

*Space for rough work*

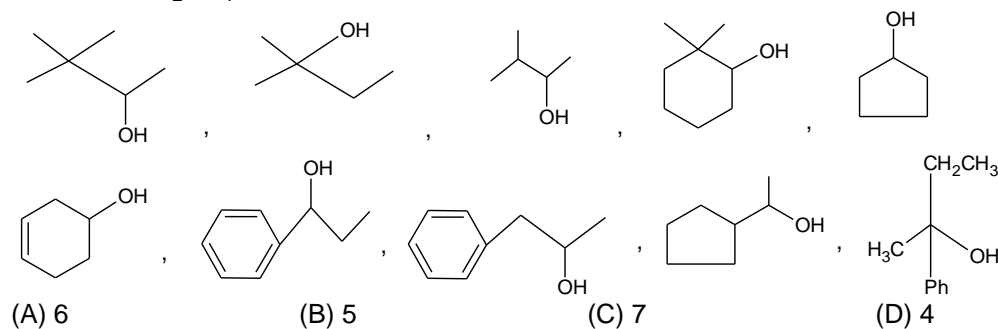
23. Which of the following reaction will go faster if the concentration of the nucleophile is raised?



24. Which of the following cannot give a precipitate when reacts with NaI in acetone?



25. Identify numbers of alcohols those will show rearrangement during dehydration with concentrate H_2SO_4 .

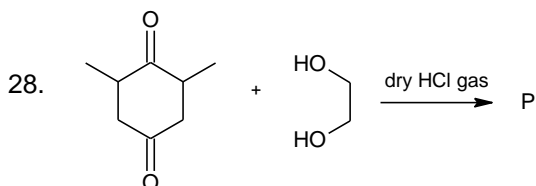
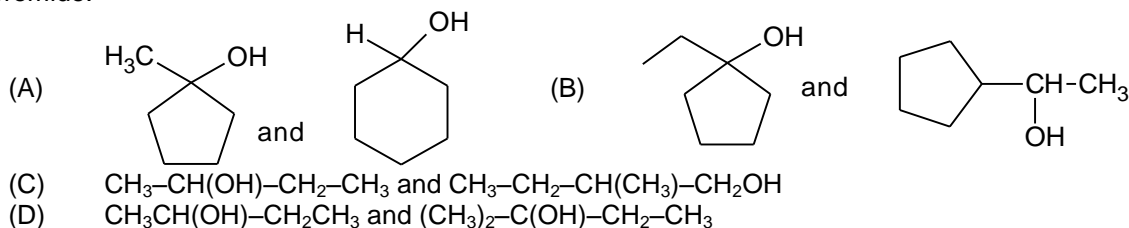


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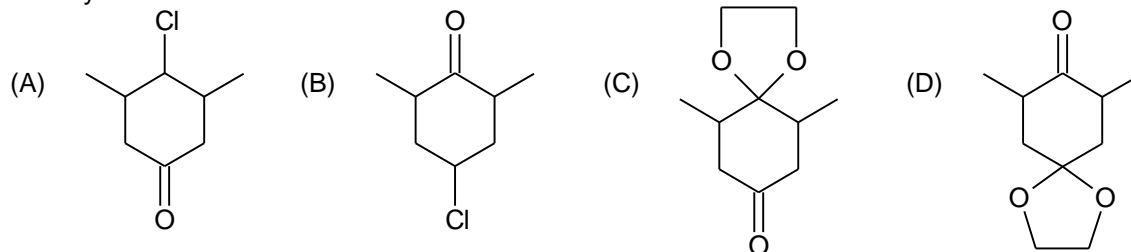
SECTION 2 (Maximum Marks: 15)

- * This section contains **SEVEN** questions.
- * Each question has **FOUR** options (A), (B), (C) and (D). **ONE OR MORE THAN ONE** of these four options is(are) correct.
- * For each question, darken the bubble(s) corresponding to all the correct option(s) in the ORS.
- * For example, if (A), (C) and (D) are all the correct options for a question, darkening all these three will get +4 marks; darkening only (A) and (D) will get +2 marks; and darkening (A) and (B) will get -2 marks, as a wrong option is also darkened.

26. Identify the correct statements
- (A) $(\text{CH}_3)_2\text{CH-O}^- > (\text{H}_3\text{C})_3\text{C-O}^-$ (Nucleophilicity)
- (B) $\text{C}_2\text{H}_5\text{O}^- > \text{OH}^-$ (Basic strength)
- (C) $\text{O}^-\text{Ts} > \text{O}^-\text{H}$ (leaving ability)
- (D) $(\text{CH}_3)_3\text{C-Br} > (\text{CH}_3)_2\text{CHBr}$ ($\text{S}_{\text{N}}1$ reactivity)
27. In the given pair of alcohol, in which pair second alcohol is less reactive than first towards hydrogen bromide.

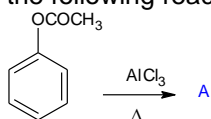


Identify the structure and structures "P" can not be



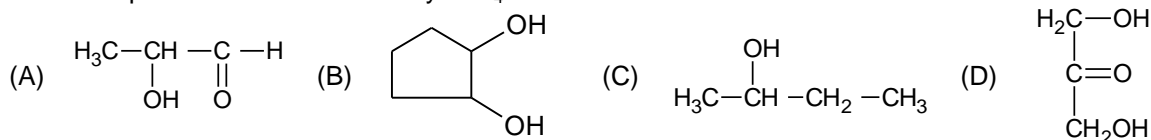
Space for rough work

29. See the following reaction.



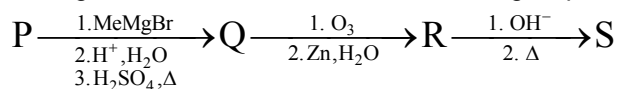
Correct statement regarding A

- (A) Contains phenolic $-\text{OH}$ group
 (B) Gives iodoform when treated with $\text{I}_2/\text{excess NaOH}$
 (C) Releases H_2 gas when treated with sodium
 (D) Consumes a maximum of 4 moles of hydrogen under catalytic conditions
30. Which compounds will be oxidized by HIO_4 ?

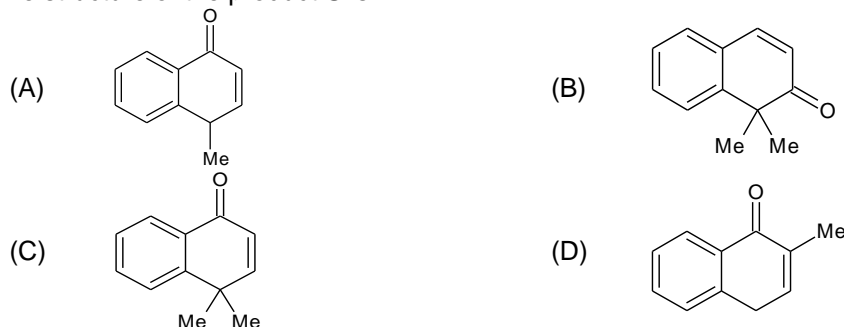


31. Lucas test of alcohols involve following reaction. $\text{R}-\text{OH} + \text{HCl}(\text{conc.}) \xrightarrow[\text{ZnCl}_2]{\text{Anhydrous}} \text{RCl} + \text{H}_2\text{O}$. Select the correct statements for Lucas test.
- (A) ROH behaves as a base
 (B) lesser is the acidic character of alcohol, greater is its reactivity towards Lucas reagent
 (C) reactions of 1° , 2° , 3° alcohols, lie in the sequence (for lucas reaction) $3^\circ > 2^\circ > 1^\circ$
 (D) 2-phenyl propan-2-ol gives Lucas test most quickly

32. A carbonyl compound P, which gives positive iodoform test, undergoes reaction with MeMgBr followed by dehydration to give an olefin Q. Ozonolysis of Q leads to a dicarbonyl compound R, which undergoes intramolecular aldol reaction to give predominantly S.



