Sri Chaitanya
IIT Academy
India.

ADVANCE -FULL TEST-8

Sec: SR's_All & LT-Prog-I&II_INDIA_e-TEST_SERIES **Date: 20-07-2020**

Time: 09:00 A.M To 12:00 Noon **JEE-ADV-2015-PAPER-1** **Max. Marks: 264**

SYLLABUS:

Physics : Total Syllabus

Chemistry : Total Syllabus

Mathematics : Total Syllabus

Name of the Student: _____ **H.T. NO:** | | | | | | | |

JEE-ADVANCE-2015-P1-Model

Time: : 09:00 A.M To 12:00 Noon **IMPORTANT INSTRUCTIONS** **Max Marks: 264**

PHYSICS:

Section	Question Type	+Ve Marks	- Ve Marks	No.of Qs	Total marks
Sec – I(Q.N : 1 – 8)	Questions with Integer Answer Type	4	0	8	32
Sec – II(Q.N : 9 – 18)	Questions with Multiple Correct Choice	4	-2	10	40
Sec – II(Q.N : 19-20)	Matrix Matching Type	8	-1	2	16
Total				**20**	**88**

CHEMISTRY:

Section	Question Type	+Ve Marks	- Ve Marks	No.of Qs	Total marks
Sec – I(Q.N : 21 –28)	Questions with Integer Answer Type	4	0	8	32
Sec –II(Q.N : 29 – 38)	Questions with Multiple Correct Choice	4	-2	10	40
Sec – II(Q.N : 39-40)	Matrix Matching Type	8	-1	2	16
Total				**20**	**88**

MATHEMATICS:

Section	Question Type	+Ve Marks	- Ve Marks	No.of Qs	Total marks
Sec– I(Q.N : 41 –48)	Questions with Integer Answer Type	4	0	8	32
Sec– II(Q.N :49 – 58)	Questions with Multiple Correct Choice	4	-2	10	40
Sec – II(Q.N : 59-60)	Matrix Matching Type	8	-1	2	16
Total				**20**	**88**

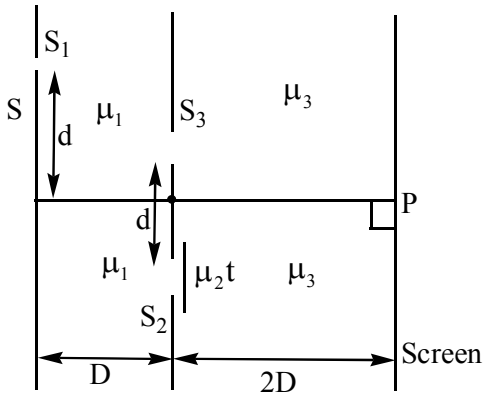
PHYSICS

Max Marks: 88

SECTION-1
(SINGLE DIGIT INTEGER TYPE QUESTIONS)

This section contains 8 Single digit integer type questions ranging from 0 to 9, both inclusive.(Each question correct marking (+4), No Negative (0))

1. In the figure shown 'S' is a monochromatic source of light emitting light of wavelength λ (in air). Light falls on slit 'S_1' from 'S' and then reach the slits 'S_2' and 'S_3' through a medium of refractive index 'μ_1'. Light from slits S_2 and S_3 reach the screen through medium of refractive index μ_3. A thin transparent film of refractive index μ_2 and thickness 't' is placed in front of 'S_2'. Point 'P' is symmetrical w r t. 'S_2' and 'S_3'. Using the values d = 1mm, D=1m, $\mu_1 = 4/3$, $\mu_2 = 3/2$, $\mu_3 = 9/5$ and $t = \frac{4}{9}\times 10^{-5} m$. Find the Distance of central maxima from P (in mm)

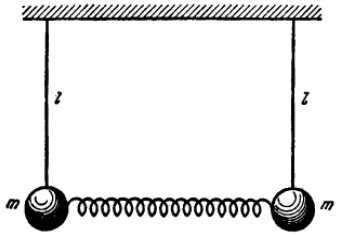


2. One mole of an ideal gas at a temperature T expands slowly according to the law P / V = constant. Its final temperature is 15 times its initial temperature. The work done by the gas is *kRT*. What is the value of *k*?

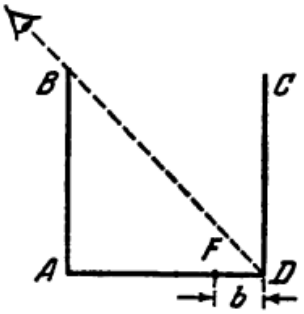
3. A bird is singing on a low branch of a tree and a man is listening to it at a distance *r* = 10m from the bird. The displacement of the man towards the bird so that the loudness increases by 20dB is [Assume that the motion of man is along the line joining the bird and the man]

4. A large tank of cross-section area *A* contains liquid of density ρ. A cylinder of density $\rho/4$, length *l* = 40 cm, and cross-section area a (<< A) floating in the liquid. It is pushed inside the liquid so that it is just submerged and then released at *t* = 0. Assuming that the water level in the tank remains constant, determine the speed (in m /s) of the cylinder when it reaches its equilibrium position for the first time. Neglect viscous forces.

