

FIITJEE RET – 2

(2017 – 2019)(2ND YEAR_CHAMPIONS)

IIT-2014 (P2)

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:

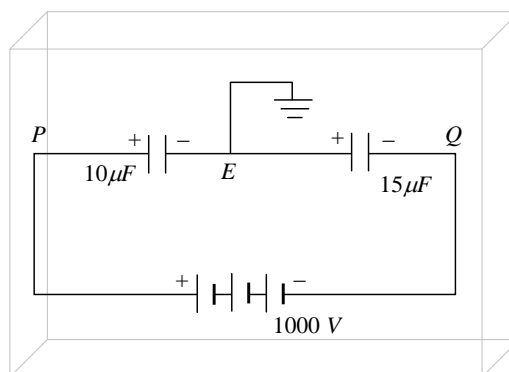
ENROLLMENT NO.:

PAPER – II
PART I: PHYSICS

SECTION – I: Single Correct Answer Type

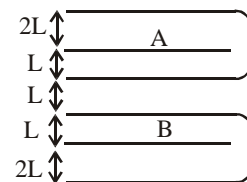
The section contains **10 multiple choice questions**. Each question has four choices (A), (B), (C) and (D) out of which **ONLY ONE is correct**.

- An air capacitor of capacity $C = 10\ \mu F$ is connected to a constant voltage battery of 12 V. Now the space between the plates is filled with a liquid of dielectric constant 5. The charge that flows now from battery to the capacitor is
(A) $120\ \mu C$ (B) $600\ \mu C$ (C) $480\ \mu C$ (D) $24\ \mu C$
- Two condensers of capacity C and $2C$ are connected in parallel and these are charged upto V volt. If the battery is removed and dielectric medium of constant K is put between the plates of first condenser, then the potential at each condenser is
(A) $\frac{V}{K+2}$ (B) $2 + \frac{K}{3V}$ (C) $\frac{2V}{K+2}$ (D) $\frac{3V}{K+2}$
- A $1\ \mu F$ capacitor and a $2\ \mu F$ capacitor are connected in parallel across a 1200 volts line. The charged capacitors are then disconnected from the line and from each other. These two capacitors are now connected to each other in parallel with terminals of unlike signs together. The charges on the capacitors will now be
(A) $1800\ \mu C$ each (B) $400\ \mu C$ and $800\ \mu C$ (C) $800\ \mu C$ and $400\ \mu C$ (D) $800\ \mu C$ and $800\ \mu C$
- The figure shows a circuit with E as the earthing of the common plate. The potentials at P and Q are
(A) $0\ V, -1000\ V$
(B) $1000\ V, 0\ V$
(C) $+600\ V, -400\ V$
(D) $+400\ V, -600\ V$



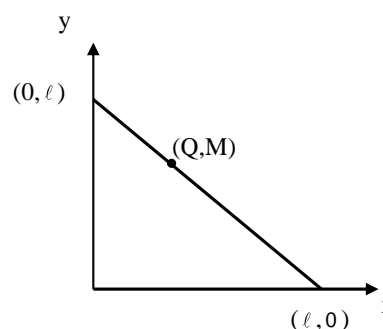
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5. In the arrangement shown, all plates have equal area. The amount of spacing between plates is mentioned. Find the equivalent capacitance of the system between A and B if $C = \frac{\epsilon_0 A}{L}$



- (A) $\frac{5}{7}C$ (B) $\frac{3}{7}C$ (C) $\frac{1}{7}C$ (D) None of these
6. A parallel plate capacitor C is connected to a battery and is charged to a potential difference V. Another capacitor of capacitance 2C is similarly charged to a potential difference 2V. The charging battery is now disconnected and the capacitors are connected in parallel to each other in such a way that the positive terminal of one is connected to the negative terminal of other. The final energy of the configuration is:
- (A) zero (B) $\frac{1}{2} CV^2$ (C) $\frac{3}{4} CV^2$ (D) $\frac{9}{4} CV^2$

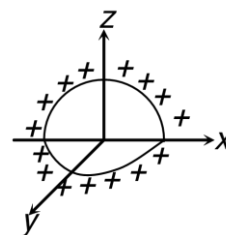
7. Electric field given by the vector $\vec{E} = \frac{E_0}{\ell} (x\hat{i} + y\hat{j})$ N/C is present in the $x - y$ plane. A small ring of mass M carrying charge +Q, which can slide freely on a smooth non conducting rod is projected along the rod from the point $(0, \ell)$ such that it can reach the other end of the rod. Assuming there is no gravity in the region. What minimum velocity should be given to the ring (in m/s), if $\frac{QE_0\ell}{M} = 8$?



- (A) 2 (B) 3
- (C) 2.5 (D) 3.5

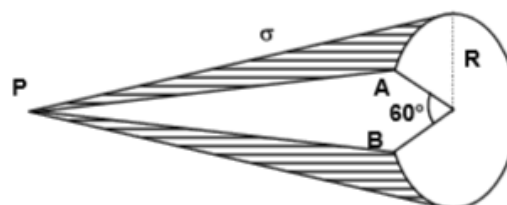
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8. In the given figure two semicircular wire is connected which are in x - y and x - z plane respectively. And $+2q_0$ charge is distributed over it, then what will be the magnitude of electric field intensity at the origin.