The structure of the product S is



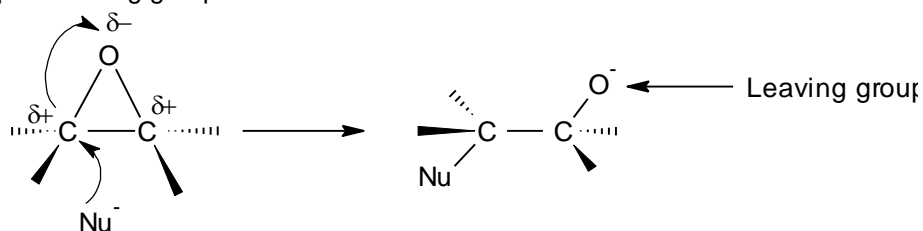
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SECTION 3 (Maximum Marks: 18)

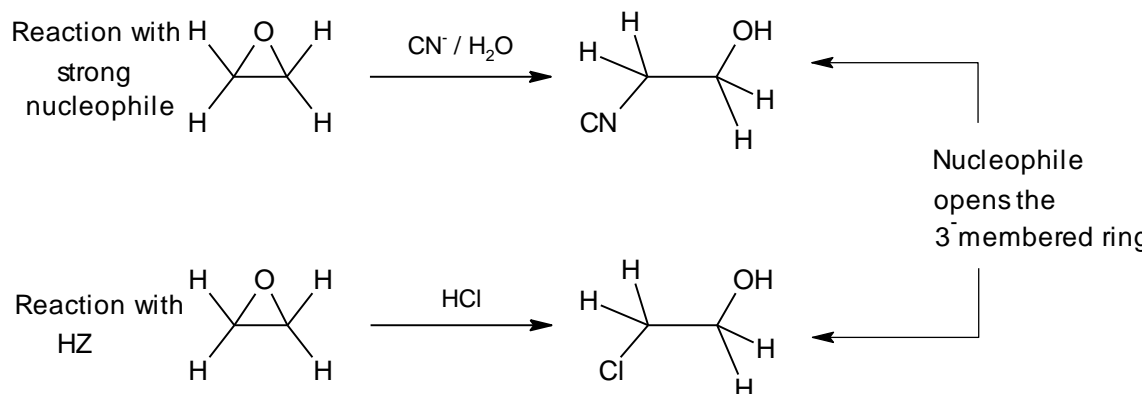
- * This section contains **TWO** paragraphs.
- * Based on each paragraph, there are **TWO** questions.
- * Each question has **FOUR** options (A), (B), (C) and (D). **ONLY ONE** of these four options is correct.
- * For each question, darken the bubble corresponding to the correct option in the ORS.

Paragraph-1

Although epoxides do not contain a good leaving group, they contain a strained three-membered ring with polar bonds. Nucleophilic attack opens the strained three-membered ring, making it favourable process even with the poor leaving group

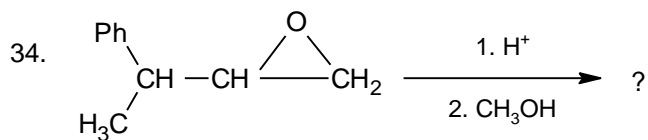
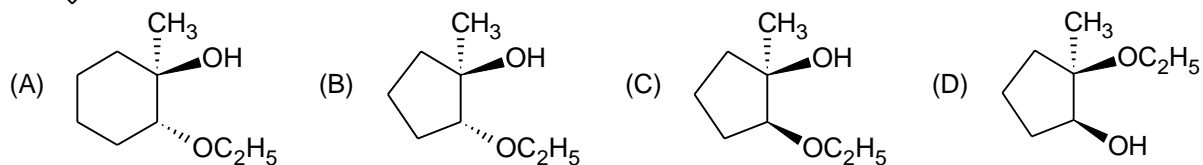
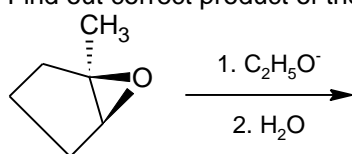


This reaction occurs readily with strong nucleophile, and with acids like HZ, where Z is nucleophilic atom.

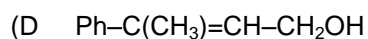
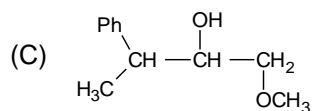
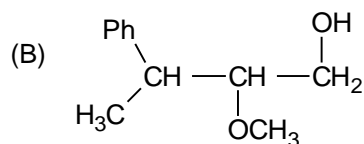
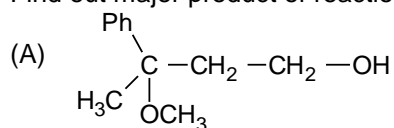


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33. Find out correct product of the reaction :



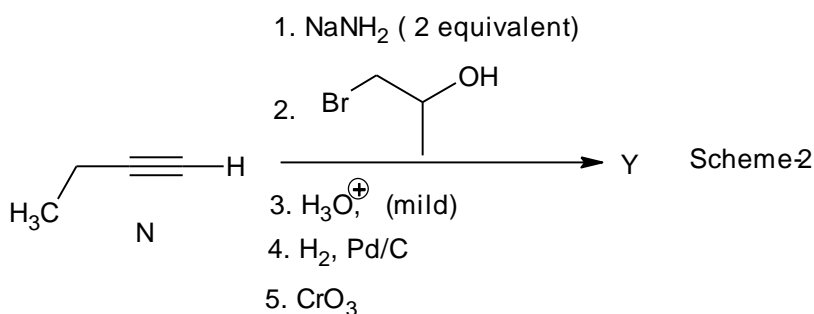
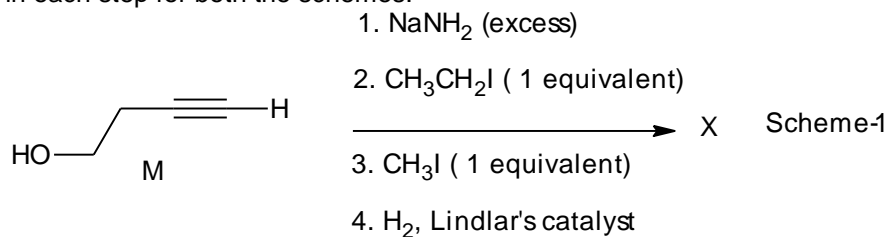
Find out major product of reaction :



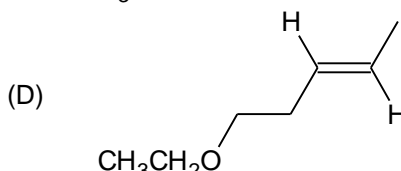
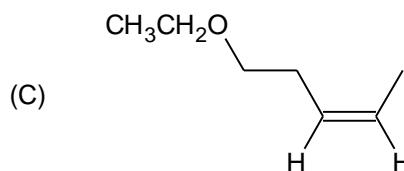
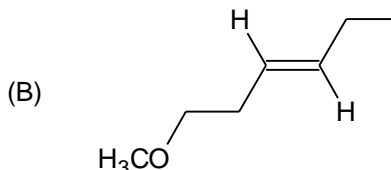
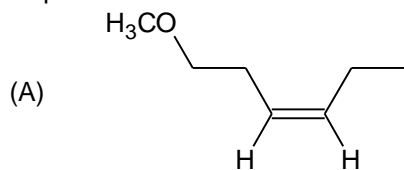
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Paragraph-2

Schemes 1 and 2 describe sequential transformation of alkynes M and N. Consider only the major products formed in each step for both the schemes.



35. The product X is



36. The correct statement with respect to product Y is

- (A) It gives a positive Tollens test and is a functional isomer of X.
 (B) It gives a positive Tollens test and is a geometrical isomer of X.
 (C) It gives a positive iodoform test and is a functional isomer of X.
 (D) It gives a positive iodoform test and is a geometrical isomer of X.

Space for rough work

PART III: MATHEMATICS

SECTION 1 (Maximum Marks: 28)

* This section contains **SEVEN** questions.

* Each question has **FOUR** options (A), (B), (C) and (D). **ONLY ONE** of these four options is correct.

* For each question, darken the bubble corresponding to all the correct option in the ORS.

