

FIITJEE RET – 2

(2017 – 2019)(2ND YEAR_REGULAR)

IIT-2014 (P2)_SET-A

DATE: 18.06.2018

Time: 3 hours

Maximum Marks: 180

INSTRUCTIONS:

A. General

1. This booklet is your Question Paper containing 60 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:

7. The question paper consists of **3 parts (Physics, Chemistry and Mathematics)**. Each part consists of **three sections**.
8. **Section I** contains **10 multiple choice questions**. Each question has four choices (A), (B), (C) and (D) out of which **ONE** is correct.
9. **Section II** contains **3 paragraphs**. Each describing theory, experiment, data etc., **Six questions** related to three paragraphs with two questions on each paragraph. Each question to a particular passage should have **ONLY ONE correct answer** among the four given choices (A), (B), (C) and (D).
10. **Section III** contains **4 Multiple choice questions**. Each question has two lists (List-1: P, Q, R and S; List-2: 1, 2, 3 and 4). The options for the correct match are provided as (A), (B), (C) and (D) out of which **ONLY ONE is correct**.

D. Marking Scheme

11. For each question in **Section 1, 2 and 3** you will be awarded **3 marks** if you darken the bubble corresponding to the correct answer and **zero mark** if no bubble is darkened. In all other cases, **minus one (-1) mark** will be awarded.

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:

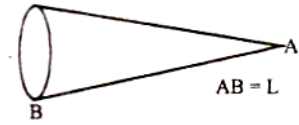
ENROLLMENT NO.:

PAPER – II
PART I: PHYSICS

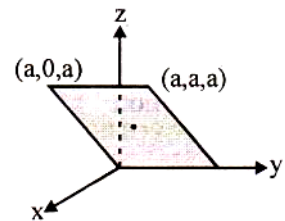
SECTION – I: Single Correct Answer Type

The section contains **10 multiple choice questions**. Each question has four choices (A), (B), (C) and (D) out of which **ONLY ONE is correct**.

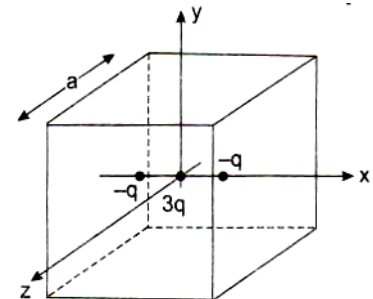
1. A cone made of insulating material has a total charge Q spread uniformly over its sloping surface. The energy required to take a test charge q from infinity to apex A of cone is given by $\frac{2Qq}{S\pi\epsilon_0 L}$. The slant length is L . Then find S .
- (A) 3 (B) 5
(C) 7 (D) None



2. Consider an electric field $\vec{E} = E_0 \hat{x}$, where E_0 is a constant. The flux through the shaded area (as shown in the figure) due to this field is $YE_0 a^x$ then $x - y = ?$
- (A) 1 (B) 2
(C) 8 (D) 9



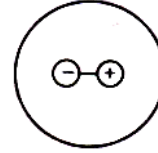
3. A cubical region of side a has its centre at the origin. It enclose three fixed point charges, $-q$ at $(a, -a/4, 0)$, $+3q$ at $(0, 0, 0)$ and $-q$ at $(0, +a/4, 0)$. Choose the incorrect option



- (A) The net electric flux crossing the plane $x = +a/2$ is equal to the net electric flux crossing the plane $x = -a/2$
- (B) The net electric flux crossing the plane $y = +a/2$ is more than the net electric flux crossing the plane $y = -a/2$
- (C) The net electric flux crossing the entire region is $\frac{q}{\epsilon_0}$.
- (D) The net electric flux crossing the plane $z = +a/2$ is equal to the net electric flux crossing the plane $x = +a/2$.

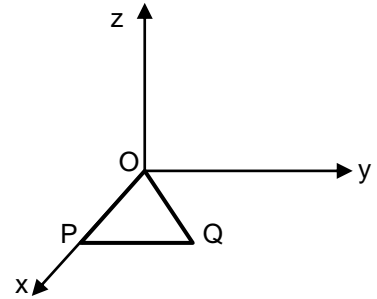
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4. Consider a Gaussian spherical surface covering a dipole of charge q and $-q$, then. Incorrect statement is



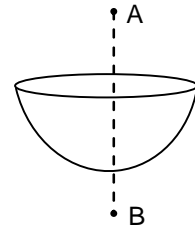
- (A) $q_{in} = 0$ (Net charge enclosed by the spherical surface)
 (B) $\phi_{net} = 0$ (Net flux coming out the spherical surface)
 (C) $E = 0$ at all points on the spherical surface
 (D) $\int \vec{E} \cdot d\vec{s} = 0$ (surface integral of \vec{E} over the spherical surface)

5. A charge $8q$ is placed at $(0, 0, a)$. The flux through a triangle shaped area OPQ is then find the value of n ? The length of the side OP as well as PQ is 'a'.



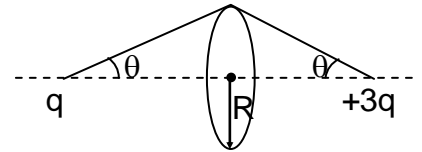
- (A) $\frac{q}{2\epsilon_0}$ (B) $\frac{q}{4\epsilon_0}$
 (C) $\frac{q}{6\epsilon_0}$ (D) None

6. Figure shows a uniformly charged hemisphere of radius R . It has a volume charge density ρ . If the electric field at a point $2R$, above its center is E , then what is the electric field at the point $2R$ below its center?



- (A) $\frac{\rho R}{6\epsilon_0} + E$ (B) $\frac{\rho R}{12\epsilon_0} - E$
 (C) $-\frac{\rho R}{6\epsilon_0} + E$ (D) $\frac{\rho R}{12\epsilon_0} + E$

7. Find the electric flux through a disc of radius R kept parallel to XY axis and whose centre is at $(0, 0, a)$.

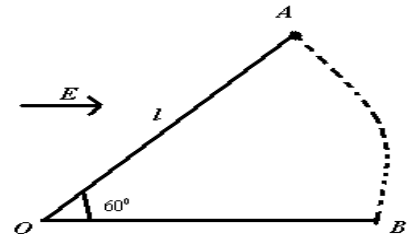


- (A) $\phi = \frac{q}{\epsilon_0} (1 - \cos \theta)$ (B) $\phi = \frac{2q}{\epsilon_0} (1 - \cos \theta)$
 (C) $\phi = \frac{q}{2\epsilon_0} (1 - \cos \theta)$ (D) zero

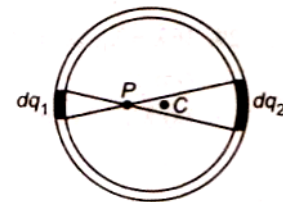
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8. A Gaussian surface. Then incorrect statement is
 (A) must not pass through any discrete charge
 (B) must pass through any material medium whether conducting or non – conducting
 (C) may pass through a continuous charge distribution
 (D) may pass through a region where no material medium is present
9. A particle of mass m and charge q is fastened to one end of a string fixed a point O . The whole system lies on a frictionless horizontal plane. Initially, the mass is at rest at A . A uniform electric field in the direction shown is then switched on. Then correct statement is

- (A) The speed of the particle when it reaches B is $\sqrt{\frac{2qEl}{m}}$
 (B) The tension in the string when particle reaches at B is $2qE$.
 (C) The tension in the string when particle reaches at B is qE .
 (D) None



10. The net electric field due to dq_1 and dq_2 of a uniform surface charged spherical shell is
 (A) directed towards right
 (B) directed towards left
 (C) zero
 (D) directed towards the centre C



SECTION – II: Paragraph Type

This section contains **3 paragraphs** each describing theory, experiment, data etc., **Six questions** relate to three paragraphs with two question on each paragraph. Each question of a paragraph has **only one correct answer** among the four choices (A), (B), (C) and (D).

Paragraph For Questions 11 & 12

A small sphere is charged uniformly and placed at point A so that the sphere produces electric field strength $\vec{E} = (54\hat{i} + 72\hat{j})\text{NC}^{-1}$ and potential $+900$ volt at a point B of position coordinates $(8\text{m}, 7\text{m})$.

11. Charge on the sphere is _____
 (A) $1\mu\text{C}$ (B) $2\mu\text{C}$ (C) $3\mu\text{C}$ (D) $4\mu\text{C}$

Space for rough work

12. Co-ordinates of point A are
 (A) (1m, 2m) (B) (2m, 1m) (C) (2m, -1m) (D) (1m, -2m)

Paragraph For Questions 13 & 14

The line of force in an electric field is an imaginary line, the tangent to which at any point on it represents the direction of electric field at the given point. Line of force originates out from a positive charge and terminates on a negative charge. If there is only one positive charge then lines start from positive charge and terminate at ∞ .

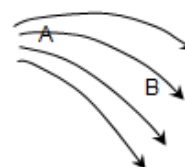
If lines are dense \Rightarrow E will be more

Number of lines originating (terminating) is proportional to the charge. Electric lines of force end or start perpendicularly on the surface of a conductor. Electric lines of force never enter into conductors.

With the information given above, indicate the right answers for the following two questions:

13. Three lines of force are shown in figure, for point A and B. Then which of the following is true?

- (A) $E_B > E_A$ (B) $E_B = E_A$
 (C) $V_A > V_B$ (D) $V_A = V_B$

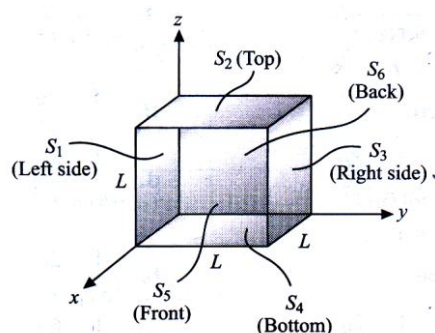


14. If a charge is released in electric field,
 (A) It always follows the lines of force.
 (B) It follows lines of force only when the lines are parallel.
 (C) It follows lines of force only when the lines are curved.
 (D) It can never follow the lines of force.

Space for rough work

Paragraph For Questions 15 & 16

The cube as shown has sides of length $L = 10.0$ cm. The electric field is uniform, has a magnitude $E = 4.00 \times 10^3 \text{ NC}^{-1}$, and is parallel to the xy -plane at an angle of 37° measured from the $+x$ -axis toward the $+y$ -axis.



15. Which of the surfaces have zero flux?
 (A) S_1 and S_3 (B) S_5 and S_6 (C) S_2 and S_4 (D) S_2 and S_1
16. Electric flux passing through the surface S_1 is
 (A) $-24 \text{ N-m}^2 \text{ C}^{-1}$ (B) $24 \text{ N-m}^2 \text{ C}^{-1}$ (C) $32 \text{ N-m}^2 \text{ C}^{-1}$ (D) $-32 \text{ N-m}^2 \text{ C}^{-1}$

SECTION – III: (Matching List Type)

This section contains 4 questions, each having two matching lists. Choices for the correct combination of elements from List-I and List-II are given as option (A), (B), (C) and (D) out of which **ONLY ONE** is correct.