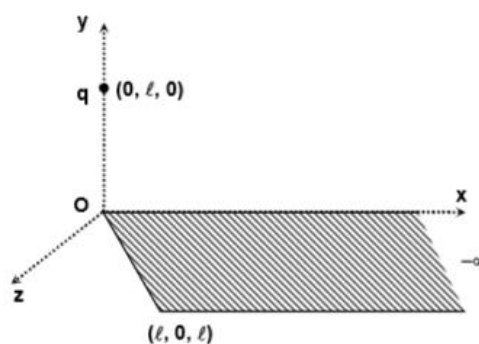
- (A) $\frac{q_0}{\pi\epsilon_0 R^2}$ (B) $\frac{4q_0^2}{\pi\epsilon_0 R^2}$
 (C) $\frac{q_0}{\sqrt{2}\pi^2\epsilon_0 R^2}$ (D) $\frac{q_0}{\sqrt{2}\pi\epsilon_0 R^2}$

9. A non – conducting hollow cone has charge density σ . A part ABP is cut and removed from the cone. The potential due to the remaining portion of the cone at point 'P' is



- (A) $\frac{5 \sigma R}{6 \epsilon_0}$ (B) $\frac{5 \sigma R}{24 \epsilon_0}$
 (C) $\frac{5 \sigma R}{3 \epsilon_0}$ (D) $\frac{5 \sigma R}{12 \epsilon_0}$

10. A point charge 'q' is placed at a distance ' ℓ ' (on the y -axis) vertically above the surface which lies in the xz plane as shown in the figure. The flux of electric field passing the plate is



- (A) $\frac{q}{6\epsilon_0}$ (B) $\frac{q}{18\epsilon_0}$
 (C) $\frac{q}{24\epsilon_0}$ (D) $\frac{q}{48\epsilon_0}$

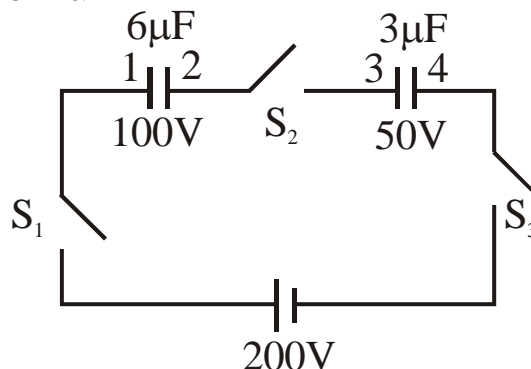
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SECTION – II: Paragraph Type

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 11 & 12

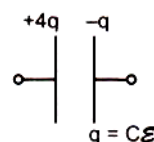
Two capacitors of capacity $6\ \mu\text{F}$ and $3\ \mu\text{F}$ are charged to $100\ \text{V}$ and $50\ \text{V}$ separately and connected as shown. Now all the three switches S_1 , S_2 and S_3 are closed.



11. Charges on $6\ \mu\text{F}$ and $3\ \mu\text{F}$ capacitors in steady state will be
 (A) $400\ \mu\text{C}$, $400\ \mu\text{C}$ (B) $700\ \mu\text{C}$, $250\ \mu\text{C}$ (C) $800\ \mu\text{C}$, $350\ \mu\text{C}$ (D) $300\ \mu\text{C}$, $450\ \mu\text{C}$.
12. Suppose q_1 , q_2 and q_3 be the magnitudes of charges flown from switches S_1 , S_2 and S_3 after they are closed. Then :
 (A) $q_1 = q_3$ and $q_2 = 0$ (B) $q_1 = q_3 = \frac{q_2}{2}$ (C) $q_1 = q_3 = 3q_2$ (D) $q_1 = q_2 = q_3$.

Paragraph For Questions 13 & 14

Two identical plates of a capacitor are given charges as shown in figure. Now this capacitor is connected to a battery of emf \mathcal{E} , with positive plate capacitor to positive terminal of battery.

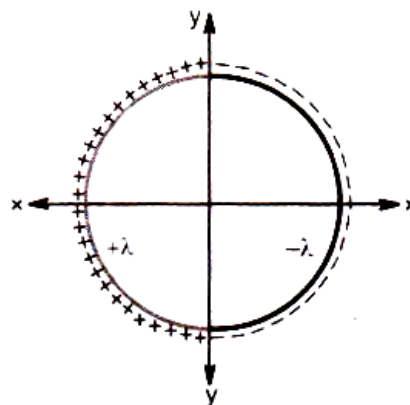


13. What is final charge on capacitor plates ?
 (A) $2C\mathcal{E}$ (B) $3C\mathcal{E}$ (C) $C\mathcal{E}$ (D) $\frac{3}{2}C\mathcal{E}$
14. Work done by battery is
 (A) $+2C\mathcal{E}^2$ (B) $-2C\mathcal{E}^2$ (C) $+C\mathcal{E}^2$ (D) $-C\mathcal{E}^2$

Space for rough work

Paragraph For Questions 15 & 16

A thin ring of radius R meters is placed in x - y plane such that its centre lies on origin. The half ring in region $x < 0$ carries uniform linear charge density $+\lambda$ C/m and the remaining half ring in region $x > 0$ carries uniform linear charge density $-\lambda$ C/m.



