FIITJEE

ALL INDIA TEST SERIES

FULL TEST – II

JEE (Advanced)-2019

PAPER –1

Time Allotted: 3 Hours **Maximum Marks: 183**

General Instructions:

- The test consists of total 54 questions.
- Each subject (PCM) has 18 questions.
- This question paper contains **Three Parts.**
- **Part-I** is Physics, **Part-II** is Chemistry and **Part-III** is Mathematics.
- Each **Part** is further divided into **Two Sections**: **Section-A & Section-C.**

  Section-A (01– 07, 19 – 25, 37 - 43) *contains 21 multiple choice questions which have* ***one or more than one correct*** *answer. Each question carries* ***+4 marks*** *for correct answer and* ***–2 mark*** *for wrong answer*

  Partial Marks **+1** for each correct option provided no incorrect options is selected.

  Section-A (08 – 13, 26 – 31, 44 - 49) *contains 18 questions. Each of 2 Tables with 3 Columns and 4 Rows has three questions. Column 1 will be with 4 rows designated (I), (II), (III) and (IV). Column 2 will be with 4 rows designated (i), (ii), (iii) and (iv). Column 3 will be with 4 rows designated (P), (Q), (R) and (S).*

  Each question has ***only one correct*** *answer and carries* ***+3 marks*** *for correct answer and* ***–1 mark*** *for wrong answer.*

  Section-C (14 – 18, 32 – 36, 50 - 54) *contains 15 Numerical based questions with answer as numerical value from* ***0 to 9*** *and each question carries* ***+3 marks*** *for correct answer. There is no negative marking.*

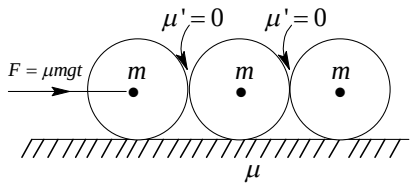
Physics

PART – I

SECTION – A
(More Than One Correct Type)

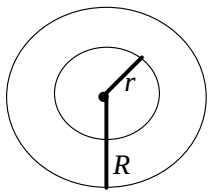
This section contains **7 multiple** choice questions. Each question has 4 choices (A), (B), (C) and (D) for its answer, out of which **ONE OR MORE** is/are correct.

1. Three identical cylinders each of mass M and radius R are in contact and kept on a rough horizontal surface, coefficient of friction between any cylinder and surface is μ. A force $F = \mu Mgt$ acts on the first cylinder. Mark the correct statement:



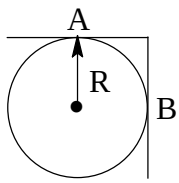
(A) The cylinders will start pure rolling and keep on rolling without sliding
(B) At t = 9 second slipping will start
(C) Velocity of centre of mass of each sphere will keep on increasing
(D) After a certain value of F angular velocity of each sphere will become constant

2. A soap bubble of radius r is formed inside another soap bubble of radius R(>r). The atmosphere pressure is P_0 and surface tension of the soap solution is T. Now the bigger bubble bursts. Assume that the excess pressure inside a bubble is small compared to P_0. For the smaller bubble choose the correct options:



(A) The bubble shrinks
(B) The bubble expands
(C) Change in its radius is $\frac{4Tr}{3P_0R}$
(D) Change in its radius is $\frac{3Tr}{4P_0R}$

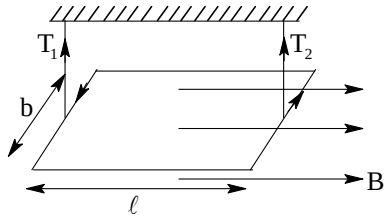
3. A rod bent at right angel along its centre line, is placed on a rough horizontal fixed cylinder of radius R as shown in figure. Mass of rod is 2m and rod is in equilibrium. Assume that friction force on rod at A and B are equal in magnitude. Then:



(A) Normal force applied by cylinder on rod at A is 3mg/2
(B) Normal force applied by cylinder on rod at B must be zero
(C) Friction force acting on rod at B is upward
(D) Normal force applied by cylinder on rod at A is mg

Space for Rough work

4. A uniform conducting rectangular loop of sides ℓ, b and mass m carrying current i is hanging horizontally with the help of two vertical strings. There exists a uniform horizontal magnetic field B which is parallel to the longer side of loop. Choose the **CORRECT** option(s)



(A) The value of $T_1 = T_2 = \frac{mg}{2}$

(B) The value of $T_1 = \frac{mg - 2ibB}{2}$

(C) The value of $T_2 = \frac{mg + 2ibB}{2}$

(D) The value of $T_1 <$ value of T_2

5. A bob of mass M is rotating on smooth horizontal table with constant angular speed ω on a circular path with the help of an elastic wire of mass m $(m << M)$, length ℓ, specific heat s, area of cross-section A and young's modulus Y. Then:

(A) The increase in length of wire $\frac{\ell}{\left(\frac{YA}{M\ell\omega^2} - 1\right)}$

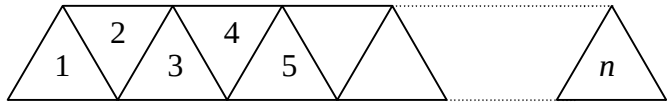
(B) The increase in length of wire $\frac{\ell}{\left(\frac{YA}{2M\ell\omega^2} - 1\right)}$