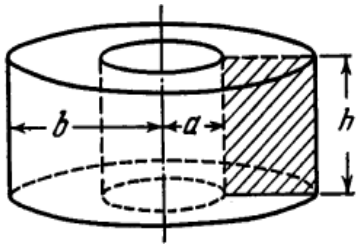
5. Two simple pendulums each with a length *l* are connected by a massless spring as shown. The spring constant of the spring is *k* = 3*mg*/2*l*, and the mass of bob of each pendulum is *m* . If the pendulums are displaced in the same direction, the time period of oscillations is T_1 and when they are displaced in the opposite direction, the time period of oscillations is T_2. What is the value of square of T_1/T_2 ?



6. A cuboidal vessel with non-transparent walls is so located that the eye of an observer does not see its bottom, but sees the entire wall CD. To what height (in cm), water (refractive index 4/3) should be poured into the vessel for the observer to see an object *F* placed at a distance b = 3.5 cm from corner D? The side AD of the vessel is 20 cm and the side AB of the vessel is 15 cm.



7. A ring of inner radius *a*= 1m, outer radius *b*= 2m and thickness h=0.5m is made of a material whose resistivity is ρ. The ring is placed in a uniform magnetic field present in a cylindrical region coaxial with the given ring (circular symmetry) and of radius larger than b. The magnetic field is directed along the axis of the ring and is given by $B = kt$, where k is a positive constant and t is time. What is the current induced in the ring in Ampere? (Given $k/\rho = 8$ in SI)

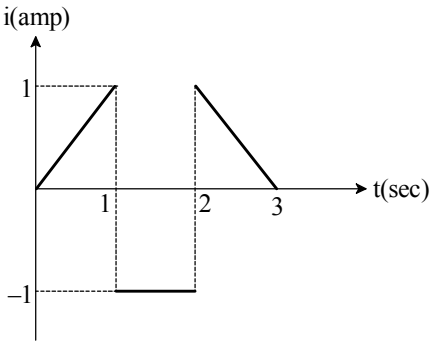


8. A point charge of $2\mu C$ starts moving (with negligible initial velocity) from infinity towards a large conducting plate. What is the kinetic energy of the charge when it is at a distance of 3 mm from the plate?

SECTION-2
(ONE OR MORE THAN ONE CORRECT OPTION QUESTIONS)

This section contains 10 multiple choice questions. Each question contains four options A, B, C and D (Each question correct marking (+4), Negative mark(-2))

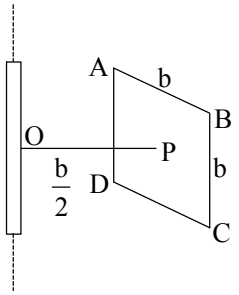
9. The figure shows current varying with time. The magnitude of constant direct current for a particular time which would produce same heat in an identical resistance as produced by given time varying current in three seconds.



A) 1 A when passed for 15 seconds **B)** $\frac{1}{3}$A when passed for 15 seconds

C) $\frac{\sqrt{5}}{3}$A when passed for 3 seconds **D)** $\frac{\sqrt{5}}{9}$A when passed for 3 seconds

10. There is a square wire frame ABCD of side equal to b and whose centre is at a distance $OP = \frac{b}{2}$ from an infinite line charge (parallel to BC and AD) with linear charge density λ then [plane of the frame is perpendicular to line OP]



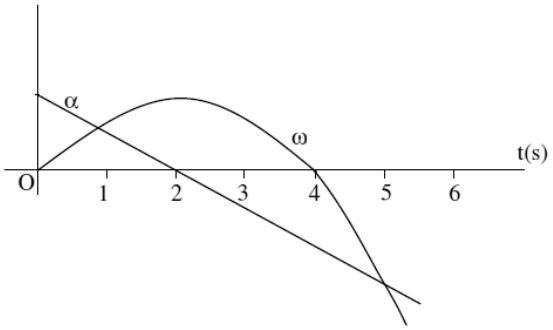
A) flux through ABCD is $\frac{\lambda b}{\epsilon_0}$

B) flux through ABCD is $\frac{\lambda b}{4\epsilon_0}$

C) electric field across AB is uniform

D) electric field across BC is uniform

11. The angular velocity (ω) and the angular acceleration (α) are plotted with time as shown. Which of the following options are incorrect?



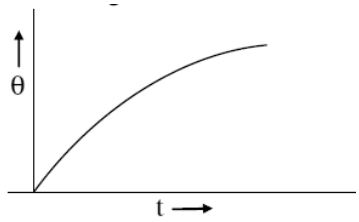
A) During the time 0 to 2 sec rotation is speeding down.

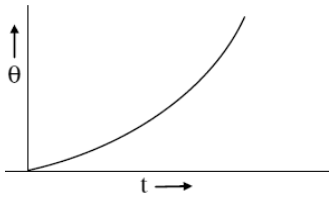
B) During the time 2 to 4 sec rotation is speeding down

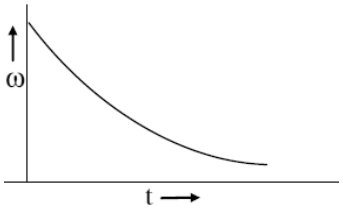
C) During the time 4 to 5 sec rotation is speeding down

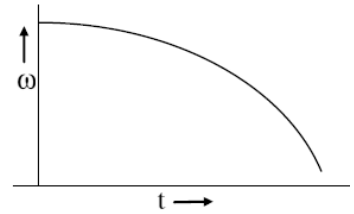
D) During the time 4 to 5 sec rotation is speeding up.