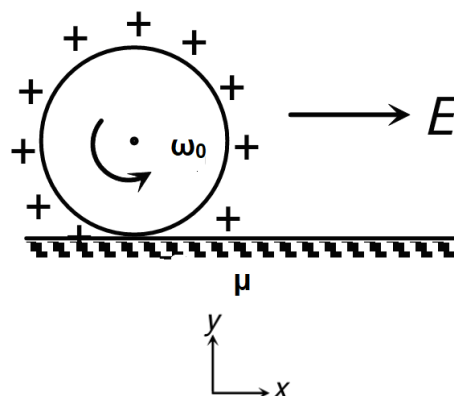
15. Then the direction of electric field at point P whose coordinates are $\left(0, +\frac{R}{2}\right)$ is
 (A) Along positive x -direction
 (B) Along negative x -direction
 (C) Along negative y -direction
 (D) None of these
16. Then the dipole moment of the ring in C- m is
 (A) $-(2\pi R^2\lambda)\hat{i}$ (B) $(2\pi R^2\lambda)\hat{i}$ (C) $-(4R^2\lambda)\hat{i}$ (D) $(4R^2\lambda)\hat{i}$

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. A uniformly charged non-conducting hollow sphere of radius 1m and mass 2kg having angular speed $\omega_0 = 9 \text{ rad/s}$ is gently placed on non-conducting rough horizontal surface with coefficient of friction μ at $t = 0$. Charge on the sphere is Q_0 and uniform electric field E is present in the region parallel to horizontal surface. (given $Q_0E = 10 \text{ N}$, $g = 10 \text{ m/s}^2$). Then match the column



Column – I		Column – II	
(P)	If $\mu = 0.6$, then a_{cm} till 1 s	(1)	along +ve x-axis
(Q)	If $\mu = 0.4$, then a_{cm} till 1 s	(2)	along –ve x-axis
(R)	If $\mu = 0.5$, then a_{cm} till 1 s	(3)	zero
(S)	If $\mu = 0.6$, then friction force till 1 s	(4)	non-zero

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

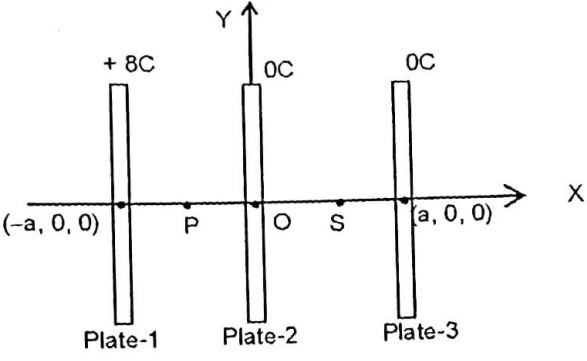
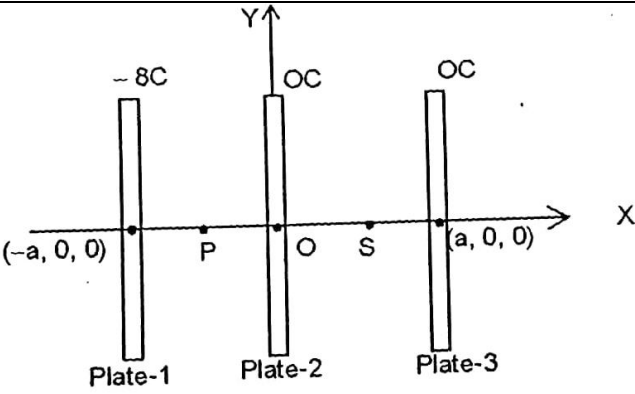
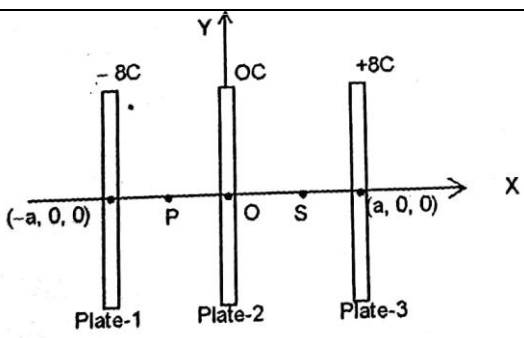
18.

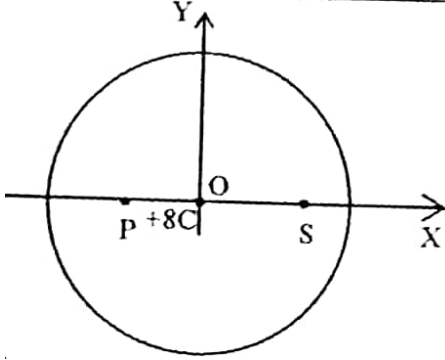
	Column – I		Column – II
(P)	When a dielectric slab is slowly inserted between the plates of an isolated parallel plate capacitor.	(1)	the electric potential energy of the system decreases.
(Q)	When a dielectric slab is slowly inserted between the plates of a parallel plate capacitor and its potential is kept constant.	(2)	work done by external agent is positive.
(R)	When the plates of a parallel plate capacitor are pulled apart slowly keeping its potential constant.	(3)	work done by battery is positive.
(S)	When the plates of a parallel plate capacitor are pulled apart slowly, keeping its charge constant	(4)	work done by external agent is negative.

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

Space for rough work

19. List I shows four electrostatic systems with charge and List II represents nature of some physical quantity related to system ($V_P - V_S$) is the potential difference between points $P(-a/2, 0, 0)$ and $S(a/2, 0, 0)$. Match the List - I with List - II

	List - I		List - II
(P)	 <p>Three identical square thin metal plates each of cross-section area A are kept parallel to y-z plates as shown in the above figure. The plate 1, plate -2 and plate -3 are given charges $8C$, $0C$, and $0C$ respectively whose ($a \ll \sqrt{A}$) centres lie on points $A(-a, 0, 0)$, $O(0, 0, 0)$ and $B(a, 0, 0)$ respectively.</p>	(1)	$V_P - V_S > 0$
(Q)	 <p>Three identical square thin metal plates each of cross-section area A are kept parallel to y-z plates as shown in the above figure. The plate 1, plate -2 and plate -3 are given charges $-8C$, $0C$, and $0C$ respectively whose ($a \ll \sqrt{A}$) centres lie on points $A(-a, 0, 0)$, $O(0, 0, 0)$ and $B(a, 0, 0)$ respectively.</p>	(2)	$V_P - V_S < 0$
(R)		(3)	$V_P - V_S = 0$