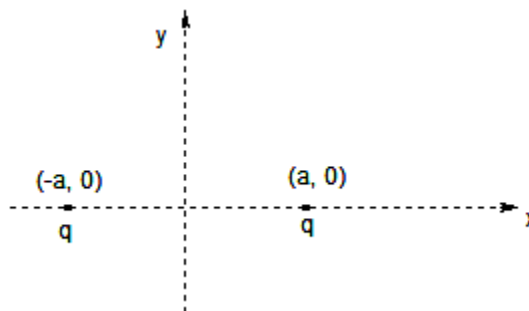
17. Match the Column – I with Column – II

Column – I		Column – II	
(P)	A circular ring of radius R with uniformly distributed charge q .	(1)	$E_x = \frac{\lambda}{4\pi\epsilon_0 x} [\sin \alpha + \sin \beta]$
(Q)	A circular disc of radius R with uniformly distributed surface charge density σ .	(2)	$E = \frac{1}{4\pi\epsilon_0} \frac{qx}{(R^2 + x^2)^{3/2}}$
(R)	An infinite sheet of uniformly distributed charges with density σ .	(3)	$E = \frac{\sigma}{2\epsilon_0} \left[1 - \frac{x}{\sqrt{x^2 + R^2}} \right]$
(S)	A finite line of charge with constant linear charged density λ along Y - axis.	(4)	$E = \frac{\sigma}{2\epsilon_0}$

	P	Q	R	S
(A)	1	2	4	3
(B)	4	3	1	2
(C)	2	3	4	1
(D)	1	4	3	2

Space for rough work

18. Two isolated point charges are fixed in the positions shown on x-axis. Each of the charge are positive and are located at $(-a, 0)$ and $(a, 0)$.



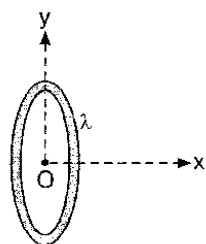
Note: In all graphs in column-II, Field or potential is along y-axis and distance along x-axis

Column - I		Column - II	
(P)	Variation of magnitude of electric field along x-axis from $x \rightarrow -\infty$ to $x \rightarrow \infty$	(1)	
(Q)	Variation of magnitude of electric field along y-axis from $y \rightarrow -\infty$ to $y \rightarrow \infty$	(2)	
(R)	Variation of electric potential along x-axis from $x \rightarrow -\infty$ to $x \rightarrow +\infty$	(3)	
(S)	Variation of electric potential along y-axis from $y \rightarrow -\infty$ to $y \rightarrow \infty$	(4)	
		(5)	None

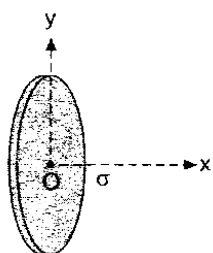
	P	Q	R	S
(A)	1	3	4	2
(B)	2	4	1	3
(C)	4	1	2	3
(D)	1	2	3	4

Space for rough work

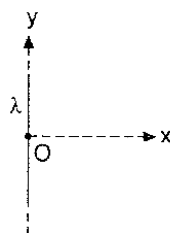
19. Figure (A) and (B) show a uniformly charged ring and a uniformly charged disc of large radius R , Figure (C) is a uniformly charged infinite thread along Y-axis and figure (D) shows a uniformly charged infinite sheet. In each figure let us consider the point O as the reference and then move away from O along the $+x$ axis. If E_1, E_2, E_3 and E_4 be the respective fields, then match the contents of COLUMN-I with those of COLUMN-II.



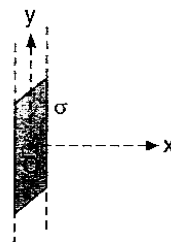
Ring of finite radius
(A)



Disc of large radius
(B)



Infinite line of charge
(C)



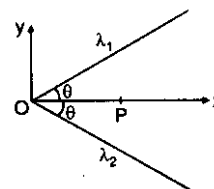
Infinite sheet of charge
(D)

	Column I		Column II
(P)	E_2	(1)	decreases
(Q)	E_4	(2)	is constant near it and then decreases
(R)	E_1	(3)	is constant
(S)	E_3	(4)	first increases and then decreases

	P	Q	R	S
(A)	3	3	1	1
(B)	1	2	4	3
(C)	1	2	4	1
(D)	4	3	1	1

Space for rough work

20. Two infinitely long line charges λ_1 and λ_2 are placed symmetric to x-axis as shown in figure. Match the following for direction of electric field at point P on the x-axis: (θ is obtuse angle)



Column-I		Column-II	
(P)	both λ_1 and λ_2 are positive	(1)	positive x-axis
(Q)	both λ_1 and λ_2 are negative	(2)	negative x-axis
(R)	λ_1 is positive but λ_2 is negative	(3)	positive y-axis
(S)	λ_1 is negative but λ_2 is positive	(4)	negative y-axis

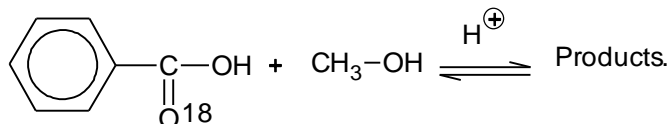
	P	Q	R	S
(A)	2	1	3	4
(B)	2	1	4	3
(C)	1	2	3	4
(D)	1	2	4	3

PART II: CHEMISTRY

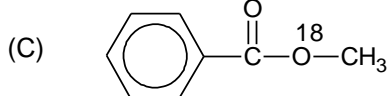
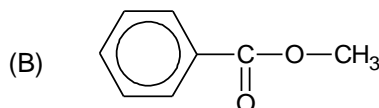
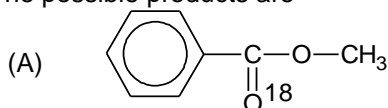
SECTION – I: Single Correct Answer Type

The section contains 10 multiple choice questions. Each question has four choices (A), (B), (C) and (D) out of which **ONLY ONE** is correct.

21.



The possible products are

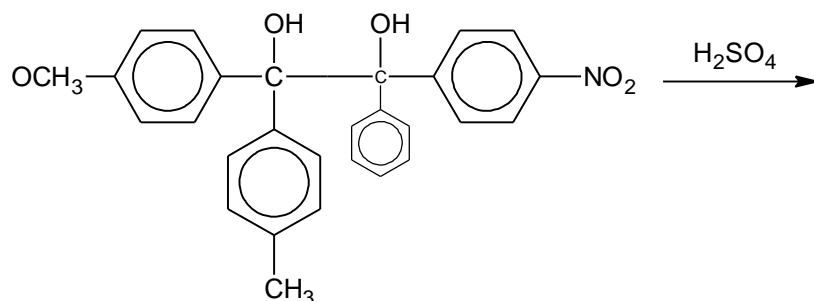


(D) Both a & b

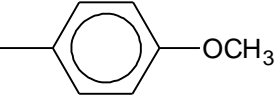
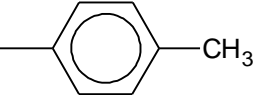
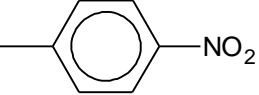
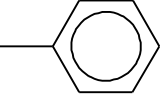
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22. $\text{CH}_3 - \text{CH}_2 - \text{CH}_2 - \text{OH} \xrightleftharpoons[\text{B}]{\text{A}} \text{CH}_3 - \text{CH}_2 - \text{COOH}$. The reagent A and B are
 (A) $\text{K}_2\text{Cr}_2\text{O}_7$, LiAlH_4 (B) PCC, LiAlH_4
 (C) KMnO_4 , NaBH_4 (D) Both a & c
23. $\text{C}_2\text{H}_5\text{OH}$ when treated with $\text{Al}_2\text{O}_3/\text{AlPO}_4$ at 250°C gives a compound 'A'. Which on treatment with concentrated HI on cold condition gives
 (A) $\text{C}_2\text{H}_5\text{OH}$ (B) $\text{C}_2\text{H}_5\text{I}$ (C) Both a & b (D) $\text{CH}_2=\text{CH}_2$

24.

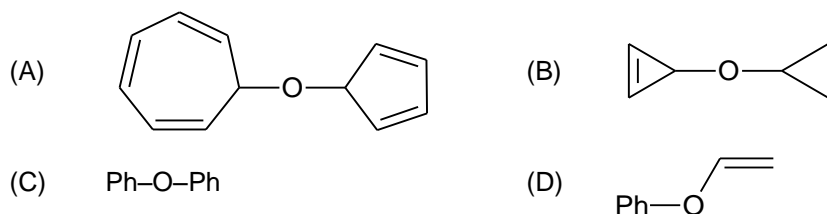


In the above process the group which get migrated to give ketone.

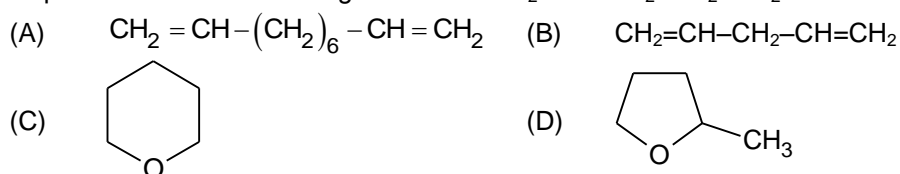
- (A)  (B) 
 (C)  (D) 
25. In no. of equivalents of HIO_4 required to complete the oxidation of 2, 3, 5 trihydroxy hexanoic acid.
 (A) 1 (B) 2 (C) 3 (D) 4
26. In which of the following reaction, Ethanol acts as a base.
 (A) Reaction with Metallic sodium
 (B) Reaction with Grignard reagent
 (C) Acid catalysed dehydration
 (D) Both b & c

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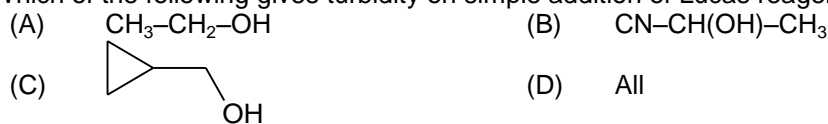
27. Which of the following reactivity is highest with HI to give alkyl iodide and alcohol.



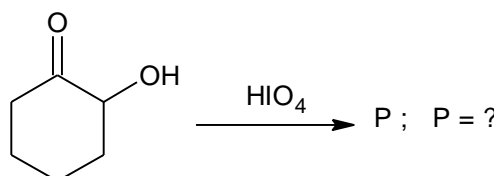
28. The product 'B' in the following reaction is $\text{CH}_2=\text{CH}-\text{CH}_2-\text{CH}_2-\text{CH}_2-\text{Br} \xrightarrow{\text{H}^+/\text{H}_2\text{O}} \text{A} \xrightarrow{\text{Na}} \text{B}$



29. Which of the following gives turbidity on simple addition of Lucas reagent.



30.