(C) If the bob snaps then the rise in temperature of wire is $\frac{YA\ell}{2ms}\left(\frac{1}{\frac{YA}{2M\ell\omega^2} - 1}\right)^2$ (ignore radiation loses)

(D) If the bob snaps then the rise in temperature of wire is $\frac{YA\ell}{2ms}\left(\frac{1}{\frac{YA}{M\ell\omega^2} - 1}\right)^2$ (ignore radiation loses)

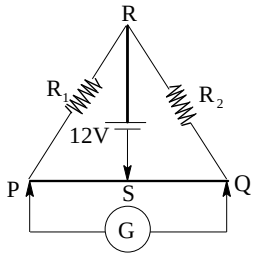
Space for Rough work

6. *n* number of identical equilateral prisms are kept in contact as shown in figure. If deviation through a single prism is δ. Then (*n*, *m* are integers)



(A) if $n = 2m$, deviation through *n* prism is zero.
(B) if $n = 2m + 1$, deviation through system of *n* prisms is δ.
(C) if $n = 2m$, deviation through system of *n* prism is δ
(D) if $n = 2m + 1$ deviation through system of *n* prisms is zero

7. In the circuit shown $R_1 - R_2 = 10\Omega$ and resistance per unit length of wire $PQ = 1\Omega / cm$ and length $PQ = 10cm$. If R_2 is made 20Ω the to get zero deflection in galvanometer. S is midpoint of wire PQ?



(A) The jockey at P can be moved towards right 2 cm.
(B) The jockey at Q can be moved towards right 2 cm.
(C) The jockey at S can be moved towards left a distance 5/3 cm.
(D) The jockey at all positions fixed and R_1 should be made 20

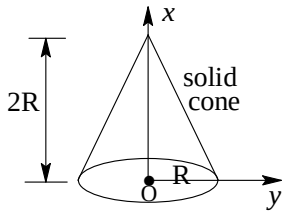
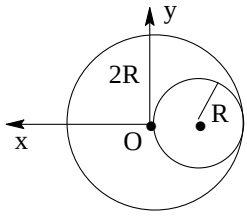
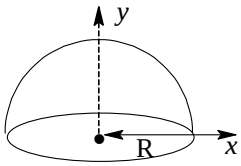
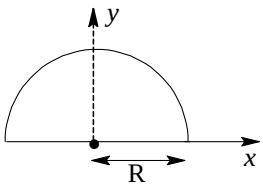
Space for Rough work

(Matching Type)
(Matching type - Single Correct Option)

This section contains **SIX** questions of matching type. The section contains **TWO** tables (each having 3 columns and 4 rows). Based on each table, there are **THREE** questions. Each question has **FOUR** options (A), (B), (C), and (D). **ONLY ONE** of these four options is correct.

Answer 8, 9 and 10 by appropriately matching the information given in the three columns of the following table.

In the column – I below, we have four bodies of uniform mass densities. Mass of each body is M. Column II gives their centre of mass distance from origin. Column three gives moment of inertia of respective bodies about an axis passing through the centre of mass and either along x-axis or parallel to x-axis:

	Column I		**Column II**		**Column III**
(I)		(i)	$\frac{R}{2}$	(P)	$\frac{2}{3}MR^2$
(II)	 A disc of radius 2R from which a smaller disc of R has been cut.	(ii)	$\frac{4R}{3\pi}$	(Q)	$\frac{3}{10}MR^2$
(III)	 Hemispherical shell	(iii)	$\frac{2R}{3}$	(R)	$\left(\frac{9\pi^2-64}{36\pi^2}\right)MR^2$
(IV)	 Semi circular disc	(iv)	$\frac{R}{3}$	(S)	$\frac{15MR^2}{12}$

8. Which of the following cases is true for the solid cone?

(A) $(\mathrm{I})\ (\mathrm{iii})\ (\mathrm{Q})$ (B) $(\mathrm{I})\ (\mathrm{i})\ (\mathrm{Q})$

(C) $(\mathrm{I})\ (\mathrm{iii})\ (\mathrm{P})$ (D) $(\mathrm{I})\ (\mathrm{ii})\ (\mathrm{R})$

Space for Rough work

9. Which of the following options hold true for the semicircular disc?

(A) $(\mathrm{IV})\ (\mathrm{ii})\ (\mathrm{P})$ (B) $(\mathrm{IV})\ (\mathrm{iii})\ (\mathrm{P})$

(C) $(\mathrm{IV})\ (\mathrm{ii})\ (\mathrm{R})$ (D) $(\mathrm{IV})\ (\mathrm{iv})\ (\mathrm{Q})$