37. $P(x)$ is a polynomial with integral coefficients such that for four distinct integers a, b, c, d ; $P(a) = P(b) = P(c) = P(d) = 3$. If $P(e) = 5$ (e is an integer), then
 (A) $e = 1$ (B) $e = 3$ (C) $e = 4$ (D) no real value of e
38. The number of positive integral solutions of $x^4 - y^4 = 3789108$ is
 (A) 0 (B) 1 (C) 2 (D) 4
39. The sum of series ${}^{20}C_0 - {}^{20}C_1 + {}^{20}C_2 - {}^{20}C_3 + \dots + {}^{20}C_{10}$ is
 (A) $\frac{1}{2} {}^{20}C_{10}$ (B) 0 (C) ${}^{20}C_{10}$ (D) $-{}^{20}C_{10}$
40. If $(1 - x^2)^n = \sum_{r=0}^n a_r x^r (1 - x)^{2n-r}$, then a_r is equal to
 (A) ${}^n C_r$ (B) ${}^n C_r 3^r$ (C) ${}^{2n} C_r$ (D) ${}^n C_r 2^r$
41. Three equal circles each of radius r touch one another. The radius of the circle touching all the three given circles internally is
 (A) $(2 + \sqrt{3})r$ (B) $\frac{(2 + \sqrt{3})}{\sqrt{3}}r$ (C) $\frac{(2 - \sqrt{3})}{\sqrt{3}}r$ (D) $(2 - \sqrt{3})r$
42. The equation of the circumcircle of an equilateral triangle is $x^2 + y^2 + 2gx + 2fy + c = 0$ and one vertex of the triangle is $(1, 1)$. The equation of the incircle of the triangle is
 (A) $4(x^2 + y^2) = g^2 + f^2$
 (B) $4(x^2 + y^2) + 8gx + 8fy = (1 - g)(1 + 3g) + (1 - f)(1 + 3f)$
 (C) $4(x^2 + y^2) + 8gx + 8fy = g^2 + f^2$
 (D) none of these
43. Two circles of radii a and b touching each other externally, are inscribed in the area bounded by $y = \sqrt{1 - x^2}$ and the x -axis. If $b = \frac{1}{2}$, then a is equal to
 (A) $\frac{1}{4}$ (B) $\frac{1}{8}$ (C) $\frac{1}{2}$ (D) $\frac{1}{\sqrt{2}}$

Space for rough work

SECTION 2 (Maximum Marks: 15)

- * This section contains **SEVEN** questions.
 * Each question has **FOUR** options (A), (B), (C) and (D). **ONE OR MORE THAN ONE** of these four options is(are) correct.
 * For each question, darken the bubble(s) corresponding to all the correct option(s) in the ORS.
 * For example, if (A), (C) and (D) are all the correct options for a question, darkening all these three will get +4 marks; darkening only (A) and (D) will get +2 marks; and darkening (A) and (B) will get –2 marks, as a wrong option is also darkened.

44. If $\cos^4\theta + \alpha$, $\sin^4\theta + \alpha$ are the roots of the equation $x^2 + 2bx + b = 0$ and $\cos^2\theta + \beta$, $\sin^2\theta + \beta$ are the roots of the equation $x^2 + 4x + 2 = 0$, then values of b are
 (A) 2 (B) –1 (C) –2 (D) 1
45. For the quadratic equation $x^2 + 2(a + 1)x + 9a - 5 = 0$, which of the following is/are true ?
 (A) If $2 < a < 5$, then roots are of opposite sign (B) If $a < 0$, then roots are of opposite sign
 (C) If $a > 7$, then both roots are negative (D) If $2 \leq a \leq 5$, then roots are unreal
46. If $(1 + x)^n = C_0 + C_1x + C_2x^2 + \dots + C_n x^n$, then $C_0 - (C_0 + C_1) + (C_0 + C_1 + C_2) - (C_0 + C_1 + C_2 + C_3) + \dots - (-1)^{n-1} (C_0 + C_1 + \dots + C_{n-1})$, where n is even integer is
 (A) a positive value (B) a negative value (C) divisible by 2^{n-1} (D) divisible by 2^n
47. $(n + 2)^n C_0 2^{n+1} - (n + 1)^n C_1 2^n + n^n C_2 2^{n-1} - \dots$ is equal to
 (A) 4 (B) 4n (C) $4(n + 1)$ (D) $2(n + 2)$
48. The last two digits of the number $(23)^{14}$ are
 (A) 01 (B) 03 (C) 09 (D) none of these
49. Let $(1 + x^2)^2 (1 + x)^n = \sum_{k=0}^{n+4} a_k x^k$. If a_1 , a_2 and a_3 are in arithmetic progression, then the possible value / values of n is/are
 (A) 5 (B) 4 (C) 3 (D) 2
50. A circle S passes through the point (0, 1) and is orthogonal to the circles $(x - 1)^2 + y^2 = 16$ and $x^2 + y^2 = 1$. Then
 (A) radius of S is 8 (B) radius of S is 7
 (C) centre of S is (–7, 1) (D) centre of S is (–8, 1)

Space for rough work

SECTION 3 (Maximum Marks: 18)

- * This section contains **TWO** paragraphs.
- * Based on each paragraph, there are **TWO** questions.
- * Each question has **FOUR** options (A), (B), (C) and (D). **ONLY ONE** of these four options is correct.
- * For each question, darken the bubble corresponding to the correct option in the ORS.

Paragraph-1

Consider the equation $x^2 + x + a - 9 < 0$

51. The value of the real parameter 'a' so that the given inequation has at least one positive solution:

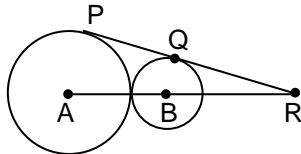
(A) $\left(-\infty, \frac{37}{4}\right)$ (B) $(-\infty, \infty)$ (C) $(3, \infty)$ (D) $(-\infty, 9)$

52. The values of the real parameter 'a' so that the given inequation has at least one negative solution:

(A) $(-\infty, 9)$ (B) $\left(\frac{37}{4}, \infty\right)$ (C) $\left(-\infty, \frac{37}{4}\right)$ (D) none of these

Paragraph-2

In the given figure, there are two circles with centres A and B. The common tangent to the circles touches them, respectively, at P and Q. AR is 40cm and AB is divided by the point of contact of the circles in the ratio 5 : 3.



53. What is ratio of the length of AB to that of BR ?
 (A) 1 : 4 (B) 2 : 3 (C) 2 : 5 (D) 7 : 4
54. The radius of the circle with centre B is
 (A) 10cm (B) 3cm (C) 6cm (D) 8cm

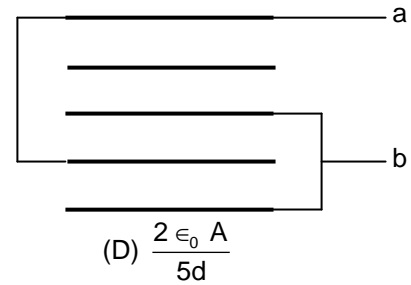
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PAPER-I
PART I: PHYSICS
SECTION 1 (Maximum Marks: 28)

- * This section contains **SEVEN** questions.
* Each question has **FOUR** options (A), (B), (C) and (D). **ONLY ONE** of these four options is correct.
* For each question, darken the bubble corresponding to all the correct option in the ORS.

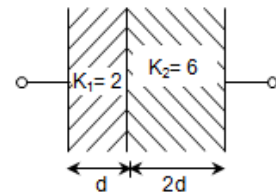
1. An electric field given by $\vec{E} = 4\hat{i} - 3(y^2 + 2)\hat{j}$ pierces Gaussian cube of side 1m placed at origin such that its three sides represents x, y and z axes. The net charge enclosed within the cube is $n\epsilon_0$, then find the value of n?
(A) ϵ_0 (B) $2\epsilon_0$ (C) $3\epsilon_0$ (D) $4\epsilon_0$
2. N identical drops of mercury have identical potential of 10 volts. They are combined to form one large drop, and the potential was found to be 40V, then N is?
(A) 4 (B) 6 (C) 8 (D) 16
3. When a current I is set up in a wire of radius r, then drift velocity is V_d . If the same current is set up through a wire of same material, of radius 2r, then drift velocity will be
(A) $\frac{V_d}{2}$ (B) $2V_d$ (C) $4V_d$ (D) $\frac{V_d}{4}$

4. Five identical metal plates are placed at equal gap 'd' has cross section area A shown in figure. If the equivalent capacitance between a and b is $\frac{n\epsilon_0 A}{2d}$; find the value of n