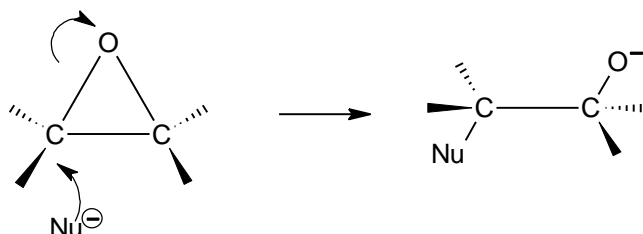
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SECTION – II: Paragraph Type

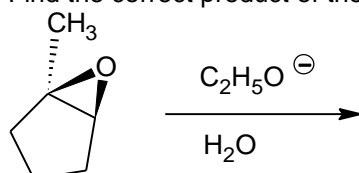
This section contains **3 paragraphs** each describing theory, experiment, data etc., **Six questions** relate to three paragraphs with two question on each paragraph. Each question of a paragraph has **only one correct answer** among the four choices (A), (B), (C) and (D).

Paragraph For Questions 31 & 32

Although epoxides do not contain a good leaving group, they contain a strained 3-membered ring with polar bonds. Nu^- attack opens the strained 3-membered ring, making it favourable process even with the poor leaving group.



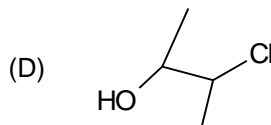
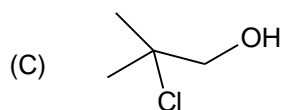
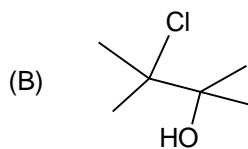
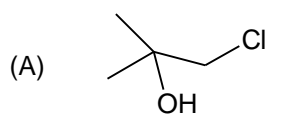
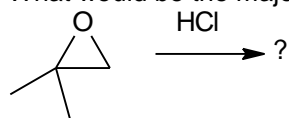
31. Find the correct product of the reaction.



- (A)
- (B)
- (C)
- (D)

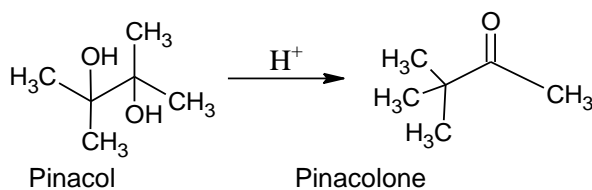
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32. What would be the major product of the reaction.

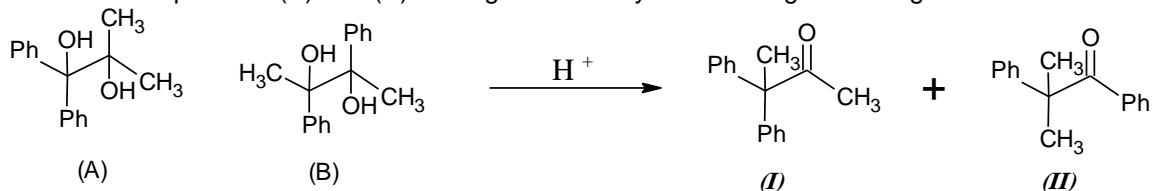


Paragraph For Questions 33 & 34

When 1,2- or vic- diols are treated with acids they undergo facile dehydrative rearrangement to yield ketones or aldehydes. This is called pinacol - pinacolone rearrangement. The reaction proceeds via formation of an intermediate carbocation.



33. Two isomeric pinacols (A) and (B) undergo acid catalysed rearrangement to give



(A) only (II)

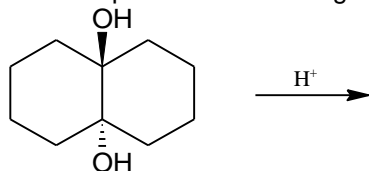
(B) Only (I)

(C) (A) gives (I) and (B) gives (II)

(D) (A) gives (II) and (B) gives (I)

Space for rough work

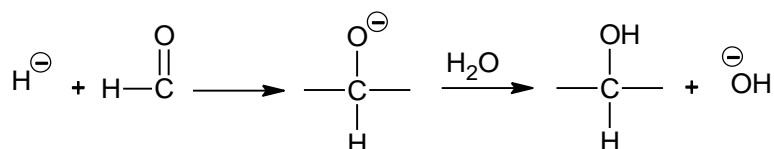
34. The compound on reaction gives a pinacolone having a combination of



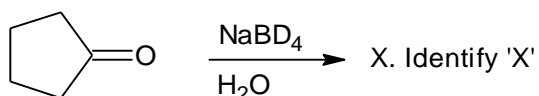
- (A) Six member ring and a four member ring (B) Two five member rings
(C) Six member ring and a five member ring (D) Seven member and a three member ring

Paragraph For Questions 35 & 36

Carbon-oxygen double bond is easily reduced by NaBH_4 or LiAlH_4 . The metal hydrogen bond is more polar in LiAlH_4 than in NaBH_4 . As a result LiAlH_4 is a stronger reducing agent than NaBH_4 . The actual reducing agent in these reactions is a $\text{H}^{(-)}$ ion.



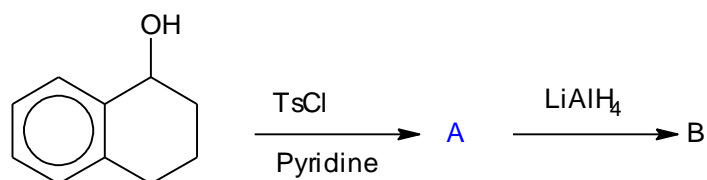
- 35.



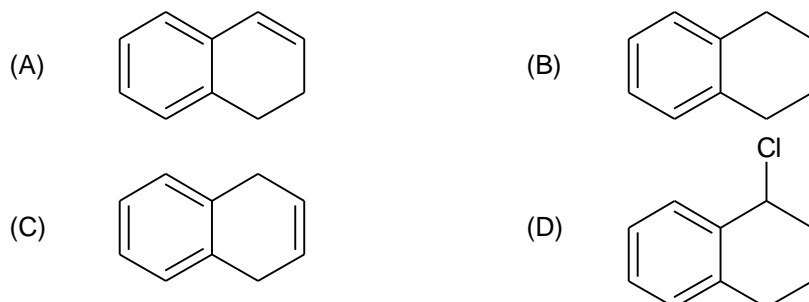
- (A) (B)
- (C) (D)

Space for rough work

36.



Product B at the above reaction is

**SECTION – III: (Matching List Type)**

This section contains 4 questions, each having two matching lists. Choices for the correct combination of elements from List-I and List-II are given as option (A), (B), (C) and (D) out of which **ONLY ONE** is correct.

37.

Column – I (Reactant)		Column – II (Products)	
(P)	$\xrightarrow[\text{H}_2\text{SO}_4 (\text{Conc.})]{\text{CH}_3\text{OH}}$	(1)	
(Q)	$\xrightarrow[\text{(ii) CH}_3\text{I}]{\text{(i) NaOH}}$	(2)	
(R)	$\xrightarrow[\text{3) CH}_3\text{I}]{\text{1) HBr, 2) Mg}}$	(3)	
(S)	$\xrightarrow[\text{2) }^{14}\text{CH}_3\text{I}]{\text{1) Na}}$	(4)	

Code:

	P	Q	R	S
(A)	4	2	3	1
(B)	3	2	4	1
(C)	3	3	2	1
(D)	2	4	3	1

Space for rough work

38.

Column – I (Reaction)		Column – II (Products)	
(P)	Glycerol $\xrightarrow{\text{KHSO}_4}$	(1)	2-Methyl propene
(Q)	Ethylene glycol $\xrightarrow{\text{HIO}_4}$	(2)	HCOOH
(R)	Glycerol $\xrightarrow[110^\circ\text{C}]{\text{COOH}}$	(3)	HCHO
(S)	t-Butanol $\xrightarrow[300^\circ\text{C}]{\text{Cu}}$	(4)	Acrolein

Code:

	P	Q	R	S
(A)	1	3	2	4
(B)	4	3	2	1
(C)	1	2	3	4
(D)	4	2	3	1

39.

Column – I		Column – II	
(P)	One of the product is halogen derivative of alkane	(1)	$\text{CH}_3 - \text{CH}_2 - \text{OH} \xrightarrow[\text{CaOCl}_2]{\text{moist}} \text{Products}$
(Q)	One of the product is salt of carboxylic acid	(2)	$\text{CH}_3 - \text{CH}(\text{OH}) - \text{CH}_3 \xrightarrow[300^\circ\text{C}]{\text{Cu}} \text{Products}$
(R)	One of the product is carbonyl compound	(3)	$\text{CH}_3 - \text{COOC}_2\text{H}_5 \xrightarrow[\text{Hydrolysis}]{\text{Base}} \text{Products}$
(S)	One of the product is an alcohol	(4)	$\text{CH}_3 - \text{CH}_2 - \text{O} - \text{CH}_2 - \text{CH}_3 \xrightarrow[\text{HI}]{\text{dil.}} \text{Products}$

Code:

	P	Q	R	S
(A)	1, 4	3	2	3, 4
(B)	1, 3	2	3	1, 4
(C)	2, 3	1	4	2, 3
(D)	2, 4	4	1	2, 1

Space for rough work

40.

Column – I		Column – II	
(P)	$\text{PhMgI} + \text{CH}_3\text{CHO} \rightarrow$	(1)	Nucleophilic substitution
(Q)	$\text{CH}_3\text{CH}_2\text{CH}_2\text{OH} + \text{SOCl}_2 \rightarrow$	(2)	Nucleophilic addition
(R)	$(\text{CH}_3)_2\text{CHCl} \xrightarrow[\Delta]{\text{Ag}_2\text{O}/\text{H}_2\text{O}}$	(3)	Molecular rearrangement
(S)	$(\text{CH}_3)_2\text{C}(\text{OH})-\text{C}(\text{OH})(\text{CH}_3)_2 \xrightarrow{\text{H}_2\text{SO}_4}$	(4)	Dehydration

Code:

	P	Q	R	S
(A)	2	1	3, 4	4, 3
(B)	3	4	1, 4	3, 4
(C)	1	3	2, 4	2, 3
(D)	4	2	4, 1	1, 2

PART III: MATHEMATICS

SECTION – I: Single Correct Answer Type

The section contains **10 multiple choice questions**. Each question has four choices (A), (B), (C) and (D) out of which **ONLY ONE is correct**.