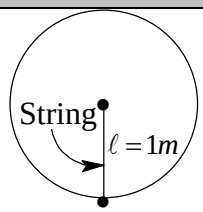
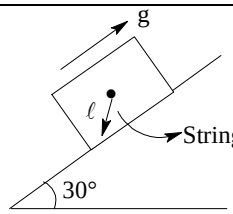
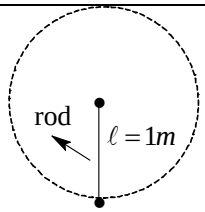
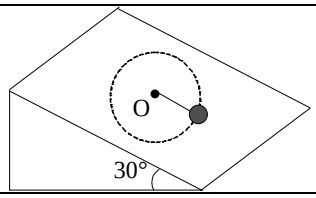
10. Which one of the following combinations is true for the disc from which a circular disc has been cut off:

(A) $(\mathrm{II})\ (\mathrm{i})\ (\mathrm{P})$ (B) $(\mathrm{II})\ (\mathrm{iii})\ (\mathrm{S})$

(C) $(\mathrm{II})\ (\mathrm{ii})\ (\mathrm{P})$ (D) $(\mathrm{II})\ (\mathrm{iv})\ (\mathrm{S})$

Answer 11, 12 and 13 by appropriately matching the information given in the three columns of the following table.

The table below gives different situations of vertical circular motion. Select the appropriate combination. Column I gives the situation of motion. Column II gives the minimum velocity required at the equilibrium position to complete the loop. Column III gives the velocity at the point which is diametrically opposite to the equilibrium position:

	Column I		**Column II (m/s)**		**Column III**
(I)		(i)	$\sqrt{50}$	(P)	Zero
(II)	 Cabin accelerating upward the plane with g & $\ell=\sqrt{3}m$	(ii)	$\sqrt{40}$	(Q)	$\sqrt{10}$
(III)		(iii)	$\sqrt{150}$	(R)	$\sqrt{5}$
(IV)		(iv)	$\sqrt{25}$	(S)	$\sqrt{30}$

Space for Rough work

11. Which of the following combinations is true for entry (II) of column (I)

(A) $(\mathrm{II})\ (\mathrm{i})\ (\mathrm{P})$ (B) $(\mathrm{II})\ (\mathrm{iii})\ (\mathrm{S})$

(C) $(\mathrm{II})\ (\mathrm{ii})\ (\mathrm{Q})$ (D) $(\mathrm{II})\ (\mathrm{iii})\ (\mathrm{Q})$

12. Which one is true for entry (III) of column (I)

(A) $(\mathrm{III})\ (\mathrm{ii})\ (\mathrm{Q})$ (B) $(\mathrm{III})\ (\mathrm{iii})\ (\mathrm{S})$

(C) $(\mathrm{III})\ (\mathrm{i})\ (\mathrm{P})$ (D) $(\mathrm{III})\ (\mathrm{i})\ (\mathrm{Q})$

13. The combination which is true for entry four of column (I)

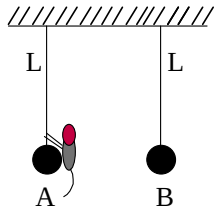
(A) $(\mathrm{IV})\ (\mathrm{iv})\ (\mathrm{R})$ (B) $(\mathrm{IV})\ (\mathrm{iii})\ (\mathrm{Q})$

(C) $(\mathrm{IV})\ (\mathrm{iv})\ (\mathrm{P})$ (D) $(\mathrm{IV})\ (\mathrm{ii})\ (\mathrm{Q})$

SECTION – C
(Single digit integer type)

This section contains **FIVE** questions. The answer to each question is a single Digit integer ranging from 0 to 9, both inclusive.

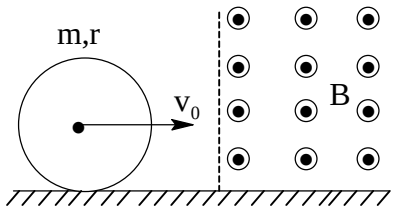
14. An insect jumps from ball A onto ball B, which are suspended from inextensible light strings each of length L = 8 cm. The mass of each ball and insect is same. What should be the minimum relative velocity (in ms^{-1}) of jump of insect w.r.t ball A, if both the balls manage to complete the full circle?



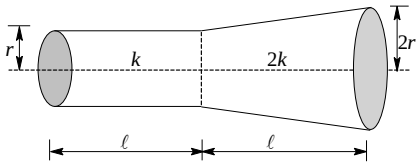
15. An electric charge distribution produces an electric field $\vec{E}=C\left(1-e^{-\alpha r}\right)\frac{\hat{r}}{r^2}$ where $C=\frac{1}{4\pi\varepsilon_0}$ & α are constant. If the net charge within the radius $r=\frac{1}{\alpha}$ is $\left(1\text{-}e^{-N}\right)$, then find the value of 'N' ?

Space for Rough work

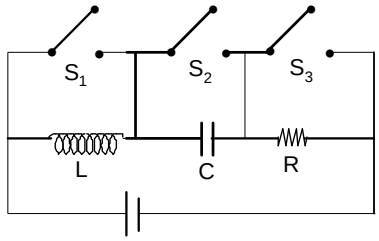
16. A ring of mass m and radius r and made of an insulating material carries uniformly distributed charge. Initially it rests on a frictionless horizontal tabletop with its plane vertical. The charge on the ring so that it starts rolling on entering completely into the region of the magnetic field is $\frac{\sqrt{N}mv_0}{rB}$,then find the value of $'N'$



17. A composite object is formed by combining a uniform rod of circular cross-section with thermal conductivity k and a frustum of same length with thermal conductivity $2k$ as shown in the figure. The equivalent thermal conductivity of the object is given as $\frac{Nk}{5}$, find $'N'$.