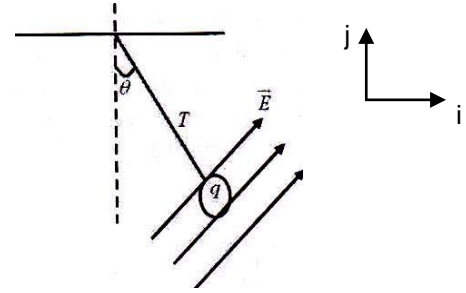
- (A) $\frac{5\epsilon_0 A}{2d}$ (B) $\frac{2\epsilon_0 A}{d}$ (C) $\frac{\epsilon_0 A}{2d}$ (D) $\frac{2\epsilon_0 A}{5d}$

5. A parallel plate capacitor has two layers of dielectrics as shown in figure. This capacitor is connected across a battery, then the ratio of potential difference across first and second the dielectric layers is
(A) 1:3 (B) 3:1 (C) 2:3 (D) 3:2

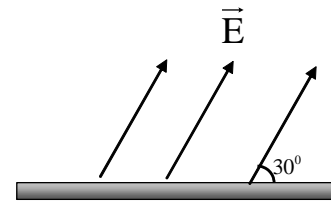


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6. A charged cork ball of mass 1g is suspended on a light string in the presence of a uniform electric field $\vec{E} = (3\hat{i} + 5\hat{j}) \times 10^5 \text{ NC}^{-1}$ so that the ball is in equilibrium at $\theta = 37^\circ$. If 'q' is charge on ball and T in tension is the string then ($g = 10\text{ms}^{-2}$)
- (A) $q = 10\text{nC}$ (B) $q = 12\text{nC}$
 (C) $T = 5.55\text{mN}$ (D) $T = 4.55\text{mN}$



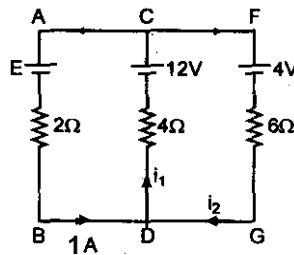
7. In a region, a uniform electric field of intensity 15 N/C making an angle of 30° with the horizontal plane is present. A ball having charge of 2C, mass 3 kg and coefficient of restitution with ground 0.5 is projected at an angle of 30° with the horizontal in the direction of electric field with speed 20 m/s. If the horizontal distance travelled by ball between the instances of first and second collision is ($g = 10 \text{ ms}^{-2}$)
- (A) $70\sqrt{3}$ (B) $\frac{70}{\sqrt{3}}$ (C) $140\sqrt{3}$ (D) $\frac{140}{\sqrt{3}}$



SECTION 2 (Maximum Marks: 15)

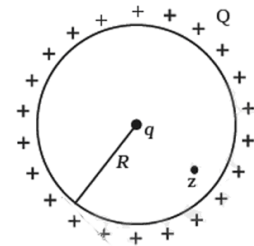
- * This section contains **SEVEN** questions.
- * Each question has **FOUR** options (A), (B), (C) and (D). **ONE OR MORE THAN ONE** of these four options is(are) correct.
- * For each question, darken the bubble(s) corresponding to all the correct option(s) in the ORS.
- * For example, if (A), (C) and (D) are all the correct options for a question, darkening all these three will get +4 marks; darkening only (A) and (D) will get +2 marks; and darkening (A) and (B) will get -2 marks, as a wrong option is also darkened.

8. In the circuit shown in figure:
- (A) $E = 6.6 \text{ V}$ (B) $E = 4.4 \text{ V}$
 (C) $I_1 = 1.4 \text{ A}$ (D) $I_1 = 2.4 \text{ A}$



Space for rough work

9. A positive charge Q is uniformly distributed along a circular ring of radius R . A small test charge q is placed at the centre of the ring (Fig.). Then which of the following statements are correct

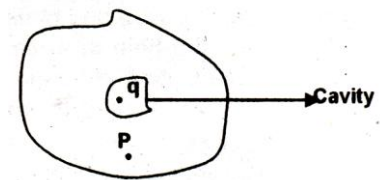


- (A) If $q > 0$ and is displaced away from the centre in the plane of the ring, it will be pushed back towards the centre.
 (B) If $q < 0$ and is displaced away from the centre in the plane of the ring, it will never return to the centre and will continue moving till it hits the ring.
 (C) If $q < 0$, it will perform SHM for small displacement along the axis of the ring.
 (D) q at the centre of the ring is in an unstable equilibrium within the plane of the ring for $q < 0$

10. A capacitor of capacitance C is connected to a battery V and charged. Then it is disconnected from the battery and reconnected in reverse polarity, i.e., the positive plate of the capacitor is connected to the negative terminal of the battery. Choose correct options:

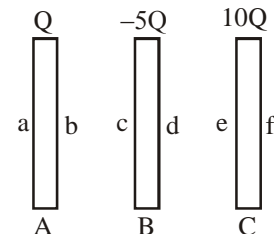
- (A) The work done after by the battery after reconnection will be CV^2
 (B) The work done after by the battery after reconnection will be $2CV^2$
 (C) The change in energy stored in the capacitor after reconnection compared to energy stored before reconnection will be zero
 (D) the loss of energy after reconnection will be equal to $2CV^2$

11. Inside an electrical conductor there is a cavity and a charge q is suspended fixed inside the cavity space without any electrical contact with conductor. Let E_1 be the electrostatic field due to charge q at P . E_2 be the electrostatic field at P due to induced charge on the inner surface of cavity. E_3 be the electrostatic field at P due the induced charge on the outer surface of conductor then



- (A) $\vec{E}_1 + \vec{E}_2 + \vec{E}_3 = 0$ (B) $\vec{E}_1 + \vec{E}_2 = 0$ (C) $\vec{E}_1 + \vec{E}_3 \neq 0$ (D) $\vec{E}_3 \neq 0$

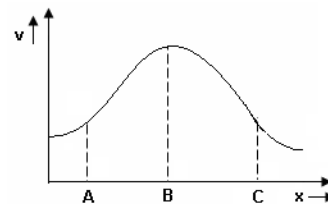
12. Three very large plates are given charges as shown in the figure. If the cross-sectional area of each plate is the same, then the final charge distribution on the surface of the plates a, b, c, d, e, f is



- (A) $7Q$ on surface e and $3Q$ on surface f
 (B) $-2Q$ on surface b and $3Q$ on surface a
 (C) $-7Q$ on surface d and $2Q$ on surface c
 (D) the magnitude of charges at surfaces b, c, d, e is equal

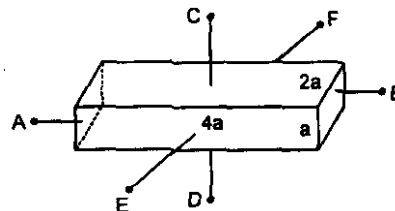
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13. Variation of electrostatic potential along x-direction is shown in the graph. The correct statement about electric field strength is



- (A) x component at point B is maximum.
- (B) x component at point A is towards negative x-axis
- (C) x component at point C is along negative x-axis
- (D) x component at point C is along positive x-axis

14. A conductor with rectangular cross section has dimensions ($a \times 2a \times 4a$) as shown in figure. Then choose the correct statement:



- (A) If a battery is to be connected across two opposite faces of the conductor then it must be connected across EF to get maximum current
- (B) If a battery is to be connected across two opposite faces of the conductor then it must be connected across CD to get maximum current
- (C) If a battery is to be connected across two opposite faces of the conductor then it must be connected across CD to get minimum current
- (D) If a battery is to be connected across two opposite faces of the conductor then it must be connected across AB to get minimum current

SECTION 3 (Maximum Marks: 18)

- * This section contains **TWO** paragraphs.
- * Based on each paragraph, there are **TWO** questions.
- * Each question has **FOUR** options (A), (B), (C) and (D). **ONLY ONE** of these four options is correct.
- * For each question, darken the bubble corresponding to the correct option in the ORS.