41. The value of $\binom{30}{0}\binom{30}{10} - \binom{30}{1}\binom{30}{11} + \binom{30}{2}\binom{30}{12} + \dots + \binom{30}{20}\binom{30}{30} =$
- (A) ${}^{60}C_{20}$ (B) ${}^{30}C_{10}$ (C) ${}^{60}C_{30}$ (D) ${}^{40}C_{30}$
42. The value of ${}^{20}C_0 + {}^{20}C_1 + {}^{20}C_2 + {}^{20}C_3 + {}^{20}C_4 + {}^{20}C_{12} + {}^{20}C_{13} + {}^{20}C_{14} + {}^{20}C_{15}$ is
- (A) $2^{19} - \frac{{}^{20}C_{10} + {}^{20}C_9}{2}$ (B) $2^{19} - \frac{{}^{20}C_{10} + 2 \times {}^{20}C_9}{2}$
- (C) $2^{19} - \frac{{}^{20}C_{10}}{2}$ (D) none of these
43. If $C_0, C_1, C_2, \dots, C_n$ are the binomial coefficients, then $2 \times C_1 + 2^3 \times C_3 + 2^5 \times C_5 + \dots$ equals
- (A) $\frac{3^n + (-1)^n}{2}$ (B) $\frac{3 - (-1)^n}{2}$ (C) $\frac{3^n + 1}{2}$ (D) $\frac{3^n - 1}{2}$

Space for rough work

44. $(1+x)^n = C_0 + C_1x + C_2x^2 + \dots + C_nx^n$, then $C_0C_2 + C_1C_3 + C_2C_4 + \dots + C_{n-2}C_n =$
 (A) $\frac{(2n)!}{(n!)^2}$ (B) $\frac{(2n)!}{(n-1)!(n+1)!}$ (C) $\frac{(2n)!}{(n-2)!(n+2)!}$ (D) none of these
45. 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) $-{}^{20}C_{10}$
46. The value of $\sum_{r=0}^{10} (r) {}^{20}C_r$ is equal to
 (A) $10 \cdot 2^{19}$ (B) $20 (2^{18} + {}^{19}C_{10})$ (C) $20 (2^{18} + {}^{19}C_{11})$ (D) $10 (2^{18} + {}^{19}C_{11})$
47. 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) ${}^nC_r 2^r$
48. 'p' is a prime number and $n < p < 2n$. If $N = {}^{2n}C_n$, then
 (A) p divides N (B) p^2 divides N (C) p cannot divide N (D) none of these
49. 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
50. ${}^{404}C_4 - {}^4C_1 {}^{303}C_4 + {}^4C_2 {}^{202}C_4 - {}^4C_3 {}^{101}C_4$ is equal to
 (A) $(401)^4$ (B) $(101)^4$ (C) 0 (D) $(201)^4$

Space for rough work

SECTION – II: Paragraph Type

This section contains **3 paragraphs** each describing theory, experiment, data etc., **Six questions** relate to three paragraphs with two question on each paragraph. Each question of a paragraph has **only one correct answer** among the four choices (A), (B), (C) and (D).

Paragraph For Questions 51 & 52

Let $(x + 1)(x + 2)(x + 3)\dots(x + n) = x^n + A_1x^{n-1} + A_2x^{n-2} + A_3x^{n-3} + \dots + A_n$

51. $A_1 + A_n =$

- (A) $\frac{n}{2} + n!$ (B) $\frac{n+1}{2} + n!$ (C) $\frac{n(n+1)}{2} + n!$ (D) $(n + 1)!$

52. $A_2 =$

- (A) $\frac{(n-1)n(n+1)}{12}$ (B) $\frac{n(n+1)n(3n+1)}{12}$ (C) $\frac{(n+1)(3n+1)}{24}$ (D) $\frac{(n-1)n(n+1)(3n+2)}{24}$

Paragraph For Questions 53 & 54

If $m, n, r \in \mathbb{N}$, then ${}^m C_0 \cdot {}^n C_r + {}^m C_1 \cdot {}^n C_{r-1} + {}^m C_2 \cdot {}^n C_{r-2} + \dots + {}^m C_r \cdot {}^n C_0 =$ coefficient of x^r in

$(1+x)^m (1+x)^n =$ coefficient of x^r in $(1+x)^{m+n} = {}^{(m+n)} C_r$

We can use similar techniques to evaluate product of binomial coefficients.

53. The value of r for which $S \equiv {}^{20} C_r \cdot {}^{10} C_0 + {}^{20} C_{r-1} \cdot {}^{10} C_1 + \dots + {}^{20} C_0 \cdot {}^{10} C_r$ is maximum when $r =$

- (A) 7 (B) 8 (C) 10 (D) 15

54. The value of r ($0 \leq r \leq 30$) is when S is least is

- (A) 0 (B) 1 (C) 10 (D) 15

Space for rough work

Paragraph For Questions 55 & 56

$$\text{Suppose } f(n, r) = \sum_{r=0}^n (-1)^r {}^n C_r \left(\frac{1}{2^r} + \frac{3^r}{2^{2r}} + \frac{7^r}{2^{3r}} + \dots \text{upto } m \text{ terms} \right)$$

55. k^{th} term of $f(n, r)$ will be

- (A) $\frac{1}{2^{kn}}$ (B) $\frac{1}{2^{(k-1)n}}$ (C) $-\frac{1}{2^{kn}}$ (D) $\frac{-1}{2^{(k-1)n}}$

56. $f(n, r)$ will be

- (A) $\frac{2^{mn} - 1}{2^{mn}(2^{n-1})}$ (B) $\frac{2^{mn} + 1}{2^{mn}(2^{n-1})}$ (C) $\frac{2^{m-1}}{2^n - 1}$ (D) $\frac{2^{mn} - 1}{2^{mn}(2^n - 1)}$

SECTION – III: (Matching List Type)

This section contains 4 questions, each having two matching lists. Choices for the correct combination of elements from List-I and List-II are given as option (A), (B), (C) and (D) out of which **ONLY ONE** is correct.

57. Match the following

	Column – I		Column – II
(P)	${}^{32}C_0^2 - {}^{32}C_1^2 + {}^{32}C_2^2 - \dots + {}^{32}C_{32}^2 =$	(1)	${}^{63}C_{32}$
(Q)	${}^{32}C_0^2 + {}^{32}C_1^2 + {}^{32}C_2^2 - \dots + {}^{32}C_{32}^2 =$	(2)	${}^{32}C_{16}$
(R)	$\frac{1}{32} (1 \times {}^{32}C_1^2 + 2 \times {}^{32}C_2^2 + \dots + 32 \times {}^{32}C_{32}^2) =$	(3)	0
(S)	${}^{31}C_0^2 - {}^{31}C_1^2 + {}^{31}C_2^2 - \dots - {}^{31}C_{31}^2 =$	(4)	${}^{64}C_{32}$

Code:

	P	Q	R	S
(A)	1	4	3	2
(B)	2	4	1	3
(C)	2	3	4	1
(D)	2	1	4	3

Space for rough work

58. Observe the following columns :

Column - I		Column - II	
(P)	Number of distinct terms in the expansion of $(x+y-z)^{16}$	(1)	2^{12}
(Q)	Number of terms in the expansion of $(x + \sqrt{x^2 - 1})^6 + (x - \sqrt{x^2 - 1})^6$	(2)	97
(R)	The number of irrational terms in $(\sqrt[8]{5} + \sqrt[6]{2})^{100}$	(3)	4
(S)	The sum of numerical coefficients in the expansion of $(1 + \frac{x}{3} + \frac{2y}{3})^{12}$	(4)	153

Code:

	P	Q	R	S
(A)	1	4	3	2
(B)	2	4	1	3
(C)	2	3	4	1
(D)	4	3	2	1

59. Match the following

Column - I		Column - II	
(P)	If the coefficient of x^2 and x^3 in $(3 + \alpha x)^9$ are equal, then value of α is	(1)	$\frac{4}{7}$
(Q)	If a denote the coefficient of x^n in $(1 + x)^{2n}$ and b denote the coefficient of x^{n-1} in $(1 + x)^{2n-1}$, then $\left(\frac{a-b}{a+b}\right)^3$ equals	(2)	$\frac{9}{7}$
(R)	If $\{x\}$ denote the fractional part of x, then $\left\{\frac{3^{2008}}{7}\right\}$ is	(3)	$\frac{1}{27}$
(S)	The term independent of x in the expansion of $(1+x+2x^2)\left(\frac{3x^2}{2} + \frac{1}{3x}\right)^7$	(4)	$\frac{7}{12}$

Code:

	P	Q	R	S
(A)	1	4	3	2
(B)	2	3	1	4
(C)	2	3	4	1
(D)	2	1	4	3

Space for rough work

60. Match the following

Column - I		Column - II	
(P)	If ${}^{(n+1)}C_4 + {}^{(n+1)}C_3 + {}^{(n+2)}C_3 > {}^{(n+3)}C_3$, then value of n is not less than	(1)	7
(Q)	The remainder when $(3053)^{456} - (2417)^{333}$ is divided by 9 is	(2)	9
(R)	The digit in the unit place of the number $183! + 3^{183}$ is	(3)	2
(S)	If sum of the coefficients of the first, second and third terms of the expansion of $\left(x^2 + \frac{1}{x}\right)^m$ is 46, then the index of the term that does not contain x is	(4)	5

Code:

	P	Q	R	S
(A)	1	4	3	2
(B)	2	3	1	4
(C)	4	3	1	2
(D)	2	1	4	3

pace for rough work

FIITJEE RET – 2**(2017 – 2019)(2ND YEAR_REGULAR)****IIT-2014 (P2)_SET-A****DATE: 18.06.2018****ANSWERS****PHYSICS**

1. D	2. A	3. B	4. C
5. C	6. B	7. A	8. B
9. B	10. C	11. A	12. C
13. C	14. B	15. C	16. A
17. C	18. C	19. BONUS	20. D

CHEMISTRY

21. D	22. A	23. C	24. D
25. A	26. C	27. A	28. D
29. C	30. B	31. B	32. C
33. B	34. C	35. B	36. B
37. C	38. B	39. A	40. BONUS

MATHEMATICS

41. B	42. B	43. B	44. C
45. A	46. A	47. D	48. A
49. D	50. B	51. C	52. D
53. C	54. A	55. A	56. D
57. B	58. D	59. B	60. C

FIITJEE RET – 2

(2017 – 2019)(2ND YEAR_REGULAR)

IIT-2014 (P2)_SET-B

DATE: 18.06.2018

Time: 3 hours

Maximum Marks: 180

INSTRUCTIONS:

A. General

1. This booklet is your Question Paper containing 60 questions.
6. 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.
7. Fill in the boxes provided for Name and Enrolment No.
8. The answer sheet, a machine-readable Objective Response (ORS), is provided separately.
9. 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:

12. The question paper consists of **3 parts (Physics, Chemistry and Mathematics)**. Each part consists of **three sections**.
13. **Section I** contains **10 multiple choice questions**. Each question has four choices (A), (B), (C) and (D) out of which **ONE** is correct.
14. **Section II** contains **3 paragraphs**. Each describing theory, experiment, data etc., **Six questions** related to three paragraphs with two questions on each paragraph. Each question to a particular passage should have **ONLY ONE correct answer** among the four given choices (A), (B), (C) and (D).
15. **Section III** contains **4 Multiple choice questions**. Each question has two lists (List-1: P, Q, R and S; List-2: 1, 2, 3 and 4). The options for the correct match are provided as (A), (B), (C) and (D) out of which **ONLY ONE is correct**.