18. Consider the circuit shown in figure. With switch S1 closed and the other two switches open, the circuit has a time constant 0.05 sec. With switch S2 closed and the other two switches open, the circuit has a time constant 2 sec. With switch S3 closed and the other two switches open, the circuit oscillates with a period T. Find T (in sec). (Take pie2 = 10)



Space for Rough work

Chemistry

PART – II

SECTION – A
(More Than One Correct Type)

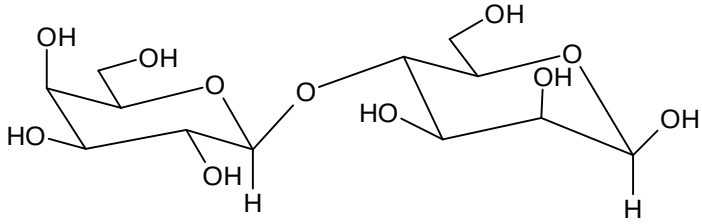
This section contains **7 multiple** choice questions. Each question has 4 choices (A), (B), (C) and (D) for its answer, out of which **ONE OR MORE** is/are correct.

19. The correct statements about some of the ions of 3d-series in aqueous solution
(A) Cr^{2+} is better reducing agent than Fe^{2+}
(B) Co^{3+} is better oxidising agent than Fe^{3+}.
(C) When Fe^{3+} is used as oxidising agent, it attains $3d^6$ electronic configuration
(D) Cu is the only metal in 3d series, which is not having ability to displace hydrogen as H_2 from acid (consider thermodynamic aspect).

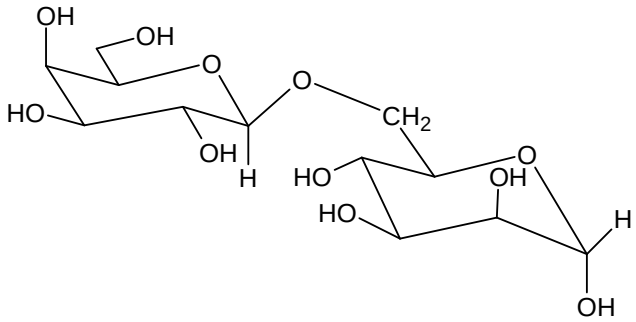
Space for Rough work

20. An unknown carbohydrate, formula $C_{12}H_{22}O_{11}$ reacts with Tollen's reagent to form a silver mirror. An α-glycosidase has no effect on the carbohydrate but a β-galactosidase hydrolyzes it to D-galactose (C_4 – epimers of D-glucose) and D-mannose (C_2 – epimers of D-glucose). When the carbohydrate is methylated (using methyl iodide and silver oxide) and then hydrolyzed with dilute HCl, the products are 2,3,4,6-tetra-O-methyl galactose and 2,3,4 tri-O-methyl mannose. Which of the following is correct structure of unknown carbohydrate?

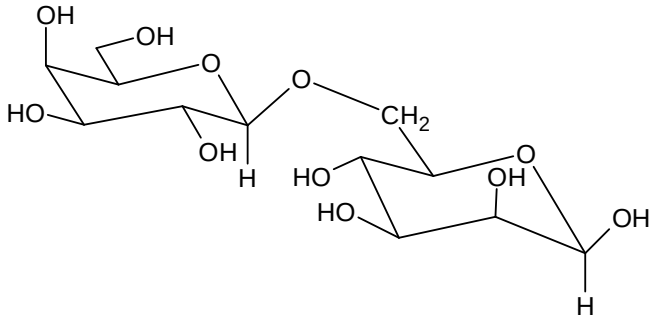
(A)



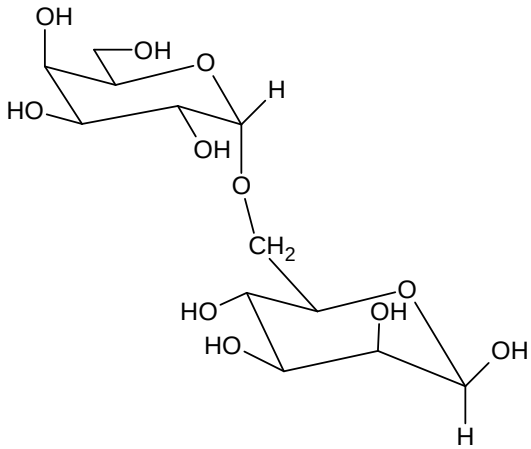
(B)



(C)



(D)



Space for Rough work

21. Which of the following solution will show negative deviation from ideal behaviour (Raoult's law)

(A) HNO_3+H_2O (B) Benzene+toluene

(C) Acetone+chloroform (D) Octanol+water

22. The standard electrode potentials of some of the alkali metals are

(i) $Li^+/Li = -3.05\,V$

$Na^+/Na = -2.71\,V$

$K^+/K = -2.93\,V$

(ii) Alkali metals react with water according to the following reaction. (M = alkali metal)

$2M + H_2O \rightarrow 2MOH + H_2$ It is found Li reacts gently with water whereas potassium reacts violently with water.