	<p>Three identical square thin metal plates each of cross – section area A are kept parallel to $y-z$ plane as shown in the above figure. The plate 1, plate -2 and plate – 3 are given charges $8C$, $0C$, and $+8C$ respectively whose ($a \ll \sqrt{A}$) centres lie on points $A(-a,0,0)$, $O(0,0,0)$ and $B(a,0,0)$ respectively.</p>		
(S)	 <p>A neutral conducting shell has radius a and centre at origin. A point charge $8C$ is kept at origin</p>	(4)	<p>Nothing can be said for $(V_P - V_S)$</p>

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

Space for rough work

20. In case of two conducting spherical shells having radii a and b ($b > a$).

Column – I	Column -II
(P) Shells are concentric and inner is given a charge while outer is earthed.	1. $C = 4\pi\epsilon_0 (a + b)$
(Q) Shells are concentric and outer is given a charge while inner is earthed.	2. $C = \frac{4\pi\epsilon_0 ab}{b - a}$
(R) Shells carry equal and opposite charges and are separated by a distance d .	3. $C = \frac{4\pi\epsilon_0 b^2}{b - a}$
(S) Shells are connected by a conducting wire	4. $C = \frac{4\pi\epsilon_0}{\frac{1}{a} + \frac{1}{b} - \frac{2}{d}}$
	5. $C = \frac{2\pi\epsilon_0 b^2}{b + a}$

	P	Q	R	S
(A)	2	5	4	3
(B)	2	3	4	1
(C)	3	5	4	1
(D)	3	2	4	5

Space for rough work

PART II: CHEMISTRY

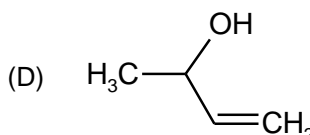
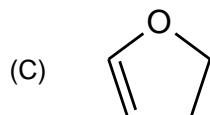
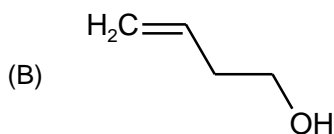
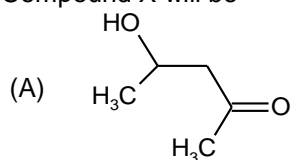
SECTION – I: Single Correct Answer Type

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

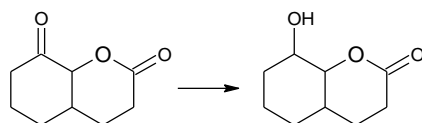
21. Which of the following compound(s), having molecular formula C_4H_8O , gives following results

Reaction with →	Br_2/CCl_4	Na metal	Chromic acid	Lucas reagent
Compound X	Decolorizes	Bubbles	Orange to Green	Very-very slow reaction

Compound X will be



22. The reduction:



can be brought about by

(A) $LiAlH_4$

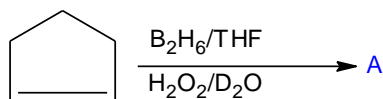
(B) $NaBH_4$

(C) Clemmensen's reduction

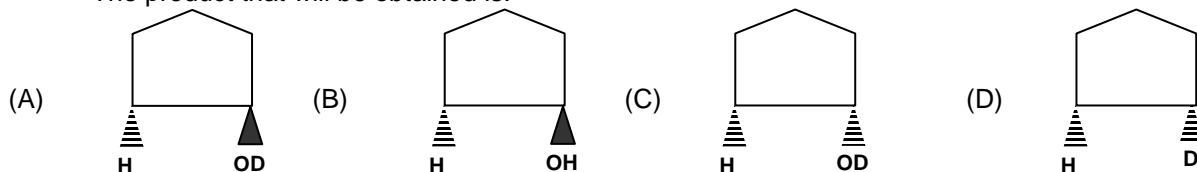
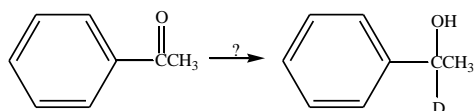
(D) Wolff-Kishner reduction

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23.

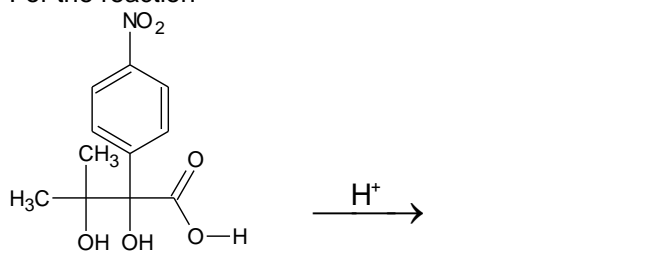


The product that will be obtained is:

24. Which of the following reagents would carry out the following transformation? ($\text{D} = \frac{2}{1} \text{H}$)

- (A) NaBD_4 in CH_3OH (B) LiAlH_4 , then D_2O (C) NaBD_4 in CH_3OD (D) LiAlD_4 , then D_2O

25. For the reaction



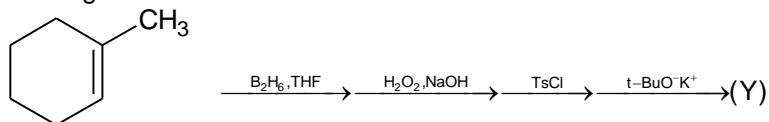
- (A) In the above reaction is formed as major product

- (B) In the above reaction is formed as major product

- (C) In the above reaction benzylic carbonium ion is more stable than tertiary carbocation
 (D) In the above reaction Racemic Mixture is obtained