12. A solid body rotates about a stationary axis so that its angular velocity depends upon the rotation angle θ as $\omega = \omega_0 - k\theta$, where ω_0 and θ are positive constants. At the moment $t = 0$, the angle $\theta = 0$. Which of the following variations are correct?

A) 

B) 

C) 

D) 

13. A region is space contains a total positive charge Q that is distributed spherically such that the volume charge density is given by

$$\rho(r) = \begin{cases} \alpha & \text{for} \quad r \le \dfrac{R}{2} \\ 2\alpha\left[1 - \dfrac{r}{R}\right] & \text{for} \quad \dfrac{R}{2} \le r \le R \\ 0 & \text{for} \quad r \ge R \end{cases}$$

Where α is a positive constant. Then

A) The electric field intensity increases linearly with r for r < R/2

B) The electric field intensity increases monotonically with r for R/2 < r < R

C) The value of α in terms of Q and R is $\frac{8Q}{5\pi R^3}$

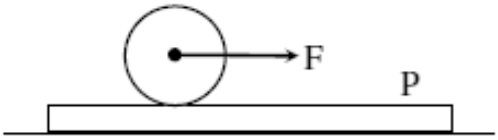
D) The value of α in terms of Q and R is $\frac{3Q\pi R^3}{8}$

14. There are four tuning forks, and one of them has frequency 553 Hz. By using any two forks at a time, the beat frequencies heard are 1, 2, 3, 5, 7, 8. Which of the following could be a possible set of frequencies of other three forks .

A) 554 555 and 561 Hz **B)** 552, 555 and 561 Hz

C) 554, 556 and 561 Hz **D)** 551, 554 and 559 Hz

15. A disc of mass *m* and radius *R* is placed over a plank of mass *m*. There is sufficient friction between disc and plank to prevent slipping and there is no friction between plank and ground. A horizontal force F is applied at the centre of the disc, then



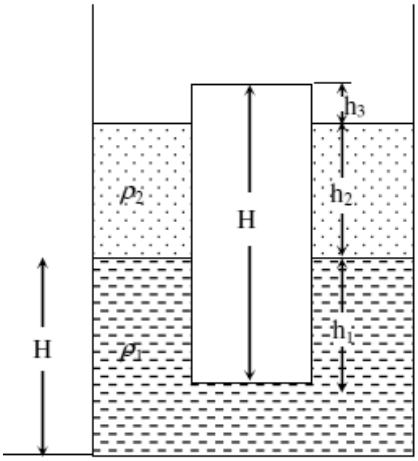
A) Acceleration of the disc is 3F/2m

B) Acceleration of the plank is F/3m

C) Friction force between disc and plank is $\frac{F}{4}$

D) Friction force between disc and plank is $\frac{F}{3}$

16. A solid cylinder having uniform cross section of height H and having density ρ is floating in equilibrium in two immiscible liquids of densities ρ_1 and ρ_2 as shown in figure. Choose correct alternatives. (h_2 < H)



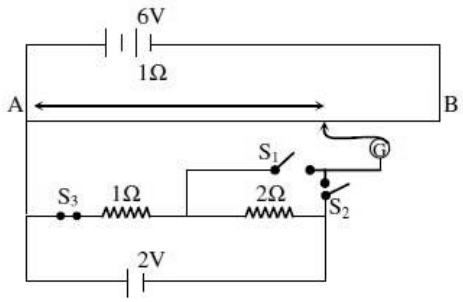
A) If $\rho < \rho_2 < \rho_1, h_3$ must be zero

B) If $\rho < \rho_2 < \rho_1, h_3$ may be zero

C) If $\rho_2 < \rho < \rho_1, h_3$ must be zero

D) If $\rho_2 < \rho < \rho_1, h_3$ must be non zero

17. Figure shows a potentiometer circuit. The length of the potentiometer wire AB is 120cm and its resistance is 2Ω. The internal resistance of 2V cell is negligible and the internal resistance of 6V cell is 1Ω. Initially the switches S_1 and S_2 are open and S_3 is closed



A) when only S_2 is open balanced length $l = 20cm$

B) when only S_1 is open balanced length $l = 60cm$

C) when all three switches are closed balanced length $60cm$

D) when S_3 is open, S_2 is also open but S_1 is closed balance length is $60cm$

18. Two radioactive samples A and B are initially in the ratio 1 : 4, and have initial activities of the nuclei in the ratio 1 : 8. If the half life of A is 4 years, choose the correct statement(s)

A) Half life of nuclei B is 2 years

B) At t = 8 years, activities of A and B are equal

C) At t = 12 years, ratio of number of nuclei of A to that of B is 2 : 1

D) At t = 4 years the activities of A and B are in ratio 1 : 2

SECTION-3
(MATRIX MATCHING TYPE QUESTIONS)

This section contains 2 Matrix matching questions. Each question contains column 1 has four entries A, B, C and D and column 2 has 5 entries P,Q, R,S and T (+2 each correct match and Negative mark -1)

19. Two blocks A and B of mass m and $2m$ respectively are connected by a massless spring of spring constant k. This system lies over a smooth horizontal surface. At t = 0 the block A is given a velocity $\mathbf{u}$ towards right as shown, while the speed of block B is zero, and the length of spring is equal to its natural length at that instant. In each situation of column I, certain statements are given and corresponding results are given in column II. Match the statements in column I corresponding to results in column II.