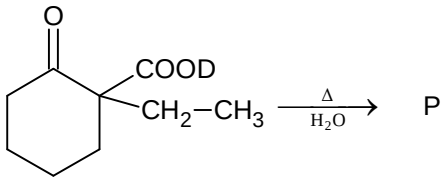
Which of the following statement (s) is/ are correct about the above experimental facts?

(A) ΔG values related with the kinetics of a reaction

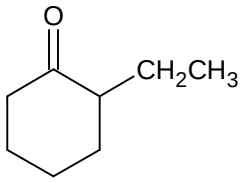
(B) The metal having large standard oxidation potential will have lesser reactivity.

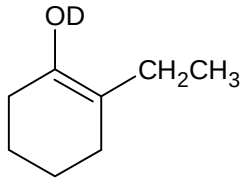
(C) K has a low melting point, and the heat of reaction is sufficient to make it melt or even vaporize. This leads to exponential increase in its surface area thus it reacts violently.

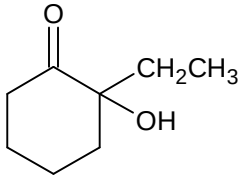
(D) Lithium is the best reducing agent due to its high hydration enthalpy.

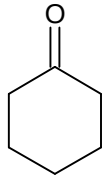
23. 

Which is possible for P is

(A) 

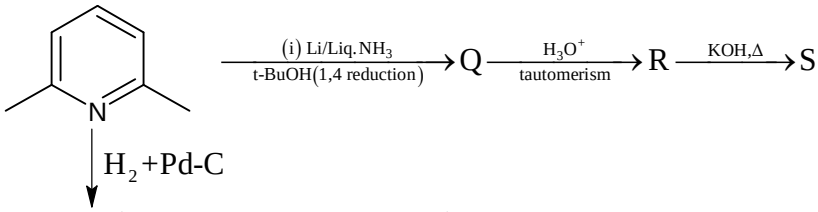
(B) 

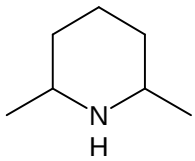
(C) 

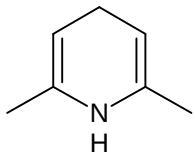
(D) 

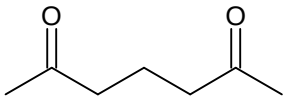
Space for Rough work

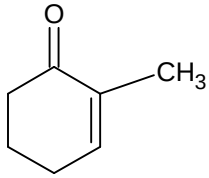
24. Which of the following are the correct statement(s) about the reaction given?



(A) 'P' is 

(B) 'Q' is 

(C) 'R' is 

(D) 'S' is 

25. Which of the following is correct?

(A) SO_3 and NSF_3 has $p\pi$-$d\pi$ bonding

(B) $(CH_3)_3NO$ has higher dipole moment than $(CH_3)_3PO$

(C) The bond angle in F_2O is smaller than H_2O

(D) The $Cl\text{-}P\text{-}Cl$ bond angle is smaller in $POCl_3$than PCl_3.

Space for Rough work

(Matching Type)
(Matching type - Single Correct Option)

This section contains **SIX** questions of matching type. The section contains **TWO** tables (each having 3 columns and 4 rows). Based on each table, there are **THREE** questions. Each question has **FOUR** options (A), (B), (C), and (D). **ONLY ONE** of these four options is correct.

Answer 26, 27 and 28 by appropriately matching the information given in the three columns of the following table.

	Column I (Ores)		Column II (Type of Ore)		Column III (Process involved in extraction/refining)
(I)	Dolomite	(i)	Chloride	(P)	Self reduction
(II)	Cassiterite	(ii)	Carbonate	(Q)	Carbon reduction
(III)	Chalcopyrite	(iii)	Sulphide	(R)	Fused electrolysis
(IV)	Cuprite	(iv)	Oxide	(S)	Poling

26. Which of the following is suitable for calcium?
(A) $(\mathrm{I})\ (\mathrm{ii})\ (\mathrm{P})$ (B) $(\mathrm{I})\ (\mathrm{ii})\ (\mathrm{R})$
(C) $(\mathrm{I})\ (\mathrm{ii})\ (\mathrm{S})$ (D) $(\mathrm{III})\ (\mathrm{ii})\ (\mathrm{R})$

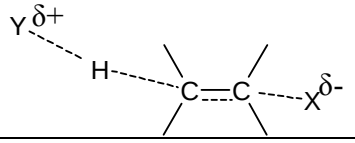
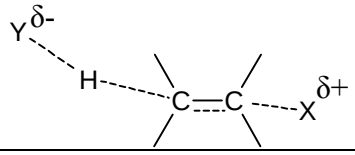
27. Which is correct for tin:
(A) $(\mathrm{II})\ (\mathrm{iii})\ (\mathrm{P})$ (B) $(\mathrm{II})\ (\mathrm{iv})\ (\mathrm{R})$
(C) $(\mathrm{II})\ (\mathrm{iv})\ (\mathrm{Q})$ (D) $(\mathrm{IV})\ (\mathrm{ii})\ (\mathrm{Q})$

28. Which of the following is used for extraction of copper?
(A) $(\mathrm{III})\ (\mathrm{iii})\ (\mathrm{R})$ (B) $(\mathrm{IV})\ (\mathrm{iii})\ (\mathrm{Q})$
(C) $(\mathrm{III})\ (\mathrm{iii})\ (\mathrm{P})$ (D) $(\mathrm{II})\ (\mathrm{iv})\ (\mathrm{Q})$

Space for Rough work

Answer 29, 30 and 31 by appropriately matching the information given in the three columns of the following table.