Space for rough work

26. In the given reaction



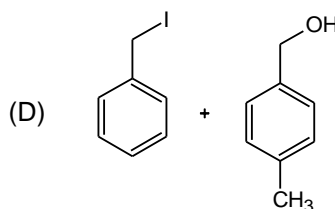
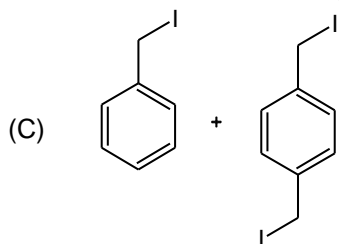
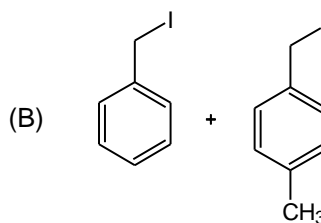
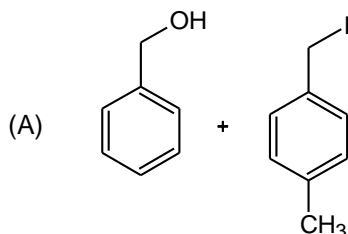
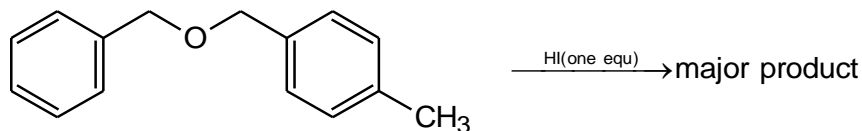
(X)

The product 'Y' is

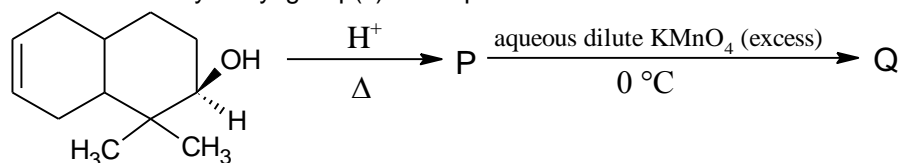
(A) Position isomer of X
(C) Chain isomer of X

(B) Identical to X
(D) An oxidation product of (X)

27.



28. The number of hydroxyl group(s) in the product Q is



(A) 1

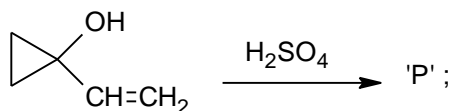
(B) 2

(C) 3

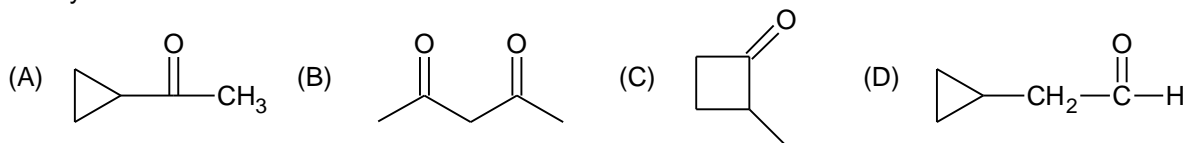
(D) 4

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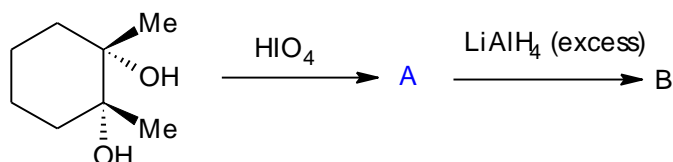
29.



Identify 'P' in the reaction.



30.



How many stereoisomers of B are possible

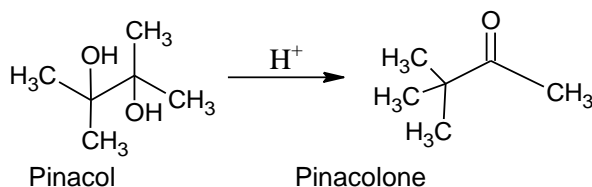
- (A) 2 (B) 0 (C) 4 (D) 3

SECTION – II: Paragraph Type

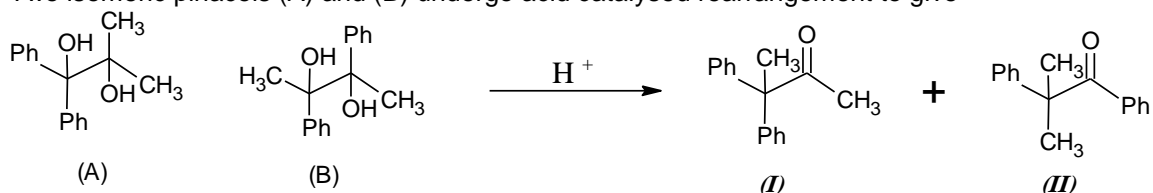
This section contains **3 paragraphs** each describing theory, experiment, data etc., **Six questions** relate to three paragraphs with two question on each paragraph. Each question of a paragraph has **only one correct answer** among the four choices (A), (B), (C) and (D).

Paragraph For Questions 31 & 32

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.