D. Marking Scheme

16. For each question in **Section 1, 2 and 3** you will be awarded **3 marks** if you darken the bubble corresponding to the correct answer and **zero mark** if no bubble is darkened. In all other cases, **minus one (-1) mark** will be awarded.

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.:

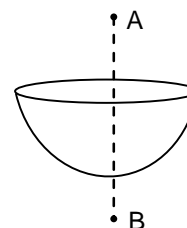
PAPER – II
PART I: PHYSICS

SECTION – I: Single Correct Answer Type

The section contains **10 multiple choice questions**. Each question has four choices (A), (B), (C) and (D) out of which **ONLY ONE is correct**.

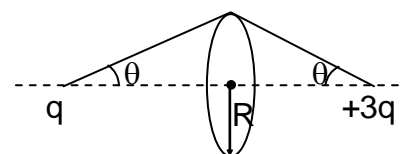
1. Figure shows a uniformly charged hemisphere of radius R . It has a volume charge density ρ . If the electric field at a point $2R$, above its center is E , then what is the electric field at the point $2R$ below its center?

- (A) $\frac{\rho R}{6\epsilon_0} + E$ (B) $\frac{\rho R}{12\epsilon_0} - E$
(C) $-\frac{\rho R}{6\epsilon_0} + E$ (D) $\frac{\rho R}{12\epsilon_0} + E$



2. Find the electric flux through a disc of radius R kept parallel to XY axis and whose centre is at $(0, 0, a)$.

- (A) $\phi = \frac{q}{\epsilon_0}(1 - \cos \theta)$ (B) $\phi = \frac{2q}{\epsilon_0}(1 - \cos \theta)$
(C) $\phi = \frac{q}{2\epsilon_0}(1 - \cos \theta)$ (D) zero

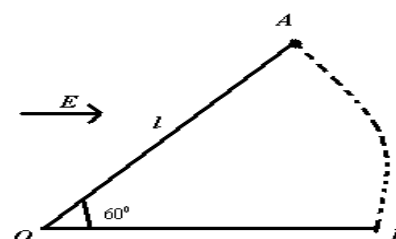


3. A Gaussian surface. Then incorrect statement is

- (A) must not pass through any discrete charge
(B) must pass through any material medium whether conducting or non – conducting
(C) may pass through a continuous charge distribution
(D) may pass through a region where no material medium is present

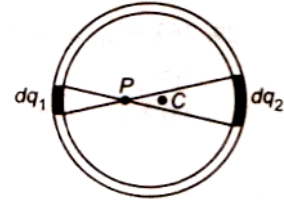
4. A particle of mass m and charge q is fastened to one end of a string fixed a point O . The whole system lies on a frictionless horizontal plane. Initially, the mass is at rest at A . A uniform electric field in the direction shown is then switched on. Then correct statement is

- (A) The speed of the particle when it reaches B is $\sqrt{\frac{2qEl}{m}}$
(B) The tension in the string when particle reaches at B is $2qE$.
(C) The tension in the string when particle reaches at B is qE .
(D) None



Space for rough work

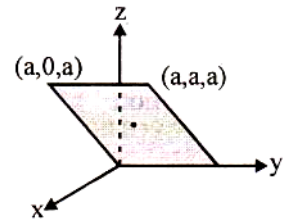
5. The net electric field due to dq_1 and dq_2 of a uniform surface charged spherical shell is
 (A) directed towards right
 (B) directed towards left
 (C) zero
 (D) directed towards the centre C



6. A cone made of insulating material has a total charge Q spread uniformly over its sloping surface. The energy required to take a test charge q from infinity to apex A of cone is given by $\frac{2Qq}{S\pi\epsilon_0 L}$. The slant length is L . Then find S .
 (A) 3 (B) 5
 (C) 7 (D) None

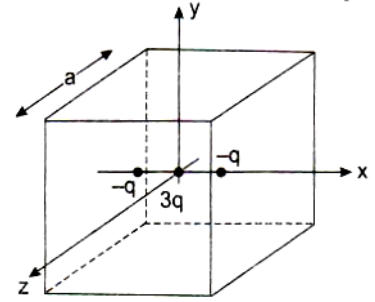


7. Consider an electric field $\vec{E} = E_0 \hat{x}$, where E_0 is a constant. The flux through the shaded area (as shown in the figure) due to this field is $YE_0 a^x$ then $x - y = ?$
 (A) 1 (B) 2
 (C) 8 (D) 9



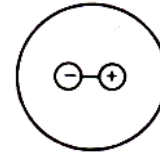
Space for rough work

8. A cubical region of side a has its centre at the origin. It enclose three fixed point charges, $-q$ at $(a, -a/4, 0)$, $+3q$ at $(0, 0, 0)$ and $-q$ at $(0, +a/4, 0)$. Choose the incorrect option



- (A) The net electric flux crossing the plane $x = +a/2$ is equal to the net electric flux crossing the plane $x = -a/2$
- (B) The net electric flux crossing the plane $y = +a/2$ is more than the net electric flux crossing the plane $y = -a/2$
- (C) The net electric flux crossing the entire region is $\frac{q}{\epsilon_0}$.
- (D) The net electric flux crossing the plane $z = +a/2$ is equal to the net electric flux crossing the plane $x = +a/2$.

9. Consider a Gaussian spherical surface covering a dipole of charge q and $-q$, then. Incorrect statement is

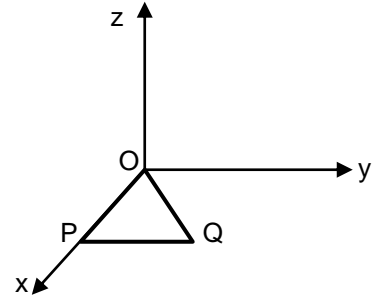


- (A) $q_{in} = 0$ (Net charge enclosed by the spherical surface)
- (B) $\phi_{net} = 0$ (Net flux coming out the spherical surface)
- (C) $E = 0$ at all points on the spherical surface
- (D) $\int \vec{E} \cdot d\vec{s} = 0$ (surface integral of \vec{E} over the spherical surface)

Space for rough work

- 10 A charge $8q$ is placed at $(0, 0, a)$. The flux through a triangle shaped area OPQ is then find the value of n ? The length of the side OP as well as PQ is 'a'.

- (A) $\frac{q}{2\epsilon_0}$ (B) $\frac{q}{4\epsilon_0}$
 (C) $\frac{q}{6\epsilon_0}$ (D) None

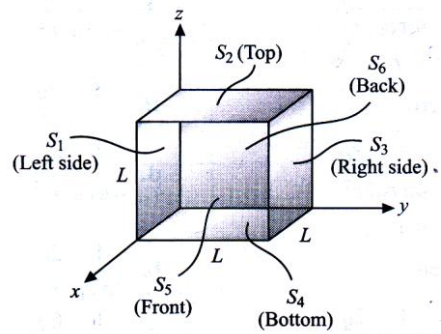


SECTION – II: Paragraph Type

This section contains **3 paragraphs** each describing theory, experiment, data etc., **Six questions** relate to three paragraphs with two question on each paragraph. Each question of a paragraph has **only one correct answer** among the four choices (A), (B), (C) and (D).

Paragraph For Questions 11 & 12

The cube as shown has sides of length $L = 10.0$ cm. The electric field is uniform, has a magnitude $E = 4.00 \times 10^3 \text{ NC}^{-1}$, and is parallel to the xy -plane at an angle of 37° measured from the $+x$ -axis toward the $+y$ -axis.



11. Which of the surfaces have zero flux?
 (A) S_1 and S_3 (B) S_5 and S_6 (C) S_2 and S_4 (D) S_2 and S_1
12. Electric flux passing through the surface S_1 is
 (A) $-24 \text{ N-m}^2 \text{ C}^{-1}$ (B) $24 \text{ N-m}^2 \text{ C}^{-1}$ (C) $32 \text{ N-m}^2 \text{ C}^{-1}$ (D) $-32 \text{ N-m}^2 \text{ C}^{-1}$

Space for rough work

Paragraph For Questions 13 & 14

A small sphere is charged uniformly and placed at point A so that the sphere produces electric field strength $\vec{E} = (54\hat{i} + 72\hat{j}) \text{NC}^{-1}$ and potential +900 volt at a point B of position coordinates (8m, 7m).

13. Charge on the sphere is _____
 (A) $1\mu\text{C}$ (B) $2\mu\text{C}$ (C) $3\mu\text{C}$ (D) $4\mu\text{C}$
14. Co-ordinates of point A are
 (A) (1m, 2m) (B) (2m, 1m) (C) (2m, -1m) (D) (1m, -2m)

Paragraph For Questions 15 & 16

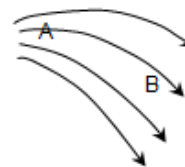
The line of force in an electric field is an imaginary line, the tangent to which at any point on it represents the direction of electric field at the given point. Line of force originates out from a positive charge and terminates on a negative charge. If there is only one positive charge then lines start from positive charge and terminate at ∞ .
 If lines are dense \Rightarrow E will be more

Number of lines originating (terminating) is proportional to the charge. Electric lines of force end or start perpendicularly on the surface of a conductor. Electric lines of force never enter into conductors.

With the information given above, indicate the right answers for the following two questions:

15. Three lines of force are shown in figure, for point A and B. Then which of the following is true?

- (A) $E_B > E_A$ (B) $E_B = E_A$
 (C) $V_A > V_B$ (D) $V_A = V_B$



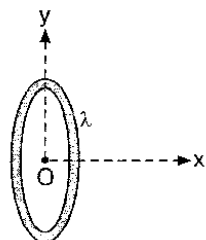
16. If a charge is released in electric field,
 (A) It always follows the lines of force.
 (B) It follows lines of force only when the lines are parallel.
 (C) It follows lines of force only when the lines are curved.
 (D) It can never follow the lines of force.

Space for rough work

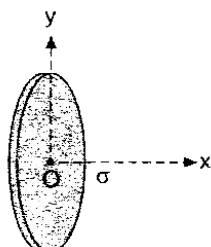
SECTION – III: (Matching List Type)

This section contains 4 questions, each having two matching lists. Choices for the correct combination of elements from List-I and List-II are given as option (A), (B), (C) and (D) out of which **ONLY ONE** is correct.

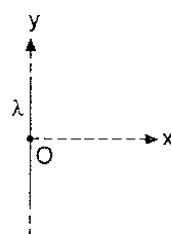
17. Figure (A) and (B) show a uniformly charged ring and a uniformly charged disc of large radius R , Figure (C) is a uniformly charged infinite thread along Y-axis and figure (D) shows a uniformly charged infinite sheet. In each figure let us consider the point O as the reference and then move away from O along the $+x$ axis. If E_1, E_2, E_3 and E_4 be the respective fields, then match the contents of COLUMN-I with those of COLUMN-II.