Consider X as leaving group and Y as a nucleophile or base :

	Column I (Activated complex of initial substrate)		Column II (Mechanism)		Column III (Effect)
(I)	$Y^{\delta+}\cdots R\cdots X^{\delta+}$	(i)	SN^2	(P)	Large decrease
(II)	$Y^{\delta-}\cdots R\cdots X^{\delta+}$	(ii)	E_2	(Q)	Large increase
(III)		(iii)	SN^1	(R)	Small decrease
(IV)		(iv)	E_1	(S)	Small increase

29. A neutral nucleophile attacks on a substrate containing neutral leaving group. Which of the following represent the correct combination of effect of increased solvent polarity on reaction rate?

(A) $(I)\ (i)\ (R)$ (B) $(II)\ (i)\ (P)$

(C) $(I)\ (iii)\ (Q)$ (D) $(II)\ (iii)\ (S)$

30. A negatively charged nucleophile attacks on a substrate containing neutral leaving group. Which of the following represent the correct combination of effect of decreased solvent polarity on reaction rate?

(A) $(I)\ (iii)\ (R)$ (B) $(II)\ (i)\ (P)$

(C) $(II)\ (i)\ (Q)$ (D) $(I)\ (iii)\ (S)$

31. A neutral base attacks on a substrate containing an anion as leaving group. Which of the following represent the correct combination of effect of increased solvent polarity on reaction rate?

(A) $(IV)\ (iv)\ (P)$ (B) $(III)\ (iv)\ (Q)$

(C) $(III)\ (ii)\ (S)$ (D) $(III)\ (ii)\ (R)$

Space for Rough work

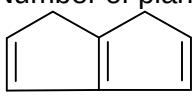
SECTION – C
(Single digit integer type)

This section contains **FIVE** questions. The answer to each question is a single Digit integer ranging from 0 to 9, both inclusive.

32. The solubility of $Ag_2C_2O_4$ in acidified water of pH=5 is 2.46×10^{-x}. The value of 'x'
($Ka_1=5\times10^{-2}, K_{a_2}=5\times10^{-5}, K_{sp}=5\times10^{-11}, (120.004)^{1/3}=4.93$)

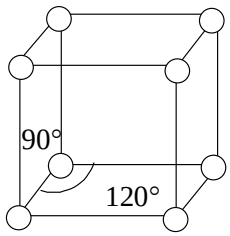
33. The CFSE $\left(E_{\text{in octahedral field}}-E_{\text{symmetric field}}\right)$ for octahedral complex for d^6 electronic configuration is 'x' kJ/mol, the value of $\left|\frac{x}{10}\right|$
[$\Delta_0=75$ kJ/mole, Pairing energy=90 kJ/mole]

34. Number of plane (s) of symmetry in the product B is/are

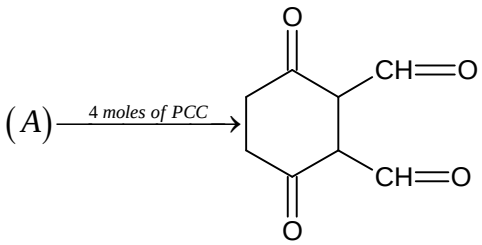


$\xrightarrow{CHCl_3(1eq.)+KOH}(A)\xrightarrow{CHCl_3(1eq.),KOH}(B)$

35. Ice crystallizes is an hexagonal lattice. At the low temperatures at which the structure was determined, the lattice constants were $a=4.53\text{Å}$ and $b=7.41\text{Å}$ as shown in the figure. How many H_2O molecules are contained in a unit cell? (Given that density of ice $=0.92\ g/cm^3$)?



36.



Maximum number of moles of Ac_2O consumed by reactant (A) is?

Space for Rough work

Mathematics

PART – III

SECTION – A
(More Than One Correct Type)

This section contains **7 multiple** choice questions. Each question has 4 choices (A), (B), (C) and (D) for its answer, out of which **ONE OR MORE** is/are correct.