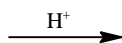
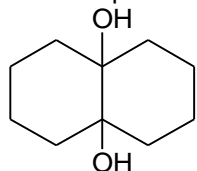
31. Two isomeric pinacols (A) and (B) undergo acid catalysed rearrangement to give



- (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

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

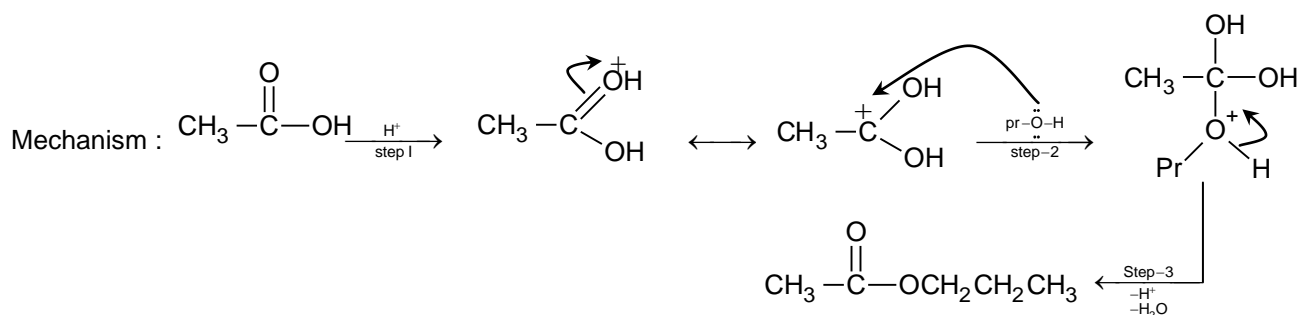
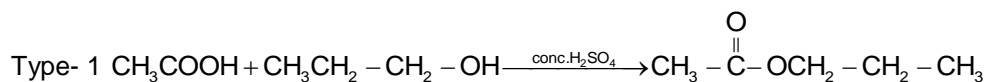
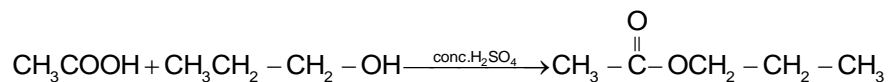


- (A) Six member ring and a four member ring (B) Two five member rings
(C) Six member ring and a five member ring (D) Seven member and a three member ring

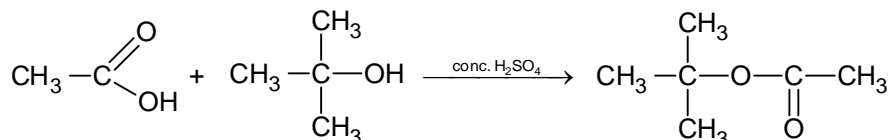
Paragraph For Questions 33 & 34

Observe the esterification mechanisms for primary and tertiary alcohols.

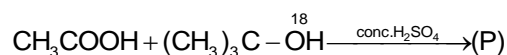
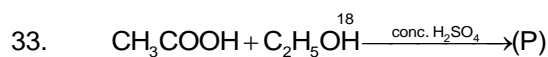
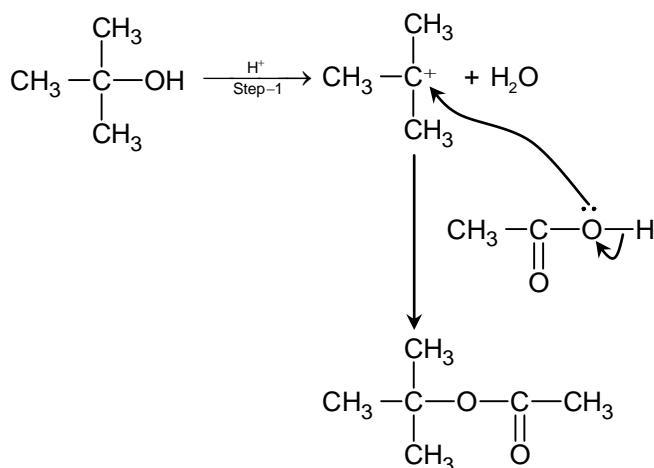
Type- 1



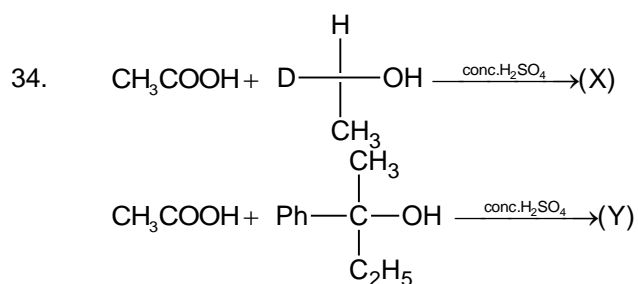
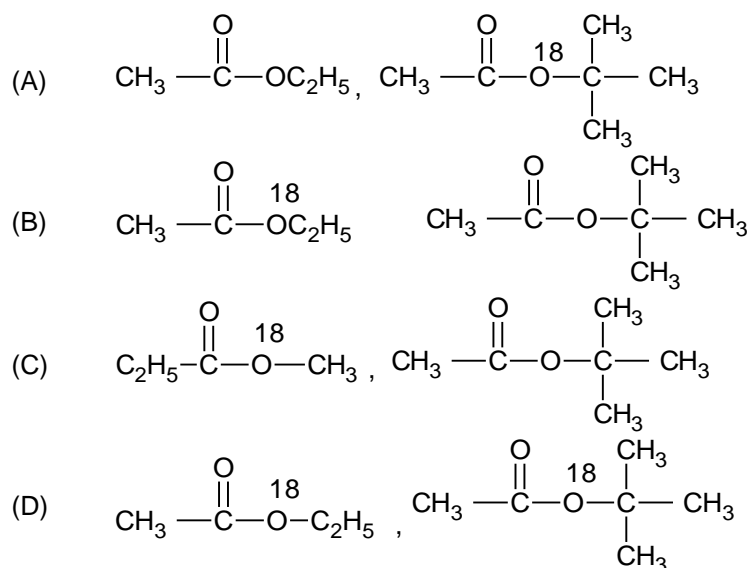
Type - 2