Space for rough work

Paragraph-1

A spherically symmetric charge distribution is given by $\rho = \rho_0 \left(1 - \frac{r}{a}\right)$ when $r \leq a$
 $\rho = 0$

15. The electric field due to charge distribution is given by

$$(A) E = \begin{cases} \frac{\rho_0}{\epsilon_0 \pi} \left(\frac{r}{3} - \frac{r^2}{4a} \right), & 0 \leq r \leq a \\ \frac{\rho_0 a^3}{12\pi\epsilon_0 r^2}, & a < r \end{cases}$$

$$(B) E = \begin{cases} \frac{\rho_0 a^3}{12\epsilon_0 \pi r^2} \left(\frac{r}{3} - \frac{r^2}{4a} \right), & 0 \leq r \leq a \\ \frac{\rho_0}{\epsilon_0} \left(\frac{r}{3} - \frac{r^2}{4a} \right), & a < r \end{cases}$$

$$(C) E = \begin{cases} \frac{\rho_0}{\epsilon_0} \left(\frac{r}{3} - \frac{r^2}{4a} \right), & 0 \leq r \leq a \\ \frac{\rho_0 a^3}{12\epsilon_0 r^2}, & a < r \end{cases}$$

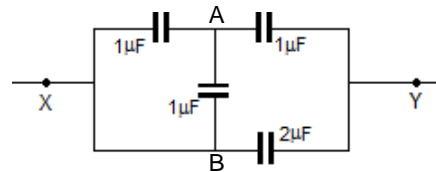
$$(D) \text{ None}$$

16. For what value of r is the field maximum

$$(A) r = \frac{a}{\sqrt{2}} \quad (B) r = \frac{a}{\sqrt{3}} \quad (C) r = \frac{2a}{\sqrt{3}} \quad (D) r = \frac{2a}{3}$$

Paragraph-2

The figure shows a circuit of four capacitors.



17. The effective capacitance between X and Y is

$$(A) \frac{5}{6} \mu\text{F} \quad (B) \frac{7}{6} \mu\text{F} \quad (C) \frac{5}{3} \mu\text{F} \quad (D) \frac{8}{3} \mu\text{F}$$

18. The effective capacitance between A and B is

$$(A) \frac{5}{6} \mu\text{F} \quad (B) \frac{7}{6} \mu\text{F} \quad (C) \frac{5}{3} \mu\text{F} \quad (D) \frac{8}{3} \mu\text{F}$$

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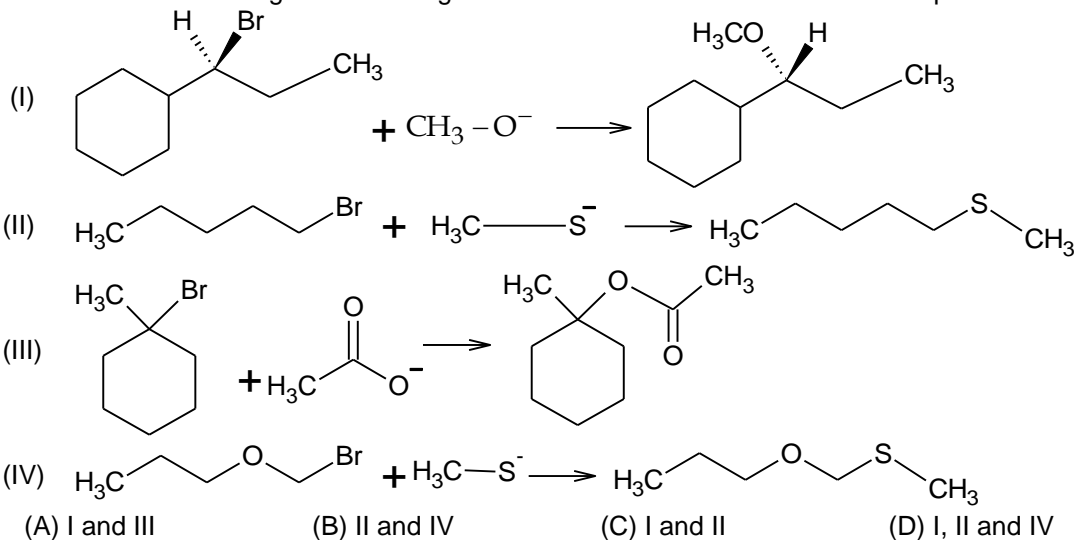
PART II: CHEMISTRY
SECTION 1 (Maximum Marks: 28)

* This section contains **SEVEN** questions.

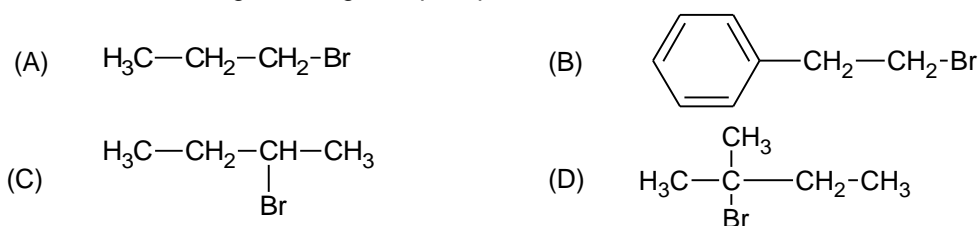
* Each question has **FOUR** options (A), (B), (C) and (D). **ONLY ONE** of these four options is correct.

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19. Which of the following reaction will go faster if the concentration of the nucleophile is raised?

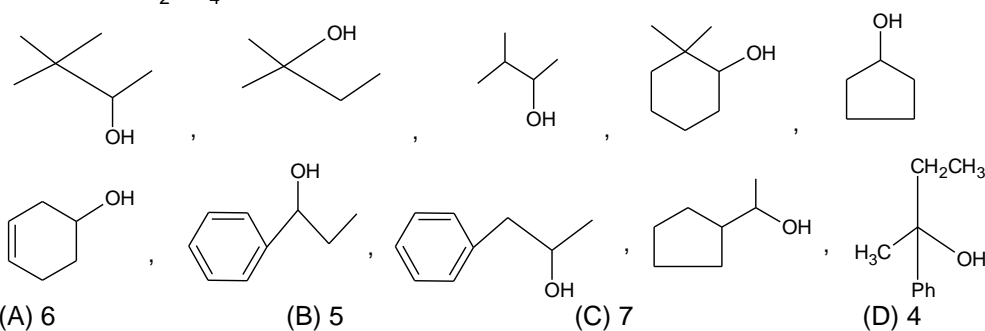


20. Which of the following cannot give a precipitate when reacts with NaI in acetone?



Space for rough work

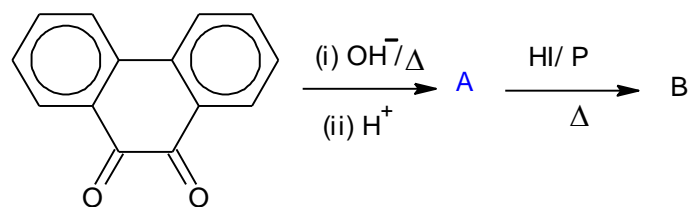
21. Identify numbers of alcohols those will show rearrangement during dehydration with concentrate H_2SO_4 .



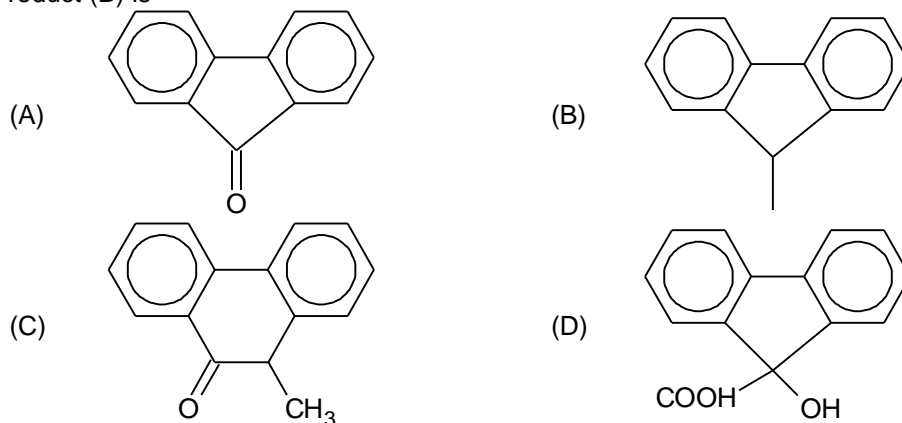
22. Silver Mirror test is given by which one of the following compounds ?

(A) Benzophenone (B) Acetaldehyde
(C) Acetone (D) Acetophenone

- 23.