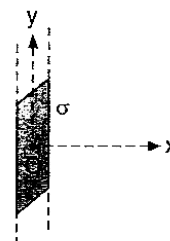
Ring of finite radius
(A)



Disc of large radius
(B)



Infinite line of charge
(C)



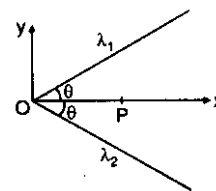
Infinite sheet of charge
(D)

	Column I		Column II
(P)	E_2	(1)	decreases
(Q)	E_4	(2)	is constant near it and then decreases
(R)	E_1	(3)	is constant
(S)	E_3	(4)	first increases and then decreases

	P	Q	R	S
(A)	3	3	1	1
(B)	1	2	4	3
(C)	1	2	4	1
(D)	4	3	1	1

Space for rough work

18. Two infinitely long line charges λ_1 and λ_2 are placed symmetric to x-axis as shown in figure. Match the following for direction of electric field at point P on the x-axis: (θ is obtuse angle)



Column-I		Column-II	
(P)	both λ_1 and λ_2 are positive	(1)	positive x-axis
(Q)	both λ_1 and λ_2 are negative	(2)	negative x-axis
(R)	λ_1 is positive but λ_2 is negative	(3)	positive y-axis
(S)	λ_1 is negative but λ_2 is positive	(4)	negative y-axis

	P	Q	R	S
(A)	2	1	3	4
(B)	2	1	4	3
(C)	1	2	3	4
(D)	1	2	4	3

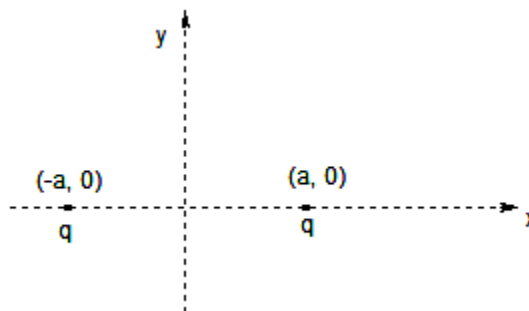
19. Match the Column - I with Column - II

Column - I		Column - II	
(P)	A circular ring of radius R with uniformly distributed charge q.	(1)	$E_x = \frac{\lambda}{4\pi\epsilon_0 x} [\sin\alpha + \sin\beta]$
(Q)	A circular disc of radius R with uniformly distributed surface charge density σ .	(2)	$E = \frac{1}{4\pi\epsilon_0} \frac{qx}{(R^2 + x^2)^{3/2}}$
(R)	An infinite sheet of uniformly distributed charges with density σ .	(3)	$E = \frac{\sigma}{2\epsilon_0} \left[1 - \frac{x}{\sqrt{x^2 + R^2}} \right]$
(S)	A finite line of charge with constant linear charged density λ along Y- axis.	(4)	$E = \frac{\sigma}{2\epsilon_0}$

	P	Q	R	S
(A)	1	2	4	3
(B)	4	3	1	2
(C)	2	3	4	1
(D)	1	4	3	2

Space for rough work

20. Two isolated point charges are fixed in the positions shown on x-axis. Each of the charge are positive and are located at $(-a, 0)$ and $(a, 0)$.



Note: In all graphs in column-II, Field or potential is along y-axis and distance along x-axis

Column - I		Column - II	
(P)	Variation of magnitude of electric field along x-axis from $x \rightarrow -\infty$ to $x \rightarrow \infty$	(1)	
(Q)	Variation of magnitude of electric field along y-axis from $y \rightarrow -\infty$ to $y \rightarrow \infty$	(2)	
(R)	Variation of electric potential along x-axis from $x \rightarrow -\infty$ to $x \rightarrow +\infty$	(3)	
(S)	Variation of electric potential along y-axis from $y \rightarrow -\infty$ to $y \rightarrow \infty$	(4)	
		(5)	None

	P	Q	R	S
(A)	1	3	4	2
(B)	2	4	1	3
(C)	4	1	2	3
(D)	1	2	3	4

Space for rough work

PART II: CHEMISTRY

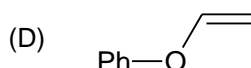
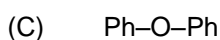
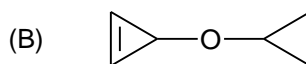
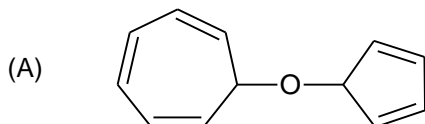
SECTION – I: Single Correct Answer Type

The section contains **10 multiple choice questions**. Each question has four choices (A), (B), (C) and (D) out of which **ONLY ONE is correct**.

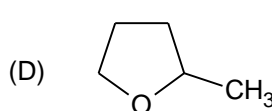
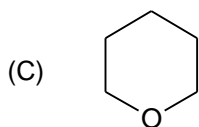
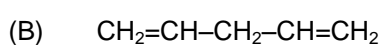
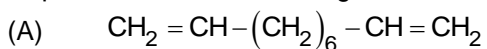
21. In which of the following reaction, Ethanol acts as a base.

- (A) Reaction with Metallic sodium
 (B) Reaction with Grignard reagent
 (C) Acid catalysed dehydration
 (D) Both b & c

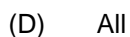
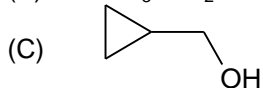
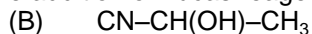
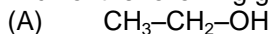
22. Which of the following reactivity is highest with HI to give alkyl iodide and alcohol.



23. The product 'B' in the following reaction is $\text{CH}_2=\text{CH}-\text{CH}_2-\text{CH}_2-\text{CH}_2-\text{Br} \xrightarrow{\text{H}^+/\text{H}_2\text{O}} \text{A} \xrightarrow{\text{Na}} \text{B}$

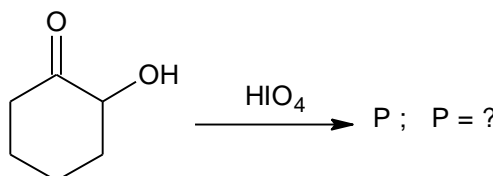


24. Which of the following gives turbidity on simple addition of Lucas reagent.



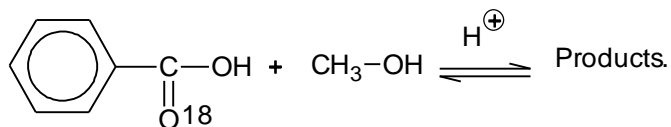
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25.



- (A) $\text{CHO}-(\text{-CH}_2\text{-})_4\text{-CHO}$ (B) $\text{OHC}-(\text{-CH}_2\text{-})_4\text{-COOH}$
 (C) $\text{HOOC}-(\text{-CH}_2\text{-})_4\text{-COOH}$ (D) $\text{HOCH}_2-(\text{-CH}_2\text{-})_4\text{-CH}_2\text{OH}$

26.



The possible products are

- (A) (B)
 (C) (D) Both a & b

27. $\text{CH}_3-\text{CH}_2-\text{CH}_2-\text{OH} \xrightleftharpoons[\text{B}]{\text{A}} \text{CH}_3-\text{CH}_2-\text{COOH}$. The reagent A and B are

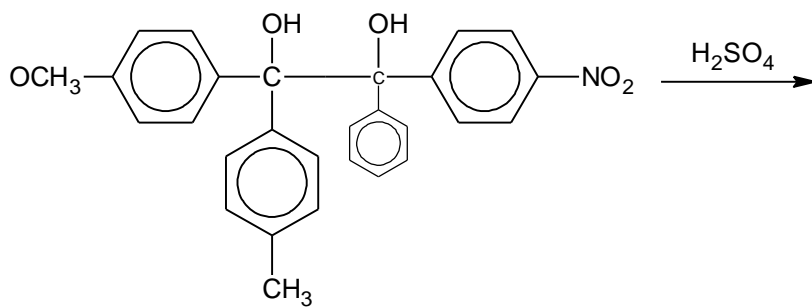
- (A) $\text{K}_2\text{Cr}_2\text{O}_7, \text{LiAlH}_4$ (B) $\text{PCC}, \text{LiAlH}_4$
 (C) $\text{KMnO}_4, \text{NaBH}_4$ (D) Both a & c

28. $\text{C}_2\text{H}_5\text{OH}$ when treated with $\text{Al}_2\text{O}_3/\text{AlPO}_4$ at 250°C gives a compound 'A'. Which on treatment with concentrated HI on cold condition gives

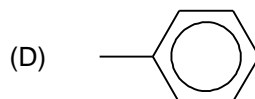
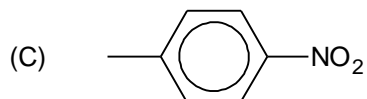
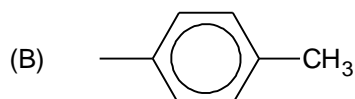
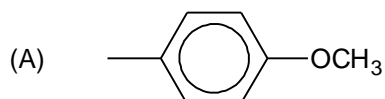
- (A) $\text{C}_2\text{H}_5\text{OH}$ (B) $\text{C}_2\text{H}_5\text{I}$ (C) Both a & b (D) $\text{CH}_2=\text{CH}_2$

Space for rough work

29.



In the above process the group which get migrated to give ketone.



30. In no. of equivalents of HIO_4 required to complete the oxidation of 2, 3, 5 trihydroxy hexanoic acid.
 (A) 1 (B) 2 (C) 3 (D) 4

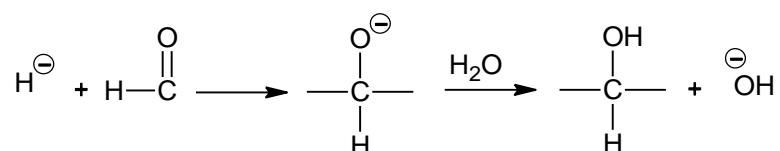
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SECTION – II: Paragraph Type

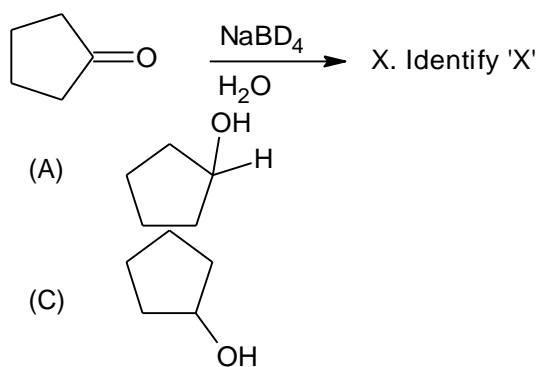
This section contains **3 paragraphs** each describing theory, experiment, data etc., **Six questions** relate to three paragraphs with two question on each paragraph. Each question of a paragraph has **only one correct answer** among the four choices (A), (B), (C) and (D).