Mechanism



In the above reactions (P) & (Q) are respectively

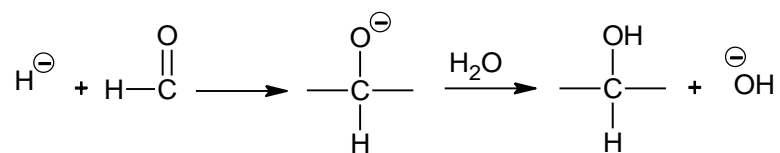


- (A) (X) solution is optically active while (Y) solution is optically inactive
 (B) Both (X) & (Y) solutions are optically active
 (C) Both (X) & (Y) solutions are optically inactive
 (D) (X) solution is optically inactive while (Y) solution is optically active

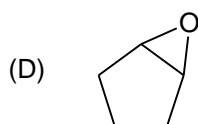
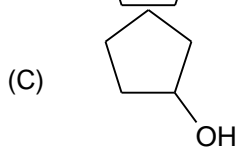
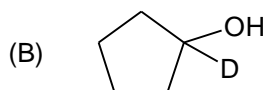
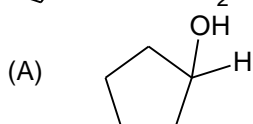
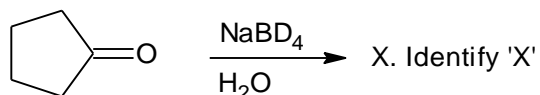
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Paragraph For Questions 35 & 36

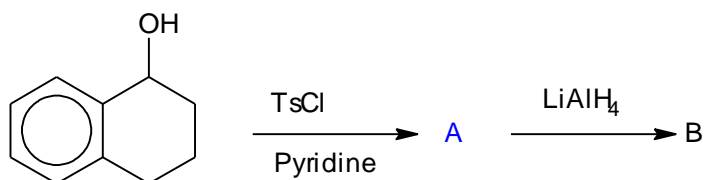
Carbon-oxygen double bond is easily reduced by NaBH_4 or LiAlH_4 . The metal-hydrogen bond is more polar in LiAlH_4 than in NaBH_4 . As a result LiAlH_4 is a stronger reducing agent than NaBH_4 . The actual reducing agent in these reactions is a H^- ion.



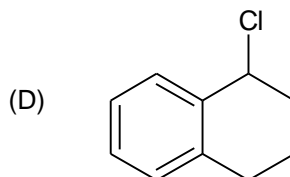
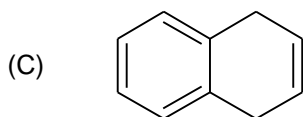
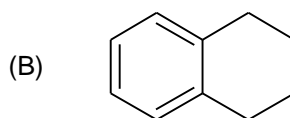
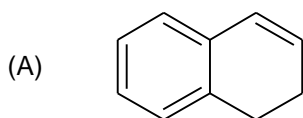
35.



36.



Product B at the above reaction is

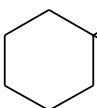
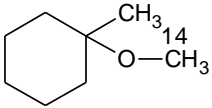
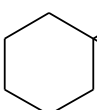
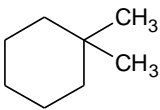
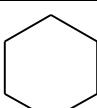
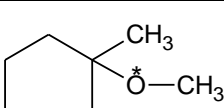
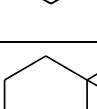
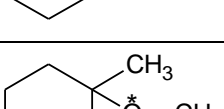


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SECTION – III: (Matching List Type)

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.

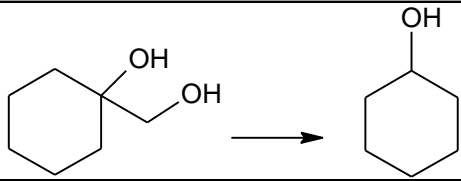
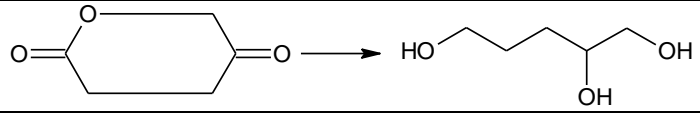
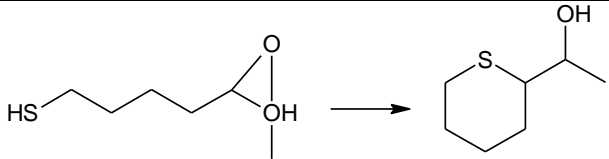
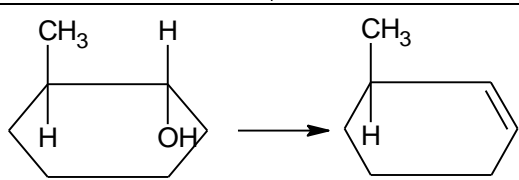
	Column – I (Reactant)		Column – II (Products)
(P)	 $\xrightarrow[\text{H}_2\text{SO}_4 \text{ (Conc.)}]{\text{CH}_3\text{OH}}$	(1)	
(Q)	 $\xrightarrow[\text{(ii) CH}_3\text{I}]{\text{(i) NaOH}}$	(2)	
(R)	 $\xrightarrow[\text{3) CH}_3\text{I}]{\begin{matrix} \text{1) HBr} \\ \text{2) Mg} \end{matrix}}$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

Space for rough work

38.

Column – I (Reaction)		Column – II (Reagent + Scheme)	
(P)		(1)	LiAlH ₄
(Q)		(2)	POCl ₃ with pyridine
(R)		(3)	H ⁽⁺⁾ / Δ, Zn(Hg) + HCl
(S)		(4)	KH, H ₂ O

Code :

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

39.

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

Space for rough work

40.