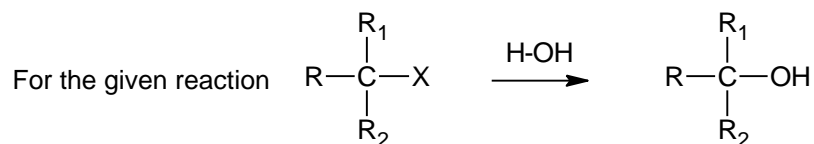


Product (B) is

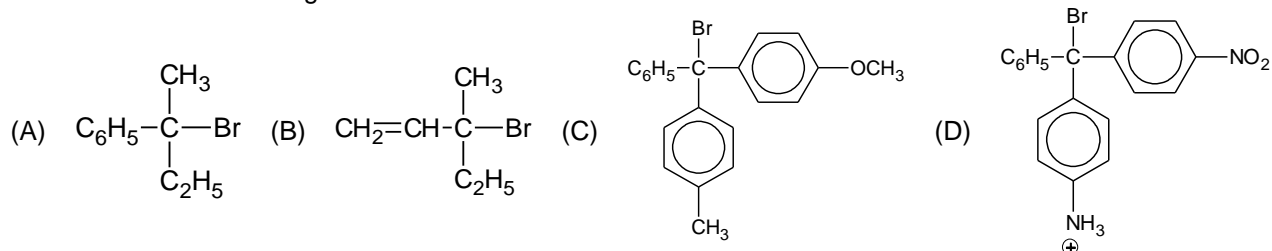


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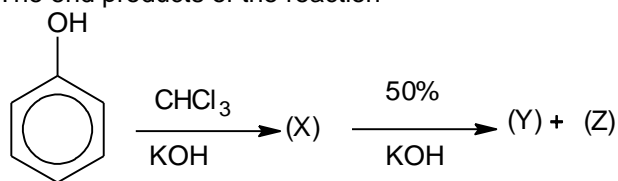
24.



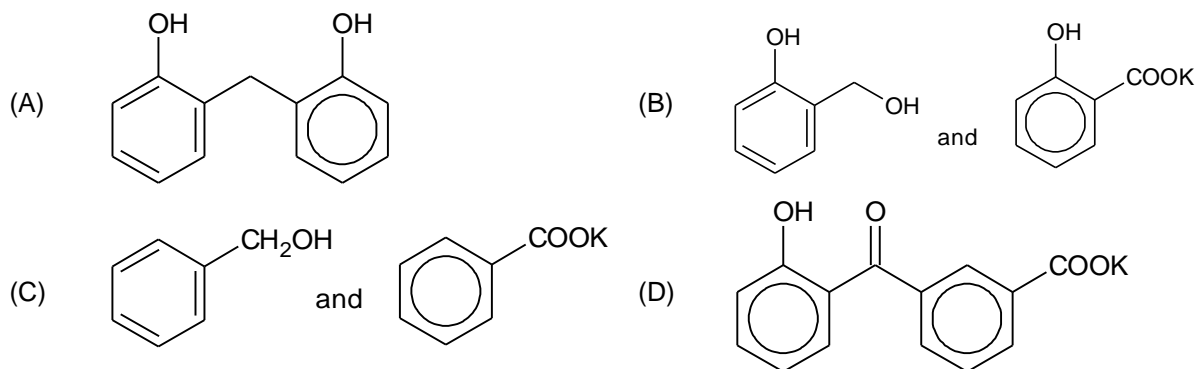
Which substrate will give maximum racemization ?



25. The end products of the reaction



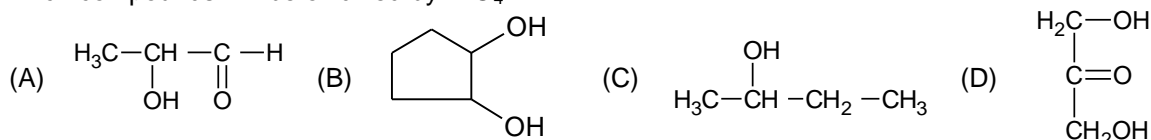
(Y) and (Z) are :

*Space for rough work*

SECTION 2 (Maximum Marks: 15)

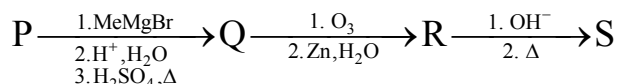
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26. Which compounds will be oxidized by HIO_4 ?



27. Lucas test of alcohols involve following reaction. $\text{R}-\text{OH} + \text{HCl}(\text{conc.}) \xrightarrow[\text{ZnCl}_2]{\text{Anhydrous}} \text{RCl} + \text{H}_2\text{O}$. Select the correct statements for Lucas test.

- (A) ROH behaves as a base
 - (B) lesser is the acidic character of alcohol, greater is its reactivity towards Lucas reagent
 - (C) reactions of 1° , 2° , 3° alcohols, lie in the sequence (for lucas reaction) $3^\circ > 2^\circ > 1^\circ$
 - (D) 2-phenyl propan-2-ol gives Lucas test most quickly
28. A carbonyl compound P, which gives positive iodoform test, undergoes reaction with MeMgBr followed by dehydration to give an olefin Q. Ozonolysis of Q leads to a dicarbonyl compound R, which undergoes intramolecular aldol reaction to give predominantly S.

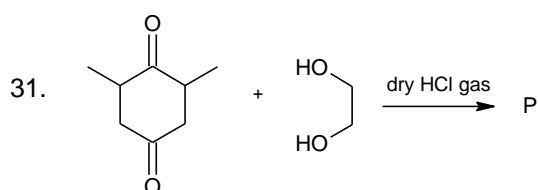
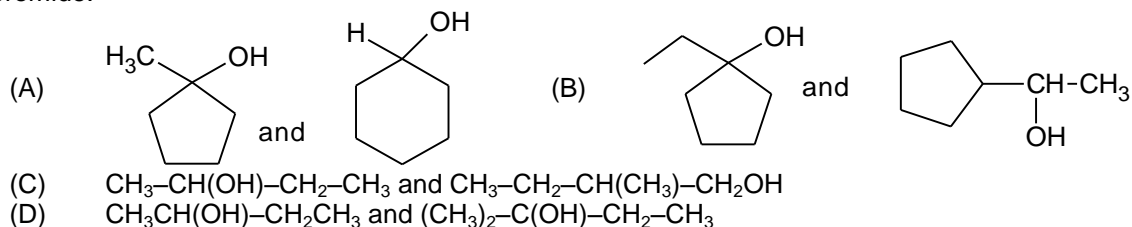


The structure of the product S is

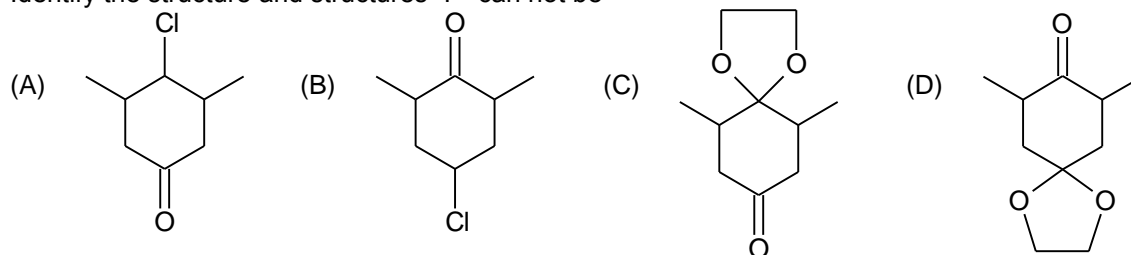


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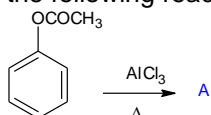
29. Identify the correct statements
- (A) $(\text{CH}_3)_2\text{CH-O}^- > (\text{H}_3\text{C})_3\text{C-O}^-$ (Nucleophilicity)
- (B) $\text{C}_2\text{H}_5\text{O}^- > \text{OH}^-$ (Basic strength)
- (C) $\text{O}^-\text{Ts} > \text{O}^-\text{H}$ (leaving ability)
- (D) $(\text{CH}_3)_3\text{C-Br} > (\text{CH}_3)_2\text{CHBr}$ ($\text{S}_\text{N}1$ reactivity)
30. In the given pair of alcohol, in which pair second alcohol is less reactive than first towards hydrogen bromide.