Paragraph For Questions 31 & 32

Carbon –oxygen double bond is easily reduced by NaBH_4 or LiAlH_4 . The metal hydrogen bond is more polar in LiAlH_4 than in NaBH_4 . As a result LiAlH_4 is a stronger reducing agent than NaBH_4 . The actual reducing agent in these reactions is a $\text{H}^{(-)}$ ion.

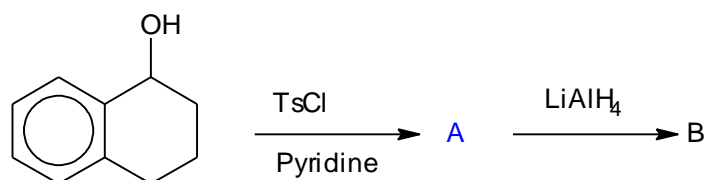


31.

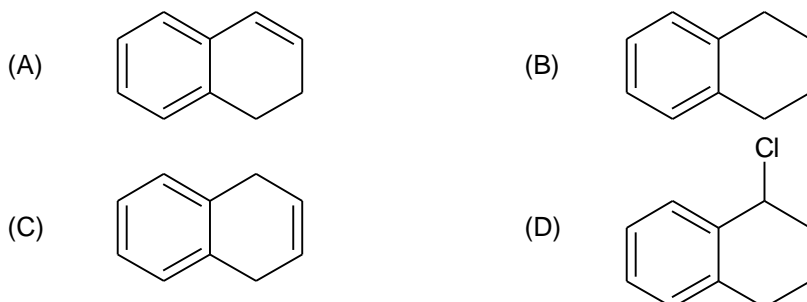


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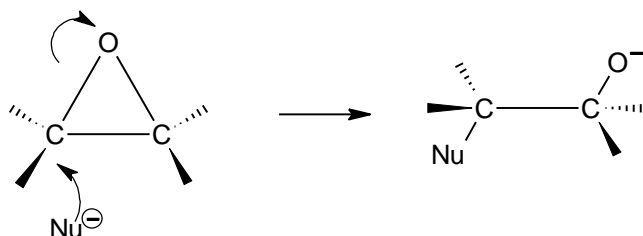
32.



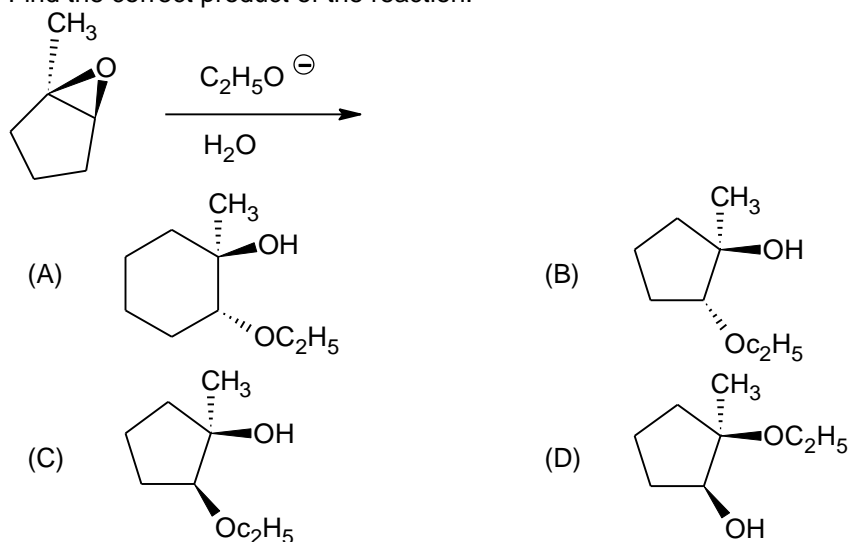
Product B at the above reaction is

**Paragraph For Questions 33 & 34**

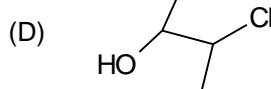
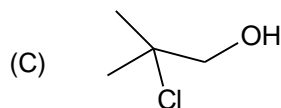
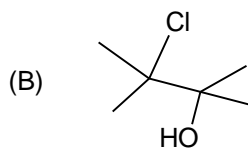
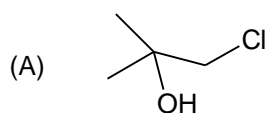
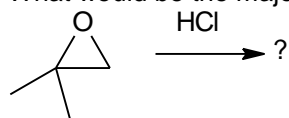
Although epoxides do not contain a good leaving group, they contain a strained 3-membered ring with polar bonds. Nu^- attack opens the strained 3-membered ring, making it a favourable process even with the poor leaving group.



33. Find the correct product of the reaction.

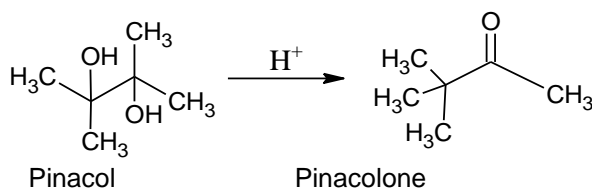
**Space for rough work**

34. What would be the major product of the reaction.

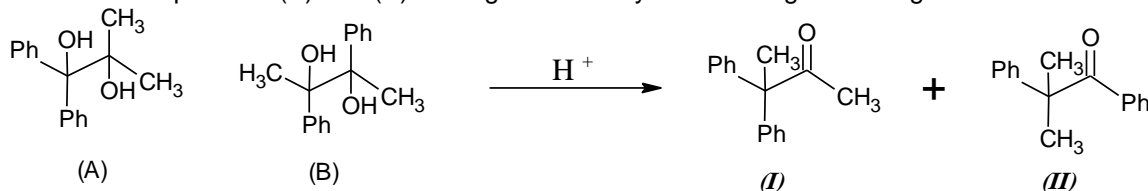


Paragraph For Questions 35 & 36

When 1,2- or vic- diols are treated with acids they undergo facile dehydrative rearrangement to yield ketones or aldehydes. This is called pinacol - pinacolone rearrangement. The reaction proceeds via formation of an intermediate carbocation.



35. Two isomeric pinacols (A) and (B) undergo acid catalysed rearrangement to give



(A) only (II)

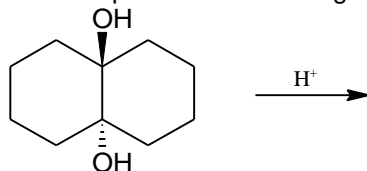
(B) Only (I)

(C) (A) gives (I) and (B) gives (II)

(D) (A) gives (II) and (B) gives (I)

Space for rough work

36. The compound on reaction gives a pinacolone having a combination of



- (A) Six member ring and a four member ring (B) Two five member rings
(C) Six member ring and a five member ring (D) Seven member and a three member ring

SECTION – III: (Matching List Type)

This section contains 4 questions, each having two matching lists. Choices for the correct combination of elements from List-I and List-II are given as option (A), (B), (C) and (D) out of which **ONLY ONE** is correct.

- 37.

Column – I		Column – II	
(P)	One of the product is halogen derivative of alkane	(1)	$\text{CH}_3 - \text{CH}_2 - \text{OH} \xrightarrow[\text{CaOCl}_2]{\text{moist}} \text{Products}$
(Q)	One of the product is salt of carboxylic acid	(2)	$\text{CH}_3 - \text{CH}(\text{OH}) - \text{CH}_3 \xrightarrow[300^\circ\text{C}]{\text{Cu}} \text{Products}$
(R)	One of the product is carbonyl compound	(3)	$\text{CH}_3 - \text{COOC}_2\text{H}_5 \xrightarrow[\text{Hydrolysis}]{\text{Base}} \text{Products}$
(S)	One of the product is an alcohol	(4)	$\text{CH}_3 - \text{CH}_2 - \text{O} - \text{CH}_2 - \text{CH}_3 \xrightarrow[\text{HI}]{\text{dil.}} \text{Products}$

Code:

	P	Q	R	S
(A)	1, 4	3	2	3, 4
(B)	1, 3	2	3	1, 4
(C)	2, 3	1	4	2, 3
(D)	2, 4	4	1	2, 1

Space for rough work

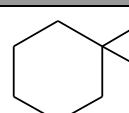
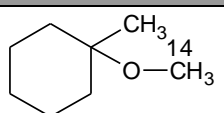
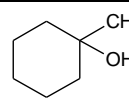
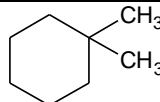
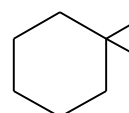
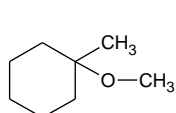
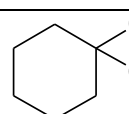
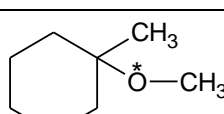
38.

Column – I		Column – II	
(P)	$\text{PhMgI} + \text{CH}_3\text{CHO} \rightarrow$	(1)	Nucleophilic substitution
(Q)	$\text{CH}_3\text{CH}_2\text{CH}_2\text{OH} + \text{SOCl}_2 \rightarrow$	(2)	Nucleophilic addition
(R)	$(\text{CH}_3)_2\text{CHCl} \xrightarrow[\Delta]{\text{Ag}_2\text{O}/\text{H}_2\text{O}}$	(3)	Molecular rearrangement
(S)	$(\text{CH}_3)_2\text{C}(\text{OH})-\text{C}(\text{OH})(\text{CH}_3)_2 \xrightarrow{\text{H}_2\text{SO}_4}$	(4)	Dehydration

Code:

	P	Q	R	S
(A)	2	1	3, 4	4, 3
(B)	3	4	1, 4	3, 4
(C)	1	3	2, 4	2, 3
(D)	4	2	4, 1	1, 2

39.

Column – I (Reactant)		Column – II (Products)	
(P)	 $\xrightarrow[\text{H}_2\text{SO}_4 (\text{Conc.})]{\text{CH}_3\text{OH}}$	(1)	
(Q)	 $\xrightarrow[\text{(ii) CH}_3\text{I}]{\text{(i) NaOH}}$	(2)	
(R)	 $\xrightarrow[\text{3) CH}_3\text{I}]{\begin{matrix} \text{1) HBr} \\ \text{2) Mg} \end{matrix}}$	(3)	
(S)	 $\xrightarrow[\text{2) } ^{14}\text{CH}_3\text{I}]{\text{1) Na}}$	(4)	

Code:

	P	Q	R	S
(A)	4	2	3	1
(B)	3	2	4	1
(C)	3	3	2	1
(D)	2	4	3	1

Space for rough work

40.