	Column-I		Column-II
A)	The velocity of block A	P)	can never be zero
B)	The velocity of block B	Q)	may be zero at certain instants of time
C)	The kinetic energy of system of two blocks	R)	is minimum at maximum compression of spring
D)	The potential energy of spring	S)	is maximum at maximum extension of spring
		T)	Continuously increases

20. For an object moving along the principle axis of an optical system, match the conditions given in column I to the optical system given in column II.

	Column-I		Column-II
A)	Object & image move in same direction.	P)	Converging mirror.
B)	Object & image move in opposite direction.	Q)	Diverging mirror
C)	If a real object moves towards the optical centre/pole, its image will always move towards it.	R)	Converging lens
D)	If a virtual object moves towards the optical centre/pole its image will always move towards it.	S)	Diverging lens
		T)	Not possible

CHEMISTRY

Max Marks: 88

SECTION-1
(SINGLE DIGIT INTEGER TYPE QUESTIONS)

This section contains 8 Single digit integer type questions ranging from 0 to 9, both inclusive.(Each question correct marking (+4), No Negative (0))

21. The maximum number of sulphur atoms that can present in same plane in S_8 molecule

22. Double strand chain silicates called amphiboles are formed by condensing (SiO_4) tetrahedra. These are three types containing 2,4 and 6 silicon atoms per basic silicate unit. The number of charges or unshared oxygens present in the basic unit containing 4 silicon atoms is

23. The number of negatively charged sols among the following is

(A) As_2S_3 (sol) (B) Au(sol) (C) Ag(sol)

(D) starch sol (E) CdS (sol) (F) TiO_2 (sol)

(G) $Al_2O_3.xH_2O$ (sol) (H) Clay (I) Methylene blue sol

24. An aqueous solution of $FeCl_3$ obtained, when an etched copper circuit board was washed, required 40 mL of 0.1 M hydrazine hydrochloride for its reduction to Fe^{2+}. During this process hydrazine gets converted to N_2. How many mL of $\frac{2}{3}$ M nitric acid is required for the re-oxidation of Fe^{2+} to Fe^{3+}?

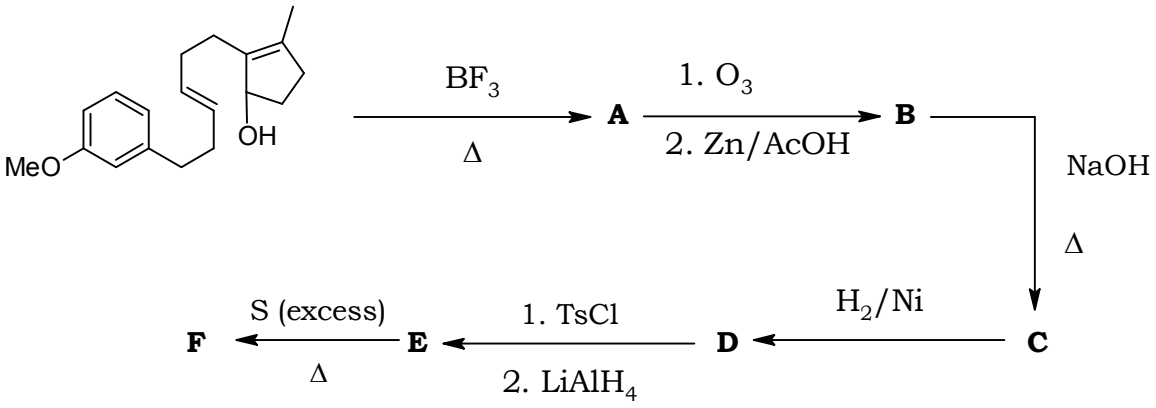
[Given: Nitric acid gets reduced to NO during this process]

25. Zinc rod is dipped in 1 L of 0.2 M $Zn(NO_3)_2$ and Ag is dipped in 1 L of 0.1M $AgNO_3$ at 25^0C. E_{cell} = 1.52V. When solid KCl is added to cathode chamber, AgCl gets precipitated and E_{cell} becomes 1.04 V and $[K^+]$ becomes 0.3M. If K_{sp} of AgCl is determined from this experiment to be 'a' $\times 10^{-10}$, what is the value of 'a'?

[Take $\frac{2.303RT}{F}=0.06$]

26. The number of isomeric dichloro derivatives of cyclopentane is

27. Consider the following reaction sequence:



The number of pi bonds in the final product of the sequence, **F,** is

28. The number of moles of electrons involved in the conversion of 1 mole of ethylbenzene to benzoic acid is

SECTION-2
(ONE OR MORE THAN ONE CORRECT OPTION QUESTIONS)

This section contains 10 multiple choice questions. Each question contains four options A, B, C and D (Each question correct marking (+4), Negative mark(-2))

29. Which of the following statements is/are correct?

A) Valence bond theory and molecular orbital theory can be described as two different views of the same thing

B) When one considers the molecular orbitals resulting from the overlap of any two specific atomic orbitals the bonding orbitals are always lower in energy than the antibonding orbitals

C) Molecular orbitals are generally described as being more delocalized than the hybrid atomic orbitals

D) One of the short comings of MO theory is its inability to account for a triple bond in the nitrogen molecule.