Identify the structure and structures "P" can not be



32. See the following reaction.



Correct statement regarding A

- (A) Contains phenolic -OH group
- (B) Gives iodoform when treated with $\text{I}_2/\text{excess NaOH}$
- (C) Releases H_2 gas when treated with sodium
- (D) Consumes a maximum of 4 moles of hydrogen under catalytic conditions

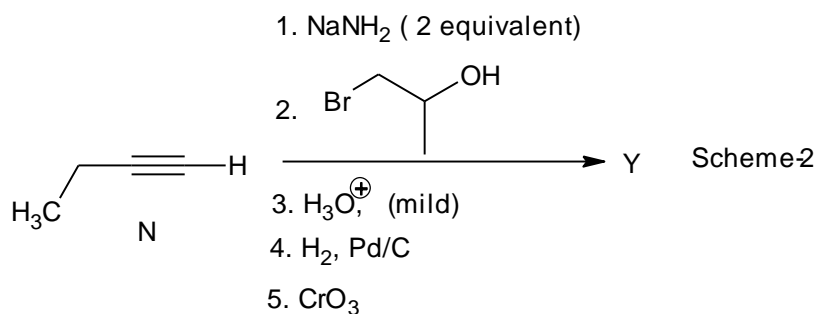
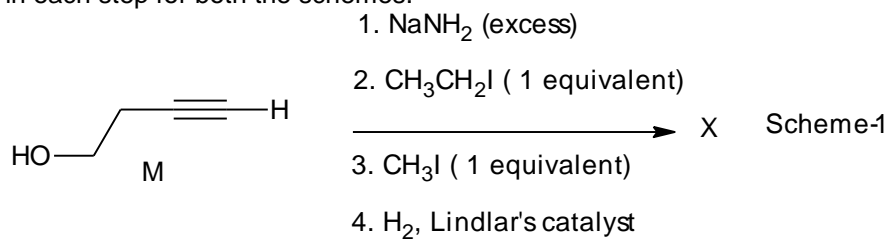
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SECTION 3 (Maximum Marks: 18)

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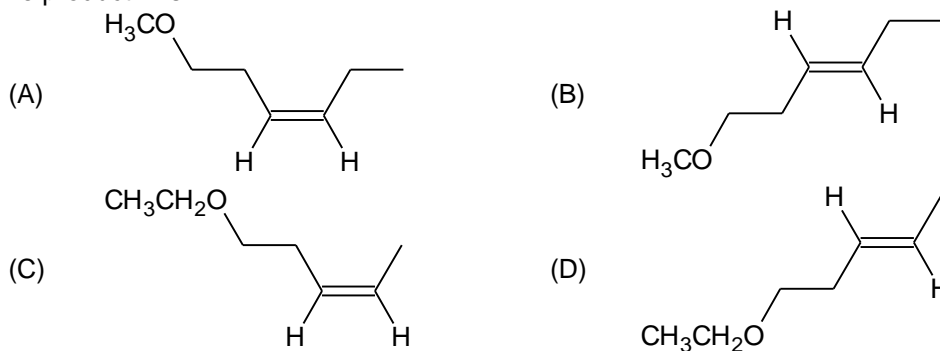
Paragraph-1

Schemes 1 and 2 describe sequential transformation of alkynes M and N. Consider only the major products formed in each step for both the schemes.



Space for rough work

33. The product X is

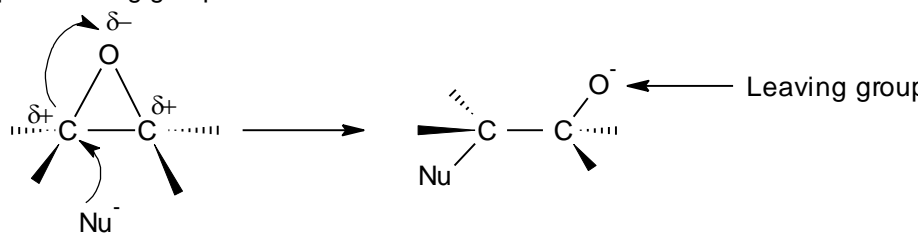


34. The correct statement with respect to product Y is

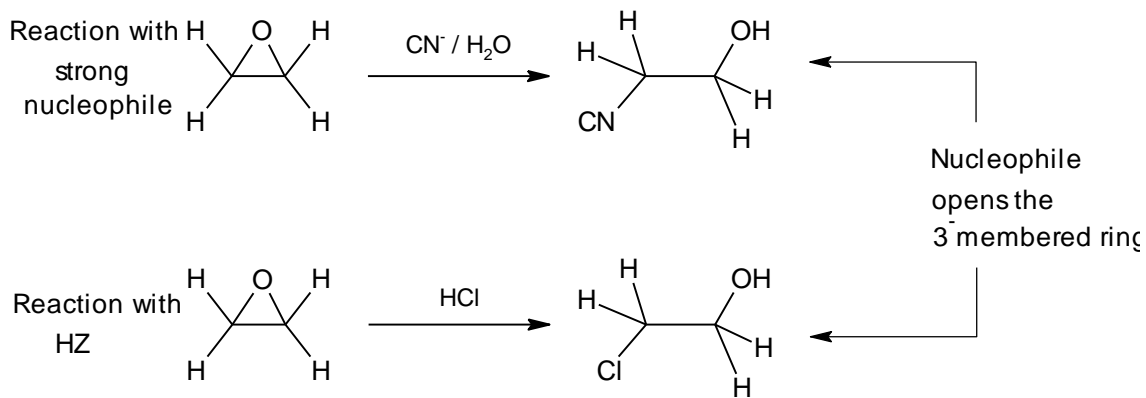
- (A) It gives a positive Tollens test and is a functional isomer of X.
- (B) It gives a positive Tollens test and is a geometrical isomer of X.
- (C) It gives a positive iodoform test and is a functional isomer of X.
- (D) It gives a positive iodoform test and is a geometrical isomer of X.

Paragraph-2

Although epoxides do not contain a good leaving group, they contain a strained three-membered ring with polar bonds. Nucleophilic attack opens the strained three-membered ring, making it favourable process even with the poor leaving group

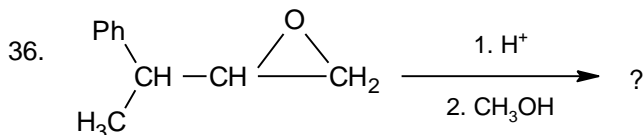
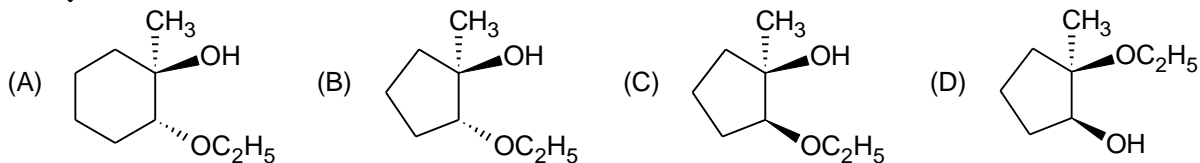
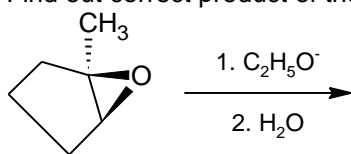


This reaction occurs readily with strong nucleophile, and with acids like HZ, where Z is nucleophilic atom.