37. $\int_{-1}^{1}\left(e^{x^3}+e^{-x^3}\right)dx$ is less than

(A) 2 (B) $2e+\frac{2}{e}$

(C) $e+\frac{1}{e}+2$ (D) 2e

38. Let $f(x)=e^{-\frac{1}{x^2}}+\int_{0}^{\frac{\pi x}{2}}\sqrt{1+\sin t}\,dt \forall x\in(0,\infty)$ then-

(A) f' exists and is continuous $\forall x\in(0,\infty)$

(B) f'' exists $\forall x\in(0,\infty)$

(C) f' is bounded

(D) There exists $\alpha>0$ such that $|f(x)|>|f'(x)| \forall x\in(\alpha,\infty)$

39. Let x,y,z are positive real numbers and ℓ_1 is the least value of $2x^4+2y^4+4z^4-8xyz$ and ℓ_2 is the least value of $x^4y+xy^4+\frac{4}{x^2y^3}+\frac{1}{x^3y^2}+8$, then-

(A) $\ell_1=-1$ (B) $\ell_2>-1$

(C) $\ell_2=10$ (D) $\ell_2>10$

40. Consider the equation in x, $8x^4-16x^3+16x^2-8x+a=0$, then sum of all the non-real roots of equation can be $(a\in R)$

(A) 1 (B) 2

(C) $\frac{1}{2}$ (D) None of these

Space for Rough work

41. For the equation $\frac{40}{x-1}-\frac{160}{x-4}-\frac{200}{x-5}+\frac{320}{x-8}=6x^2-27x$

(A) Number of real solution of above equation is 3

(B) If E denotes the product of non-zero or complex roots of equation, then sum of divisors of E is 2904

(C) It S denotes the set of all real roots of equation then, sum of elements of S taken two at a time is 81

(D) If $\alpha_1,\alpha_2 \in R$ be two roots of equation such that $\log_{\alpha_2}(2\alpha_1)$ is defined it must be 1.

42. Let a, b, c be the positive integers such that a<b<c. If the two curves $y=|x-a|+|x-b|+|x-c|$ *and* $2x+y=2003$ have exactly one point in common, then-

(A) least possible value of c is 1002 (B) greatest possible value of b is 1001

(C) least possible value of b is 1002 (D) greatest possible of a is 1000

43. Three are 5 boxes numbered from 1 to 5. There is 1 Red and 2k black balls in k^{th} box, $k=1,2,3,4,5$. From each box either one red ball is taken or one or more than one black balls are taken. But from each box both coloured balls are never taken (ball of same coloure are all alike). Now which of the following holds good?

(A) Total number of ways selecting odd number of red balls is 4725

(B) Total number of ways of selecting even number of red balls is 5670

(C) Total number of ways selecting odd number of red balls is 5670

(D) Total number of ways of selecting even number of red balls is 4725

Space for Rough work

(Matching Type)
(Matching type - Single Correct Option)

This section contains **SIX** questions of matching type. The section contains **TWO** tables (each having 3 columns and 4 rows). Based on each table, there are **THREE** questions. Each question has **FOUR** options (A), (B), (C), and (D). **ONLY ONE** of these four options is correct.

Answer 44, 45 and 46 by appropriately matching the information given in the three columns of the following table.

	Column I		Column II		Col. III
(I)	The value of $\sum_{n=0}^{\infty} 2^{-n+(-1)^n}$ is	(i)	The value of $\left[\sum_{n=0}^{\infty}\tan^{-1}\left(\frac{2}{\sqrt{n+2}+\sqrt{n}+(n+2)\sqrt{n}+n\left(\sqrt{n+2}\right)}\right)\right]$ (where [.] denotes greatest integer function) is	(P)	2
(II)	Number of solutions of equation $16\sin^3 x = 14+\sqrt[3]{\sin x+7}$ in $[0,4\pi]$ is	(ii)	If a, b, c are sides of a triangle, then $\frac{2\left(a^2+b^2+c^2\right)}{ab+bc+ca}$ is always less than	(Q)	3
(III)	Number of solutions of equation $\tan^{-1}(2\sin x)=\cot^{-1}(\cos x)$ in $[0,10\pi]$ is	(iii)	If a, b, c are distinct real numbers such that $a^2(b+c)=b^2(a+c)=2$, then the value of $c^2(a+b)$ is	(R)	4
(IV)	If the sum of roots of the quadratic equation $(-a+1)x^2+(a^2-a+4)x-2a+3=0$ is minimum, then the value of a(a>1) is	(iv)	If $P=\sin A\sin B, Q=\sin C\cos A$, $R=\sin A\cos B$ $S=\cos A\cos C$, then the value of $5\left(P^2+Q^2+R^2+S^2\right)$ is	(S)	5

44. Which of the following options is the only **CORRECT** combination?

(A) $(I)\ (ii)\ (R)$ (B) $(II)\ (iv)\ (S)$

(C) $(III)\ (i)\ (Q)$ (D) $(IV)\ (iv)\ (S)$

45. Which of the following options is the only **CORRECT** combination?

(A) $(II)\ (i)\ (P)$ (B) $(I)\ (iii)\ (R)$

(C) $(II)\ (ii)\ (P)$ (D) $(IV)\ (iii)\ (Q)$

46. Which of the following options is the only **CORRECT** combination?

(A) $(IV)\ (i)\ (P)$ (B) $(III)\ (iii)\ (R)$

(C) $(II)\ (iii)\ (P)$ (D) $(I)\ (iii)\ (Q)$

Space for Rough work

Answer 47, 48 and 49 by appropriately matching the information given in the three columns of the following table.