30. An analytical team of chemistry analysed a green mineral by fusing with NaOH in the presence of air followed by leaching with water. A brown residue and an yellow solution which changes to orange colour. On adding H_2SO_4 the yellow solution gave a solid with $BaCl_2$. The solid obtained by evaporation of filtrate when subjected to flame test gave bright yellow colour to the flame. The possible compounds formed at different stages in this process is/are

A) $Fe_2O_3.xH_2O$ **B)** Na_2CrO_4 **C)** $Na_2Cr_2O_7$ **D)** $NaCl$

31. Which of the following statement regarding sulphur is/are correct?

A) Rhombic sulphur is diamagnetic but plastic sulphur is paramagnetic

B) When paramagnetic S_2 molecules convert into rhombic sulphur containing S_8 molecules becomes diamagnetic with liberation of energy

C) Viscosity of liquid sulphur decreases with increase in temperature

D) Outer Moleculer orbital (M.O) electronic configuration of all the three molecules S_2, SO and O_2 is same

32. Which of the following statements is/are correct?

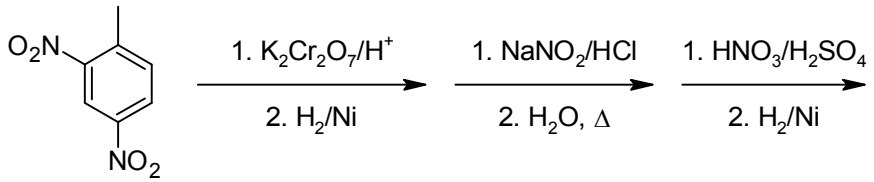
A) The stability constant of $\left[Co\left(NH_3\right)_6\right]^{3+}$ is greater than $\left[Co\left(NH_3\right)_6\right]^{2+}$

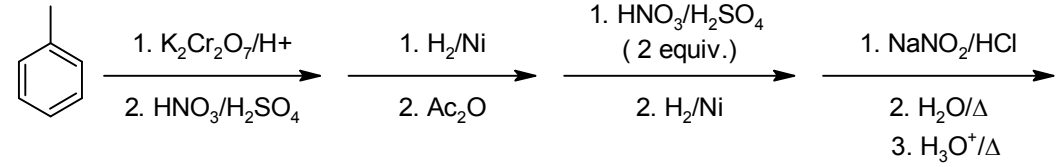
B) Among F^-, Cl^-, Br^- and I^-, F^- forms stable complexes due to small size

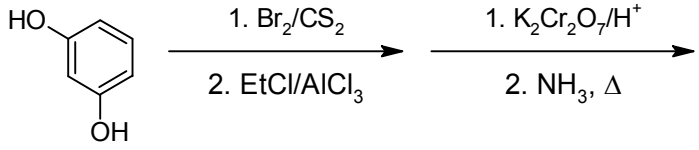
C) $\left[Cu\left(NH_3\right)_4\right]^{2+}$ is thermodynamically more stable than $\left[Zn\left(NH_3\right)_4\right]^{2+}$

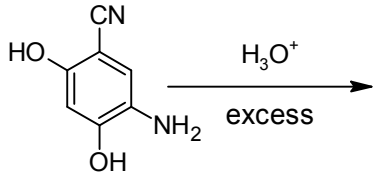
D) Among $\left[Fe\left(CN\right)_6\right]^{3-}$, $\left[Fe\left(H_2O\right)_6\right]^{2+}$ and $\left[Fe\left(en\right)_3\right]^{3+}$; $\left[Fe\left(en\right)_3\right]^{3+}$ is most stable due to chelate effect.

33. Which of the following methods produce(s) 5-Amino-2,4-dihydroxybenzoic acid as the major product?

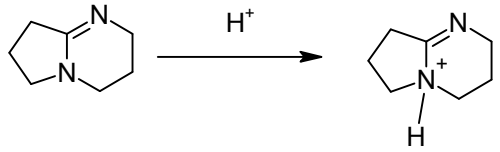
A) 

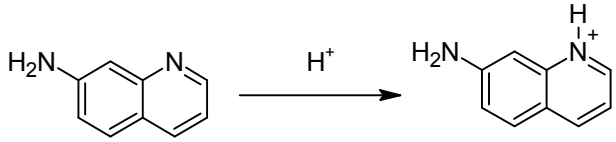
B) 

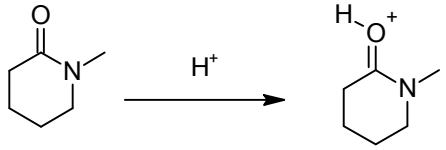
C) 

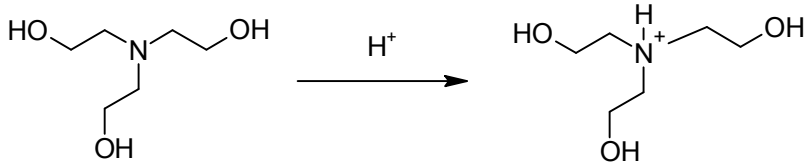
D) 

34. Spontaneous process(es) among the following is/are

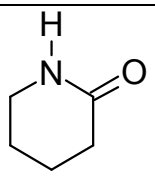
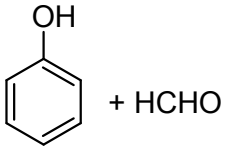
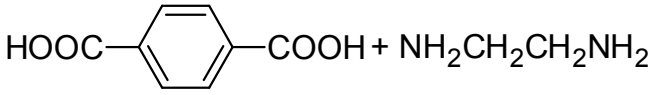
A) 

B) 

C) 

D) 

35. The correctly matched polymers and their monomers is/are

	Polymer	Monomer(s)
A)	Nylon-6	
B)	Teflon	$F_2C=CF_2$
C)	Novolac	
D)	Terylene	

36. Correct statement(s) among the following is/are

A) The restrictions on azimuthal quantum number, *l* and magnetic quantum number, *m* give rise to n^2 sets of quantum numbers for every value of *n*, the principal quantum number.