Column – I (Reactant)		Column – II (Scheme)	
(P)		(1)	(i) Br ₂ /hν (ii) alc. KOH (iii) HBO (iv) PCC →
(Q)		(2)	(i) Br ₂ /hν (ii) C ₂ H ₅ O ⁽⁻⁾ (iii) dil. KMnO ₄ (iv) HIO ₄ →
(R)		(3)	(i) PBr ₃ (ii) Mg/ether (iii) DOD →
(S)		(4)	(i) KMnO ₄ (ii) PhMgBr H ⁽⁺⁾ (iii) SOCl ₂ (iv) EtO ⁽⁻⁾ /EtOH

Code :

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

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 number of integral values of y for which the chord of the circle $x^2 + y^2 = 125$ passing through the point $P(8, y)$ gets bisected at the point $P(8, y)$ and has integral slope is
- (A) 8 (B) 6 (C) 4 (D) 2

Space for rough work

42. A circle with radius $|a|$ and centre on the y -axis slides along it and a variable line through $(a, 0)$ cuts the circle at points P and Q . The region in which the point of intersection of the tangents to the circle at points P and Q lies is represented by
 (A) $y^2 \geq 4(ax - a^2)$ (B) $y^2 \leq 4(ax - a^2)$ (C) $y \geq 4(ax - a^2)$ (D) $y \leq 4(ax - a^2)$
43. The minimum radius of the circle which contains the three circles, $x^2 + y^2 - 4y - 5 = 0$, $x^2 + y^2 + 12x + 4y + 31 = 0$ and $x^2 + y^2 + 6x + 12y + 36 = 0$ is
 (A) $\frac{7}{28}\sqrt{900} + 3$ (B) $\frac{\sqrt{845}}{9} + 4$ (C) $\frac{5}{36}\sqrt{949} + 3$ (D) none of these
44. A wheel of radius 8 units rolls along the diameter of a semicircle of radius 25 units; it bumps into this semicircle. What is the length of the portion of the diameter that cannot be touched by the wheel?
 (A) 12 (B) 15 (C) 17 (D) 20
45. The equation of the circle passing through the point of intersection of the circles $x^2 + y^2 - 4x - 2y = 8$ and $x^2 + y^2 - 2x - 4y = 8$ and the point $(-1, 4)$ is
 (A) $x^2 + y^2 + 4x + 4y - 8 = 0$ (B) $x^2 + y^2 - 3x + 4y + 8 = 0$
 (C) $x^2 + y^2 + x + y - 8 = 0$ (D) $x^2 + y^2 - 3x - 3y - 8 = 0$
46. 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
47. 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) $\frac{3^n - 1}{2}$
48. 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

49. 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) $10 (2^{18} + {}^{19}C_{11})$
50. 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) $2^n C_r$ (D) ${}^n C_r 2^r$

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

To the circle $x^2 + y^2 = 4$, two tangents are drawn from $P(-4, 0)$, which touch the circle at T_1 and T_2 . A rhombus $PT_1P'T_2$ is completed.

51. The circumcentre of triangle PT_1T_2 is at
 (A) $(-2, 0)$ (B) $(2, 0)$ (C) $\left(\frac{\sqrt{3}}{2}, 0\right)$ (D) none of these
52. The ratio of the area of triangle PT_1P' to that of triangle $P'T_1T_2$ is
 (A) $2 : 1$ (B) $1 : 2$ (C) $\sqrt{3} : 2$ (D) none of these

Paragraph For Questions 53 & 54

Consider a family of circles passing through the points $(3, 7)$ and $(6, 5)$. Answer the following questions.

53. The number of circles which belong to the family and also touch the x-axis are
 (A) 0 (B) 1 (C) 2 (D) infinite
54. If each circle in the family cuts the circle $x^2 + y^2 - 4x - 6y - 3 = 0$, then all the common chords pass through the fixed point which is
 (A) $(1, 23)$ (B) $\left(2, \frac{23}{2}\right)$ (C) $\left(-3, \frac{3}{2}\right)$ (D) none of these

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)	The number of circles touching the given three non-concurrent lines	(1)	1
(Q)	The number of circles touching $y = x$ at $(2, 2)$ and also touching the line $x + 2y - 4 = 0$	(2)	2
(R)	The number of circles touching the lines $x \pm y = 2$ and passing through the point $(4, 3)$	(3)	4
(S)	The number of circles intersecting the given three circles orthogonally	(4)	Infinite

Code:

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

58. Match the following

Column – I		Column – II	
(P)	If $ax + by - 5 = 0$ is the equation of the chord of the circle $(x - 3)^2 + (y - 4)^2 = 4$, which passes through $(2, 3)$ and at the greatest distance from the centre of the circle, then $ a + b $ is equal to	(1)	6
(Q)	Let O be the origin and P be a variable point on the circle $x^2 + y^2 + 2x + 2y = 0$. If the locus of midpoint of OP is $x^2 + y^2 + 2gx + 2fy + c = 0$, then $(g + f)$ is equal to	(2)	3
(R)	The x-coordinates of the centre of the smallest circle which cuts the circles $x^2 + y^2 - 2x - 4y - 4 = 0$ and $x^2 + y^2 - 10x + 12y + 52 = 0$ orthogonally is	(3)	2
(S)	If θ be the angle between two tangents which are drawn to the circles $x^2 + y^2 - 6\sqrt{3}x - 6y + 27 = 0$ from the origin. Then $2\sqrt{3} \tan \theta$ equals	(4)	1

Code:

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

Space for rough work

59. 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

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

Space for rough work

FIITJEE RET – 2

(2017 – 2019)(2ND YEAR_CHAMPIONS)

IIT-2014 (P2)

DATE: 18.06.2018

ANSWERS

PHYSICS

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

CHEMISTRY

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

MATHEMATICS

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