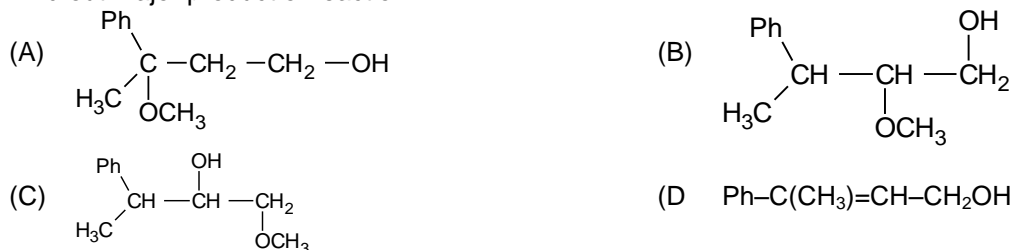


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35. Find out correct product of the reaction :



Find out major product of reaction :



PART III: MATHEMATICS

SECTION 1 (Maximum Marks: 28)

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37. Three equal circles each of radius r touch one another. The radius of the circle touching all the three given circles internally is



Space for rough work

38. The equation of the circumcircle of an equilateral triangle is $x^2 + y^2 + 2gx + 2fy + c = 0$ and one vertex of the triangle is $(1, 1)$. The equation of the incircle of the triangle is
 (A) $4(x^2 + y^2) = g^2 + f^2$
 (B) $4(x^2 + y^2) + 8gx + 8fy = (1 - g)(1 + 3g) + (1 - f)(1 + 3f)$
 (C) $4(x^2 + y^2) + 8gx + 8fy = g^2 + f^2$
 (D) none of these
39. Two circles of radii a and b touching each other externally, are inscribed in the area bounded by $y = \sqrt{1 - x^2}$ and the x -axis. If $b = \frac{1}{2}$, then a is equal to
 (A) $\frac{1}{4}$ (B) $\frac{1}{8}$ (C) $\frac{1}{2}$ (D) $\frac{1}{\sqrt{2}}$
40. $P(x)$ is a polynomial with integral coefficients such that for four distinct integers a, b, c, d ; $P(a) = P(b) = P(c) = P(d) = 3$. If $P(e) = 5$ (e is an integer), then
 (A) $e = 1$ (B) $e = 3$ (C) $e = 4$ (D) no real value of e
41. The number of positive integral solutions of $x^4 - y^4 = 3789108$ is
 (A) 0 (B) 1 (C) 2 (D) 4
42. The sum of series ${}^{20}C_0 - {}^{20}C_1 + {}^{20}C_2 - {}^{20}C_3 + \dots + {}^{20}C_{10}$ is
 (A) $\frac{1}{2} {}^{20}C_{10}$ (B) 0 (C) ${}^{20}C_{10}$ (D) $-{}^{20}C_{10}$
43. If $(1 - x^2)^n = \sum_{r=0}^n a_r x^r (1 - x)^{2n-r}$, then a_r is equal to
 (A) nC_r (B) ${}^nC_r 3^r$ (C) ${}^{2n}C_r$ (D) ${}^nC_r 2^r$

SECTION 2 (Maximum Marks: 15)

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- * For example, if (A), (C) and (D) are all the correct options for a question, darkening all these three will get +4 marks; darkening only (A) and (D) will get +2 marks; and darkening (A) and (B) will get -2 marks, as a wrong option is also darkened.

44. The last two digits of the number $(23)^{14}$ are
 (A) 01 (B) 03 (C) 09 (D) none of these

Space for rough work

45. Let $(1 + x^2)^2 (1 + x)^n = \sum_{k=0}^{n+4} a_k x^k$. If a_1, a_2 and a_3 are in arithmetic progression, then the possible value / values of n is/are
 (A) 5 (B) 4 (C) 3 (D) 2
46. A circle S passes through the point $(0, 1)$ and is orthogonal to the circles $(x - 1)^2 + y^2 = 16$ and $x^2 + y^2 = 1$. Then
 (A) radius of S is 8 (B) radius of S is 7
 (C) centre of S is $(-7, 1)$ (D) centre of S is $(-8, 1)$
47. If $\cos^4 \theta + \alpha, \sin^4 \theta + \alpha$ are the roots of the equation $x^2 + 2bx + b = 0$ and $\cos^2 \theta + \beta, \sin^2 \theta + \beta$ are the roots of the equation $x^2 + 4x + 2 = 0$, then values of b are
 (A) 2 (B) -1 (C) -2 (D) 1
48. For the quadratic equation $x^2 + 2(a + 1)x + 9a - 5 = 0$, which of the following is/are true ?
 (A) If $2 < a < 5$, then roots are of opposite sign (B) If $a < 0$, then roots are of opposite sign
 (C) If $a > 7$, then both roots are negative (D) If $2 \leq a \leq 5$, then roots are unreal
49. If $(1 + x)^n = C_0 + C_1 x + C_2 x^2 + \dots + C_n x^n$, then $C_0 - (C_0 + C_1) + (C_0 + C_1 + C_2) - (C_0 + C_1 + C_2 + C_3) + \dots - (-1)^{n-1} (C_0 + C_1 + \dots + C_{n-1})$, where n is even integer is
 (A) a positive value (B) a negative value (C) divisible by 2^{n-1} (D) divisible by 2^n
50. $(n + 2) {}^n C_0 2^{n+1} - (n + 1) {}^n C_1 2^n + n {}^n C_2 2^{n-1} - \dots$ is equal to
 (A) 4 (B) $4n$ (C) $4(n + 1)$ (D) $2(n + 2)$

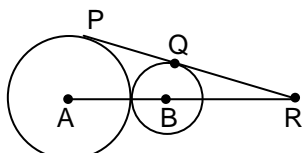
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SECTION 3 (Maximum Marks: 18)

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Paragraph-1

In the given figure, there are two circles with centres A and B. The common tangent to the circles touches them, respectively, at P and Q. AR is 40cm and AB is divided by the point of contact of the circles in the ratio 5 : 3.



51. What is ratio of the length of AB to that of BR ?
 (A) 1 : 4 (B) 2 : 3 (C) 2 : 5 (D) 7 : 4
52. The radius of the circle with centre B is
 (A) 10cm (B) 3cm (C) 6cm (D) 8cm

Paragraph-2

Consider the equation $x^2 + x + a - 9 < 0$

53. The value of the real parameter 'a' so that the given inequation has at least one positive solution:
 (A) $\left(-\infty, \frac{37}{4}\right)$ (B) $(-\infty, \infty)$ (C) $(3, \infty)$ (D) $(-\infty, 9)$
54. The values of the real parameter 'a' so that the given inequation has at least one negative solution:
 (A) $(-\infty, 9)$ (B) $\left(\frac{37}{4}, \infty\right)$ (C) $\left(-\infty, \frac{37}{4}\right)$ (D) none of these

Space for rough work

FITJEE INTERNAL TEST

IIT – JEE 2019

PHASE – V_PAPER – II_SET - A

ANSWERS

PHYSICS

- | | | | |
|-------------|-----------|---------|----------|
| 1. A | 2. D | 3. C | 4. A |
| 5. C | 6. C | 7. D | 8. A,B,C |
| 9. A,B,C | 10. B,D | 11. B,D | 12. B,C |
| 13. A,B,C,D | 14. B,C,D | 15. D | 16. D |
| 17. C | 18. D | | |

CHEMISTRY

- | | | | |
|----------------|-------------|----------------|----------------|
| 19. B | 20. B | 21. C | 22. B |
| 23. C | 24. D | 25. A | 26. A, B, C, D |
| 27. A, B, C | 28. A, B, C | 29. A, B, C, D | 30. A, B, D |
| 31. A, B, C, D | 32. B | 33. B | 34. A |
| 35. A | 36. C | | |

MATHEMATICS

- | | | | |
|---------|--------|-------|--------|
| 37. D | 38. A | 39. A | 40. D |
| 41. B | 42. B | 43. A | 44. AB |
| 45. BCD | 46. BC | 47. C | 48. C |
| 49. BCD | 50. BC | 51. D | 52. C |
| 53. B | 54. C | | |

FITJEE INTERNAL TEST

IIT – JEE 2019

PHASE – V_PAPER – II_SET - B

ANSWERS

PHYSICS

- | | | | |
|------------|-----------|-----------|-----------|
| 1. C | 2. C | 3. D | 4. A |
| 5. D | 6. C | 7. A | 8. B,C |
| 9. A,B,C,D | 10. B,C,D | 11. A,B,C | 12. A,B,C |
| 13. B,D | 14. B,D | 15. C | 16. D |
| 17. D | 18. D | | |

CHEMISTRY

- | | | | |
|----------------|----------------|----------------|-------------|
| 19. C | 20. D | 21. A | 22. B |
| 23. B | 24. C | 25. B | 26. A, B, D |
| 27. A, B, C, D | 28. B | 29. A, B, C, D | 30. A, B, C |
| 31. A, B, C | 32. A, B, C, D | 33. A | 34. C |
| 35. B | 36. A | | |

MATHEMATICS

- | | | | |
|---------|--------|--------|---------|
| 37. B | 38. B | 39. A | 40. D |
| 41. A | 42. A | 43. D | 44. C |
| 45. BCD | 46. BC | 47. AB | 48. BCD |
| 49. BC | 50. C | 51. B | 52. C |
| 53. D | 54. C | | |