B) Magnetic quantum number distinguishes between the orbitals available within a subshell.

C) Magnetic spin quantum numbers, $m_s = \pm ½$ refer to two quantum mechanical spin states, and are independent of other three quantum numbers.

D) The restrictions on principal quantum number (*n*), azimuthal quantum number (*l*), magnetic quantum number, (*m*) and magnetic spin quantum number (m_s) , give rise to $2n^2$ sets of quantum numbers for every value of n, the principal quantum number.

37. Consider the following setup of two bulbs with adiabatic walls separated by an adiabatic valve.

The left side flask is of volume 1 L and contains 0.2 moles of N_2O_4 and 0.1 moles of NO_2 at equilibrium at 25 °C.

$$N_2O_4(g) \rightleftharpoons 2NO_2(g)$$

The larger flask on the right side is of 3 L volume and is empty at 25°C. The connecting valve is suddenly opened. The correct statement(s) regarding this system is/are

A) The temperature of the system falls the moment the valve is open.

B) Entropy of the system keeps on increasing till the system regains the equilibrium.

C) The total number of moles remain the same before and after opening of the valve.

D) The number of moles of NO_2 at the new equilibrium is 0.18.

38. Correct statement(s) regarding volumetric determination of strength of $KMnO_4$ solution by standard Mohr's salt solution is/are

A) $KMnO_4$ undergoes five electron reduction in acidic medium.

B) Mn^{2+}produced as a product catalyses the reaction.

C) HCl and HNO_3 cannot be used to provide acidic medium in this titration.

D) $KMnO_4$ itself acts as the indicator in this titration.

SECTION-3
(MATRIX MATCHING TYPE QUESTIONS)

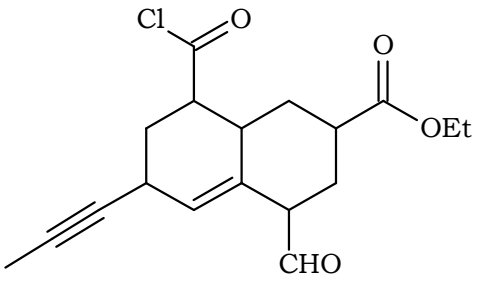
This section contains 2 Matrix matching questions. Each question contains column 1 has four entries A, B, C and D and column 2 has 5 entries P,Q, R,S and T (+2 each **correct match and Negative mark -1)**

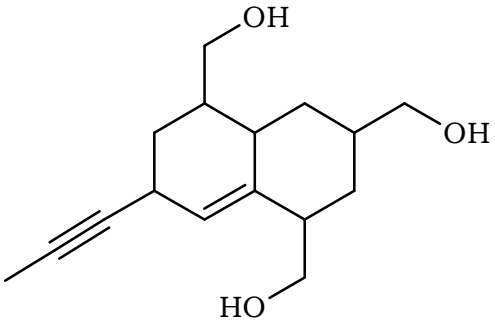
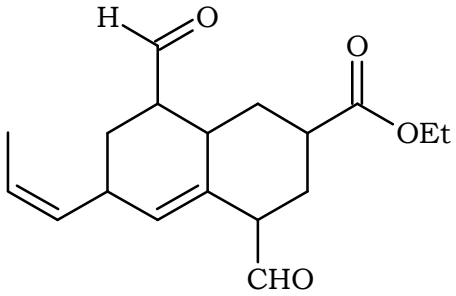
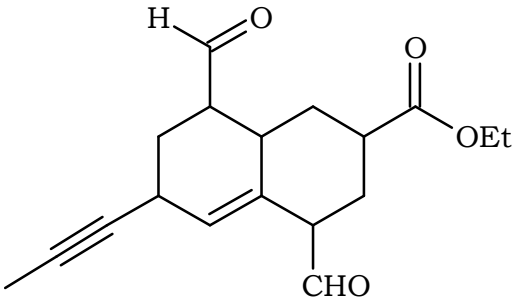
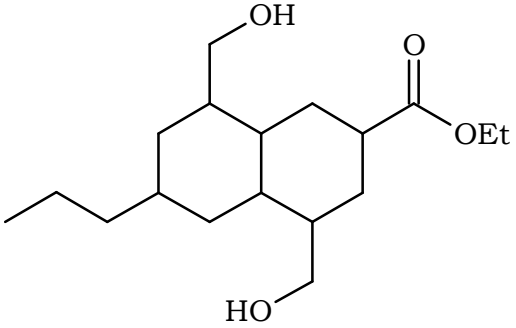
39. In Column-I metal ion is given. In column-II test for the detection of metal ions are given.

Match the metal ion given in Column-I with the test given in Column-II by which the metal ion can be identified.

	Column-I		Column-II
A)	Mn^{2+}	P)	Flame test
B)	Pb^{2+}	Q)	With aqueous ammonia gives white precipitate
C)	Ag^{+}	R)	With neutral solution of disodium hydrogen phosphate gives yellow ppt
D)	Cu^{2+}	S)	Black precipitate with KSCN which slowly changes to white
		T)	Gives precipitate with dil HCl

40. Consider the following compound with multiple functional groups. **Column-I** lists the product to be obtained and **Column-II**, the reagent(s) for the same. Match the transformations with the appropriate reagents. When more than one functional group is transformed, excess of the reagent may be employed.