Column – I (Reaction)		Column – II (Products)	
(P)	Glycerol $\xrightarrow{\text{KHSO}_4}$	(1)	2-Methyl propene
(Q)	Ethylene glycol $\xrightarrow{\text{HIO}_4}$	(2)	HCOOH
(R)	Glycerol $\xrightarrow[110^\circ\text{C}]{\begin{array}{c} \text{COOH} \\ \\ \text{COOH} \end{array}}$	(3)	HCHO
(S)	t-Butanol $\xrightarrow[300^\circ\text{C}]{\text{Cu}}$	(4)	Acrolein

Code:

	P	Q	R	S
(A)	1	3	2	4
(B)	4	3	2	1
(C)	1	2	3	4
(D)	4	2	3	1

PART III: MATHEMATICS

SECTION – I: Single Correct Answer Type

The section contains **10 multiple choice questions**. Each question has four choices (A), (B), (C) and (D) out of which **ONLY ONE is correct**.

41. The value of $\sum_{r=0}^{10} (r)^{20} C_r$ is equal to
 (A) $10 \cdot 2^{19}$ (B) $20 (2^{18} + {}^{19}C_{10})$ (C) $20 (2^{18} + {}^{19}C_{11})$ (D) $10 (2^{18} + {}^{19}C_{11})$
42. 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) ${}^n C_r 2^r$
43. 'p' is a prime number and $n < p < 2n$. If $N = {}^{2n} C_n$, then
 (A) p divides N (B) p^2 divides N (C) p cannot divide N (D) none of these

Space for rough work

44. 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
45. ${}^{404}C_4 - {}^4C_1 {}^{303}C_4 + {}^4C_2 {}^{202}C_4 - {}^4C_3 {}^{101}C_4$ is equal to
 (A) $(401)^4$ (B) $(101)^4$ (C) 0 (D) $(201)^4$
46. The value of $\binom{30}{0}\binom{30}{10} - \binom{30}{1}\binom{30}{11} + \binom{30}{2}\binom{30}{12} + \dots + \binom{30}{20}\binom{30}{30} =$
 (A) ${}^{60}C_{20}$ (B) ${}^{30}C_{10}$ (C) ${}^{60}C_{30}$ (D) ${}^{40}C_{30}$
47. The value of ${}^{20}C_0 + {}^{20}C_1 + {}^{20}C_2 + {}^{20}C_3 + {}^{20}C_4 + {}^{20}C_{12} + {}^{20}C_{13} + {}^{20}C_{14} + {}^{20}C_{15}$ is
 (A) $2^{19} - \frac{({}^{20}C_{10} + {}^{20}C_9)}{2}$ (B) $2^{19} - \frac{({}^{20}C_{10} + 2 \times {}^{20}C_9)}{2}$
 (C) $2^{19} - \frac{{}^{20}C_{10}}{2}$ (D) none of these
48. If $C_0, C_1, C_2, \dots, C_n$ are the binomial coefficients, then $2 \times C_1 + 2^3 \times C_3 + 2^5 \times C_5 + \dots$ equals
 (A) $\frac{3^n + (-1)^n}{2}$ (B) $\frac{3 - (-1)^n}{2}$ (C) $\frac{3^n + 1}{2}$ (D) $\frac{3^n - 1}{2}$
49. $(1 + x)^n = C_0 + C_1x + C_2x^2 + \dots + C_nx^n$, then $C_0C_2 + C_1C_3 + C_2C_4 + \dots + C_{n-2}C_n =$
 (A) $\frac{(2n)!}{(n!)^2}$ (B) $\frac{(2n)!}{(n-1)!(n+1)!}$ (C) $\frac{(2n)!}{(n-2)!(n+2)!}$ (D) none of these
50. 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) $-{}^{20}C_{10}$

Space for rough work

SECTION – II: Paragraph Type

This section contains **3 paragraphs** each describing theory, experiment, data etc., **Six questions** relate to three paragraphs with two question on each paragraph. Each question of a paragraph has **only one correct answer** among the four choices (A), (B), (C) and (D).

Paragraph For Questions 51 & 52

$$\text{Suppose } f(n, r) = \sum_{r=0}^n (-1)^r {}^n C_r \left(\frac{1}{2^r} + \frac{3^r}{2^{2r}} + \frac{7^r}{2^{3r}} + \dots \text{upto } m \text{ terms} \right)$$

51. k^{th} term of $f(n, r)$ will be

- (A) $\frac{1}{2^{kn}}$ (B) $\frac{1}{2^{(k-1)n}}$ (C) $-\frac{1}{2^{kn}}$ (D) $\frac{-1}{2^{(k-1)n}}$

52. $f(n, r)$ will be

- (A) $\frac{2^{mn} - 1}{2^{mn}(2^{n-1})}$ (B) $\frac{2^{mm} + 1}{2^{mn}(2^{n-1})}$ (C) $\frac{2^{m-1}}{2^n - 1}$ (D) $\frac{2^{mn} - 1}{2^{mn}(2^n - 1)}$

Paragraph For Questions 53 & 54

$$\text{Let } (x + 1)(x + 2)(x + 3)\dots(x + n) = x^n + A_1x^{n-1} + A_2x^{n-2} + A_3x^{n-3} + \dots + A_n$$

53. $A_1 + A_n =$

- (A) $\frac{n}{2} + n!$ (B) $\frac{n+1}{2} + n!$ (C) $\frac{n(n+1)}{2} + n!$ (D) $(n + 1)!$

54. $A_2 =$

- (A) $\frac{(n-1)n(n+1)}{12}$ (B) $\frac{n(n+1)n(3n+1)}{12}$ (C) $\frac{(n+1)(3n+1)}{24}$ (D) $\frac{(n-1)n(n+1)(3n+2)}{24}$

Paragraph For Questions 55 & 56

If $m, n, r \in \mathbb{N}$, then ${}^m C_0 \cdot {}^n C_r + {}^m C_1 \cdot {}^n C_{r-1} + {}^m C_2 \cdot {}^n C_{r-2} + \dots + {}^m C_r \cdot {}^n C_0 =$ coefficient of x^r in

$$(1+x)^m (1+x)^n = \text{coefficient of } x^r \text{ in } (1+x)^{m+n} = {}^{(m+n)} C_r$$

We can use similar techniques to evaluate product of binomial coefficients.

55. The value of r for which $S \equiv {}^{20} C_r \cdot {}^{10} C_0 + {}^{20} C_{r-1} \cdot {}^{10} C_1 + \dots + {}^{20} C_0 \cdot {}^{10} C_r$ is maximum when $r =$

- (A) 7 (B) 8 (C) 10 (D) 15

Space for rough work

56. The value of r ($0 \leq r \leq 30$) is when S is least is
 (A) 0 (B) 1 (C) 10 (D) 15

SECTION – III: (Matching List Type)

This section contains 4 questions, each having two matching lists. Choices for the correct combination of elements from List-I and List-II are given as option (A), (B), (C) and (D) out of which **ONLY ONE** is correct.

57. Match the following

Column – I		Column – II	
(P)	If the coefficient of x^2 and x^3 in $(3 + \alpha x)^9$ are equal, then value of α is	(1)	$\frac{4}{7}$
(Q)	If a denote the coefficient of x^n in $(1 + x)^{2n}$ and b denote the coefficient of x^{n-1} in $(1 + x)^{2n-1}$, then $\left(\frac{a-b}{a+b}\right)^3$ equals	(2)	$\frac{9}{7}$
(R)	If $\{x\}$ denote the fractional part of x , then $\left\{\frac{3^{2008}}{7}\right\}$ is	(3)	$\frac{1}{27}$
(S)	The term independent of x in the expansion of $(1+x+2x^2)\left(\frac{3x^2}{2} + \frac{1}{3x}\right)^7$	(4)	$\frac{7}{12}$

Code:

	P	Q	R	S
(A)	1	4	3	2
(B)	2	3	1	4
(C)	2	3	4	1
(D)	2	1	4	3

58. Match the following

Column – I		Column – II	
(P)	If ${}^{(n+1)}C_4 + {}^{(n+1)}C_3 + {}^{(n+2)}C_3 > {}^{(n+3)}C_3$, then value of n is not less than	(1)	7
(Q)	The remainder when $(3053)^{456} - (2417)^{333}$ is divided by 9 is	(2)	9
(R)	The digit in the unit place of the number $183! + 3^{183}$ is	(3)	2
(S)	If sum of the coefficients of the first, second and third terms of the expansion of $\left(x^2 + \frac{1}{x}\right)^m$ is 46, then the index of the term that does not contain x is	(4)	5

Code:

	P	Q	R	S
(A)	1	4	3	2
(B)	2	3	1	4
(C)	4	3	1	2
(D)	2	1	4	3

Space for rough work

59. Match the following

	Column - I		Column - II
(P)	${}^{32}C_0 - {}^{32}C_1 + {}^{32}C_2 - \dots + {}^{32}C_{32} =$	(1)	${}^{63}C_{32}$
(Q)	${}^{32}C_0 + {}^{32}C_1 + {}^{32}C_2 - \dots + {}^{32}C_{32} =$	(2)	${}^{32}C_{16}$
(R)	$\frac{1}{32} (1 \times {}^{32}C_1 + 2 \times {}^{32}C_2 + \dots + 32 \times {}^{32}C_{32}) =$	(3)	0
(S)	${}^{31}C_0 - {}^{31}C_1 + {}^{31}C_2 - \dots - {}^{31}C_{31} =$	(4)	${}^{64}C_{32}$

Code:

	P	Q	R	S
(A)	1	4	3	2
(B)	2	4	1	3
(C)	2	3	4	1
(D)	2	1	4	3

60. Observe the following columns :

	Column - I		Column - II
(P)	Number of distinct terms in the expansion of $(x+y-z)^{16}$	(1)	2^{12}
(Q)	Number of terms in the expansion of $(x + \sqrt{x^2 - 1})^6 + (x - \sqrt{x^2 - 1})^6$	(2)	97
(R)	The number of irrational terms in $(\sqrt[8]{5} + \sqrt[6]{2})^{100}$	(3)	4
(S)	The sum of numerical coefficients in the expansion of $(1 + \frac{x}{3} + \frac{2y}{3})^{12}$	(4)	153

Code:

	P	Q	R	S
(A)	1	4	3	2
(B)	2	4	1	3
(C)	2	3	4	1
(D)	4	3	2	1

pace for rough work

FIITJEE RET – 2

(2017 – 2019)(2ND YEAR_REGULAR)

IIT-2014 (P2)_SET-B

DATE: 18.06.2018

ANSWERS

PHYSICS

1. B	2. A	3. B	4. B
5. C	6. D	7. A	8. B
9. C	10. C	11. C	12. A
13. A	14. C	15. C	16. B
17. BONUS	18. D	19. C	20. C

CHEMISTRY

21. C	22. A	23. D	24. C
25. B	26. D	27. A	28. C
29. D	30. A	31. B	32. B
33. B	34. C	35. B	36. C
37. A	38. BONUS	39. C	40. B

MATHEMATICS

41. A	42. D	43. A	43. D
45. B	46. B	47. B	48. B
49. C	50. A	51. A	52. D
53. C	54. D	55. C	56. A
57. B	58. C	59. B	60. D