	Column I		Column II		Col. III
(I)	If S={Z: $\|Z+\bar{Z}\|+2\|Z-\bar{Z}\|=4$ and $\|Z\|$ is minimum} then $\frac{25}{8}A$ is (where A is area of polygon formed of all points in S taking as vertices)	(i)	If the Point $(\sec\alpha, \operatorname{cosec}\alpha)$ moves in the plane of circle $x^2+y^2=3$ and the minimum distance of this point from circle is $a-\sqrt{b}(a,b\in N)$ then a + b	(P)	2
(II)	Let S=$\left\{Z\left\|Z\bar{Z}-(3-4i)Z-(3+4i)\bar{Z}+21=0\right.\right\}$ If M and m be maximum value and minimum value of $\frac{Z-\bar{Z}}{i(Z+\bar{Z})}$ then $\frac{1}{M}+\frac{1}{m}$ is	(ii)	Two circles $x^2+y^2+2n_1x+2y+\frac{1}{2}=0$ and $x^2+y^2+n_2x+n_2y+n_1=\frac{1}{2}$ intersect each other orthogonally where n_1, n_2 are integers then the number of possible ordered pairs (n_1, n_2) is	(Q)	3
(III)	Let x is the minimum value of $\|Z\|^2+\|Z-3\|^2+\|Z-6i\|^2$ then $\frac{x}{10}$ is	(iii)	If $a_n=\sqrt{1+\left(1+\frac{1}{n}\right)^2}+\sqrt{1+\left(1-\frac{1}{n}\right)^2}$, then the value of $\left(\sum_{n=1}^{20}\frac{1}{a_n}\right)-3$ is	(R)	4
(IV)	Consider a triangle formed by the points $A\left(\frac{2}{\sqrt{3}}e^{i(\pi/2)}\right), B\left(\frac{2}{\sqrt{3}}e^{-i\left(\frac{\pi}{6}\right)}\right), C\left(\frac{2}{\sqrt{3}}e^{-i\left(\frac{5\pi}{6}\right)}\right)$ Let P(Z) is any point on it's in-circle, then $AP^2+BP^2+CP^2$ is	(iv)	The $ea^n\ \ 9x^3+9x^2y-45x^2=4y^3+4xy^2-20y^2$ represents 3 straight lines two of which pass through origin then $\frac{1}{10}$(Area of triangle formed by these lines)	(S)	5

47. Which of the following options is the only **CORRECT** combination?

(A) (I) (ii) (R) (B) (II) (iv) (S)

(C) (III) (i) (Q) (D) (IV) (iv) (S)

Space for Rough work

48. Which of the following options is the only **CORRECT** combination?

(A) $(\mathrm{II})\ (\mathrm{i})\ (\mathrm{P})$ (B) $(\mathrm{I})\ (\mathrm{iii})\ (\mathrm{R})$

(C) $(\mathrm{II})\ (\mathrm{ii})\ (\mathrm{P})$ (D) $(\mathrm{IV})\ (\mathrm{iii})\ (\mathrm{Q})$

49. Which of the following options is the only **INCORRECT** combination?

(A) $(\mathrm{IV})\ (\mathrm{i})\ (\mathrm{P})$ (B) $(\mathrm{III})\ (\mathrm{iii})\ (\mathrm{R})$

(C) $(\mathrm{II})\ (\mathrm{iii})\ (\mathrm{P})$ (D) $(\mathrm{I})\ (\mathrm{iii})\ (\mathrm{Q})$

SECTION – C
(Single digit integer type)

This section contains **FIVE** questions. The answer to each question is a single Digit integer ranging from 0 to 9, both inclusive.

50. On a normal standard die one of the 21 dots from any one of the six faces is removed at random with each dot equally likely to be chosen. The die is then rolled. If the probability that the top face has an odd number of dots is $\frac{p}{q}$ where p and q are in their lowest form, find $\frac{(\mathrm{p}+\mathrm{q})}{4}$

51. A function f is defined on the complex number by $f(z)=(a+bi)z$, where 'a' and 'b' are positive numbers. This function has the property that the image of each point in the complex plane is equidistant from that point and the origin. Given that $|a+bi|=8$ and that $b^2=\frac{u}{v}$ where u and v are coprimes. Find the value of (u + v)-250.

Space for Rough work

52. If $\begin{bmatrix} 1 & 2 & a \\ 0 & 1 & 4 \\ 0 & 0 & 1 \end{bmatrix}^n = \begin{bmatrix} 1 & 18 & 2007 \\ 0 & 1 & 36 \\ 0 & 0 & 1 \end{bmatrix}$ then find the value of $\frac{(n+a)}{100}$.

53. If the polynomial $f(x) = 4x^4 - ax^3 + bx^2 - cx + 5$ where $a, b, c \in R$ has four positive real roots say r_1, r_2, r_3 and r_4, such that $\frac{r_1}{2} + \frac{r_2}{4} + \frac{r_3}{5} + \frac{r_4}{8} = 1$. Find the value of (a-10).

54. All the three vertices of an equilateral triangle lie on the parabola $y = x^2$, and one of its sides has a slope of 2. The x-coordinates of the three vertices have a sum equal to $\frac{p}{q}$ where p and q are relatively prime positive integers. Find the value of (q-p)

Space for Rough work