	Column-I		Column-II
A)		P)	$H_2 / Pd - BaSO_4$/Quinoline
B)		Q)	$Li\left[HAl\left(O-t-Bu\right)_3\right]$/low temperature
C)		R)	$NaBH_4$
D)		S)	$LiAlH_4$
		T)	H_2 / Ni

MATHEMATICS

Max Marks: 88

SECTION-1

(SINGLE DIGIT INTEGER TYPE QUESTIONS)

This section contains 8 Single digit integer type questions ranging from 0 to 9, both inclusive. (Each question correct marking (+4), No Negative (0))

41. If $\frac{\int_0^1 x\left(1-\left(1-x^2\right)^{100}\right)^{2019}}{\int_0^1 x\left(1-\left(1-x^2\right)^{100}\right)^{2020}}dx=\frac{p}{q}\ \left(p,q,\in N,G.C.D\text{ of }\left(p,q\right)=1\right)$ then sum of digits of $p+q$ equals

42. If the number of three digit numbers which are divisible by 3 and have the property that the sum of the digits of the number is 4 times middle digit of that number is P then the number of possible integral divisors of P equals

43. In $\Delta ABC, AB=12, BC=5$, $\underline{\lfloor B}=90°$ A semicircle of maximum area Δ' with diameter on AB is inscribed in ΔABC. If the area of ΔABC is Δ then the value of $\frac{1}{3}[\Delta-\Delta']$ equals $\left([.]is\,GIF\right)$

44. If $\left(1+\frac{1}{x}\right)^{x+1}=\left(1+\frac{1}{2019}\right)^{2019}$ and if sum of the digits in x^2 is equal to S then $\frac{S}{2}$ equals____

45. Let $A_n=\left[aij\right]_{n\times n}$ where $aij=\frac{1}{\min\left(i,j\right)},1\le i,j\le n$ then the sum of digits of $\frac{\det\left(A_4\right)}{\det\left(A_6\right)}$ equals

46. Define sequence $< a_n >$ by $a_1=1, a_{2n}=a_n\ and\ a_{2n+1}=\left(-1\right)^n.a_n$ then the value of $\left(\sum_{n=1}^{2013}a_n.a_{n+2}\right)^2$ equals _____

47. Given $n\in N$, let $M\left(n\right)$ be the largest of m(n) such that $\binom{m}{n-1}>\binom{m-1}{n}$ and if the value of $\lim_{n\to\infty}\frac{M\left(n\right)}{n}=a+\sqrt{b}\left(a,b\in Q\right)$ then $\left[ab\right]$ equals $\left([.]is\,GIF\right)\left(\binom{n}{r}\text{means }{}^{n}C_{r}\right)$

48. ABCD is a square. Taking AB and AD as hypotenuse, two right triangles are constructed inward say ABE and ADF, such that A, E, F are collinear. Given AE=3, AF=4 then the value of [3x] where x=CF, is____([.] GIF)

SECTION-2

(ONE OR MORE THAN ONE CORRECT OPTION QUESTIONS)

This section contains 10 multiple choice questions. Each question contains four options A, B, C and D (Each question correct marking (+4), Negative mark(-2))

49. Which is/are correct

A) $\tan^{-1}\left(x-\sqrt{x^2+1}\right)=\frac{1}{2}\tan^{-1}x-\frac{\pi}{4}$ is true $\forall x\in\mathbb{R}$

B) $\lim_{n\to\infty}\left(n.\left(1+\frac{1}{n}\right)^n-en\right)=-\frac{e}{2}$

C) If $2020^x+2020^{-x}=3$ then $\sqrt{\frac{2020^{6x}-2020^{-6x}}{2020^x-2020^{-x}}}=12$

D) The function $f(x)=3x^2+\sqrt{2}x+\sin 2x+\cos 2x$ has no local minima.

50. Consider the lines $L_1:\frac{x-2}{-3}=\frac{y-1}{5}=\frac{z+2}{-2}$ and $L_2:\frac{x}{2}=\frac{y}{-3}=\frac{z}{1}$ then the line along the shortest distance can be constituted by the line of intersection of the planes

A) $7x+y-8z=31$ **B)** $x-3y+5z=0$

C) $5x-7y+2z=-1$ **D)** $4x+y-5z=0$

51. Let $\Delta(K)$ represents the number of real roots of the polynomial, biquadratic equation $x^4+x^2(k+1)-kx+k(1+k)=0$ then which of the following is/are **incorrect**

A) $\Delta(0)=2$ **B)** $\Delta(1)=2$

C) $\Delta(2)+\Delta(3)=4$ **D)** $\Delta(3)+\Delta(4)=2$

52. If the number of solutions of the equation $|\cos 2x|+|\cos 2x-1|+|\cos 2x-3|+|\cos 2x-4|=6$ in the interval $[0,n\pi]$, $n\in N$ is $\phi(n)$ then which is/are correct

A) $\phi(3)=4$ **B)** $\phi(4)=5$ **C)** $\phi(4)=\phi(5)$ **D)** $\phi(1)+\phi(2)=5$

53. Let $I=\int_0^1\left(\left[\frac{1}{2x}\right]-\frac{1}{2}\left[\frac{1}{x}\right]\right)dx$ $\left([.]\,is\,GIF\right)$ then which is/are correct

A) I<0 **B)** I>0 **D)** I<-1 **D)** I>-1

54. Two tangents to the parabola $y^2=8x$ are equally inclined to the line $y=x\cot\alpha+2020\left(\alpha\text{ is constant }\alpha\neq n\pi,n\in Z\right)$ then the locus of point of intersection of the tangents is $ax+y\cot 2\alpha=c$, so that the correct is/are ([.] is GIF)

A) $a+c=3$ **B)** $a+c=1$ **C)** $[a]=1$ **D)** $[c]=2$

55. Let $A\left(a,\frac{1}{a}\right)$ and $B\left(b,\frac{1}{b}\right)$ be two points respectively on $xy=1(x>0,y>0)$ and let us suppose P is on that curve between A and B such that area of ΔPAB is maximum, $(a<b)$ then the area of region bounded by $xy=1$ and line AP equals

A) $\frac{b-a}{2\sqrt{ab}}-\ln\left(\frac{b}{a}\right)$ **B)** $\frac{b-a}{\sqrt{ab}}-\frac{1}{2}\ln\left(\frac{b}{a}\right)$ **C)** $\frac{b-a}{2\sqrt{ab}}+\ln\left(\frac{b}{a}\right)$ **D)** $\frac{b-a}{\sqrt{ab}}+\frac{1}{2}\ln\left(\frac{b}{a}\right)$

56. Two regular polygons are said to be matching if double the interior angle of one is triple the exterior angle of the other. Then which is/are correct

A) The numbers of matching pairs of polygons is 4

B) If m, n are number of sides of polygons then $|m-n|$ can be 2

C) If m, n are number of sides of polygons then $|m-n|$ can be 4

D) If m, n are number of sides of polygons then $|m+n|$ can be 12

57. Let $S_k=3^k\binom{100}{0}\binom{100}{k}-3^{k-1}\binom{100}{1}\binom{99}{k-1}+3^{k-2}\binom{100}{2}\binom{98}{k-2}-.....+(-1)^k\binom{100}{k}\binom{100-k}{0}$

where $\binom{n}{r}$ represents the coefficient of x^r in the binomial expansion of $(1+x)^n\ \forall n\in N$ and $V_k=\left(\frac{1}{2}\right)^k S_k=M(100,k)$. Which of the following is/are correct

A) The value of $\sum_{k=0}^{100}S_kS_{100-k}$ equals $2^{100}\binom{200}{100}$

B) The value of the M(101,50) – M(100,50) is equal to M(100,51)

C) In an examination, there are 100 true-false type questions. The number of ways in which one student can make his choice to attempt or not to attempt the questions is given by $\sum_{k=0}^{100}S_k$

D) In an examination, there are 100 true-false type questions. The number of ways in which one student can make his choice to attempt or not to attempt the questions is given by $\sum_{k=0}^{100}V_k$

58. Starting with the number 0, Rajesh performs an infinite sequence of moves as follows. He Chooses a number from {1, 2} at random (each with probability ½) and adds it to the current number. Let p_n be the probability that he reaches a number n, then which is / are correct

A) $p_4 = 11/16$ **B)** $p_6 = 43/64$

C) $p_{20} - p_{15} = 11/2^{20}$ **D)** $p_{10} = 45/256$

SECTION-3
(MATRIX MATCHING TYPE QUESTIONS)

This section contains 2 Matrix matching questions. Each question contains column 1 has four entries A, B, C and D and column 2 has 5 entries P,Q, R,S and T (+2 each correct match and Negative mark -1)

59. Match the following

List-I		List-II	
A)	If $\sqrt[4]{5}\cos\left(\frac{1}{2}arc\tan 2\right)$ is equal to $\sqrt{\frac{a+\sqrt{b}}{2}}\ (a,b\in N)\left(\sqrt{b}surd\right)$ then a+b equals	P)	6
B)	If $\int_0^{\pi/4} x\left(\prod_{k=1}^{\infty}\cos\left(\frac{x}{2^n}\right)\right)dx = \frac{p-\sqrt{q}}{2}$ ($p,q\in N,\sqrt{q}$ surd) then p+q equals	Q)	4
C)	$\int_0^e x.\sqrt{x.\sqrt[3]{x\sqrt[4]{x.\sqrt[5]{x.....\infty}}}}\,dx = e^{A(e)+B}\ (A,B\in N)$ then A+B equals	R)	2
D)	If $\int e^{\cos^{-1}x}dx = \frac{1}{2}e^{\cos^{-1}x}\left(A+B\sqrt{1-x^2}\right)+C$ then A+B equals	S)	0
		T)	

60. Match the following

Column-I		Column-II	
A)	$\int_0^{\pi} \cos(7x)\cos(17x)\cos(37x)\,dx$ equals	P)	0
B)	$\int \sin(101x).\sin^{99} x\,dx = k\sin(100x).\sin^{100} x + C$ then sum of digits of $\frac{1}{K}$ is	Q)	1
C)	$\int_0^4 3^{\sqrt{2x+1}}\,dx = \frac{A}{\ln 3} - \frac{B}{(\ln 3)^2}$ then $A-3B$ equals	R)	3
D)	If α is the real solution of the equation $x^3 - 3x^2 - 3x - 1 = 0$ and if $\frac{1}{\alpha}$ equals $\sqrt[3]{a} - \sqrt[3]{b}$ $(a,b \in N)$ then a+b equals	S)	6