Time:3 hour

CCT - 10 (JEE MAINS)

DATE: 22.10.2023
M. MARKS: 300

TOPICS

PHYSICS: Full Syllabus
CHEMISTRY: Full Syllabus
MATHEMATICS: Full Syllabus

INSTRUCTIONS

1. Duration of Test is 3hrs.
2. The Test booklet consists of 90 questions. The maximum marks are 300.
3. There are three parts in the question paper A, B, C consisting of Physics, Chemistry and Mathematics having 30 questions in each part of equal weightage. Each part has two sections.
   (i) Section-I: This section contains 20 multiple choice questions which have only one correct answer. Each question carries 4 marks for correct answer and -1 mark for wrong answer.
   (ii) Section-II: This section contains 10 questions. In Section II, attempt any five questions out of 10. The answer to each of the questions is a numerical value. Each question carries 4 marks for correct answer and -1 for wrong answer.

PHYSICS

SECTION – A
(SINGLE CORRECT ANSWER TYPE)

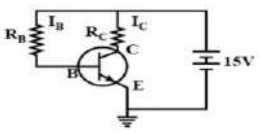
1. A student measures the time period of 20 oscillation of simple pendulum five times. That data set is $53s, 52s, 55s, 54s$ and $51s$. If the minimum division in the measuring clock is $1s$, then the reported time period should be

   1. $50 \pm 1\text{sec}$
   2. $52 \pm 2\text{sec}$
   3. $53 \pm 2\text{sec}$
   4. $53 \pm 1\text{sec}$

2. A sphere of mass m and radius r rolls on a horizontal plane without slipping with the speed u. Now, if it rolls up vertically, the maximum height it would attain will be

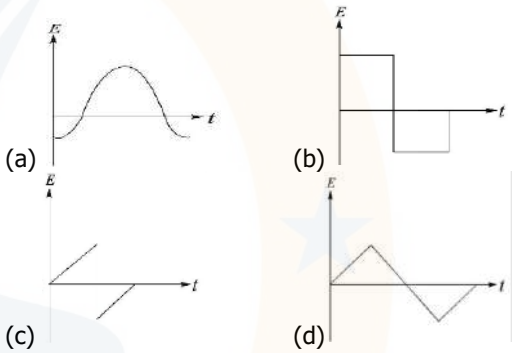
   1. $\frac{3u^2}{4g}$
   2. $\frac{35u^2}{2g}$
   3. $\frac{7u^2}{10g}$
   4. $\frac{11u^2}{9g}$

3. In the following common emitter circuit, if $\beta = 100. V_{CE} = 7$ V, $V_{BE} =$ negligible, $R_C = 2k\Omega$, then $I_B =$?



   1. 0.01 mA
   2. 0.04 mA
   3. 0.02 mA
   4. 0.03 mA

4. The variation of EMF with time for four types of generators are shown in the figures. Which amongst them can be called AC?



   1. (a) and (b)
   2. (a), (b), (c) and (d)
   3. (a) and (b)
   4. Only (a)

5. A small solid ball is dropped from a height above the free surface of a liquid. It strikes the surface of the liquid at $t = 0$. The density of the material of the ball is $500\ \text{kg/m}^3$ and that of liquid is $1000\ \text{kg/m}^3$. If the ball comes momentarily at rest at $t = 2\text{sec}$ then initial height of the ball from the surface of liquid was (neglect viscosity) $(g = 10m/s^2)$

   1. 20 m
   2. 10 m
   3. 15 m
   4. 25 m

6. The relations amongst the three elements earth's magnetic field, namely horizontal component H, vertical component V and dip δ are, ($B_E =$ total magnetic field)

   1. $V = B_E \tan\delta, H = B_E$
   2. $V = B_E \sin\delta, H = B_E \cos\delta$
   3. $V = B_E \cos\delta, H = B_E \sin\delta$
   4. $V = B_E, H = B_E \tan\delta$

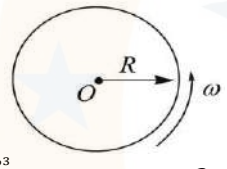
7. A hollow metal sphere or radius R is uniformly charged. The electric field due to the sphere at a distance r from the centre:

1. Increases as r increases for $r < R$ and for $r > R$
2. Zero as r increases for $r < R$, decreases as r increases for $r > R$
3. Zero as r increases for $r < R$, increases as r increases for $r > R$
4. Decreases as r increases for $r < R$ and $r > R$

8. The value of numerical aperture of the objective lens of a microscope is 1.25. If light of wavelength 5000Å is used then minimum separation between two points, to be seen as distinct is

1. $0.24\mu m$
2. $0.48\mu m$
3. $0.12\mu m$
4. $0.38\mu m$

9. A uniform circular ring of radius ' R ' density ρ and young's modulus ' Y ' is placed on a smooth horizontal surface. The ring is rotated with a constant angular velocity ω about is own axis is shown. The increase in the radius of the ring is (assume increment in radius is very small as compared to radius)



1. $\frac{\rho\omega^2R^3}{2Y}$
2. $\frac{\rho\omega^2R^3}{Y}$
3. $\frac{3\rho\omega^2R^3}{2Y}$
4. $\frac{2\rho\omega^2R^3}{Y}$

10. A uniform chain of mass m and length ℓ hangs on a thread and touches the surface of a table by its lower end. Find the force exerted by the table on the chain when half of its length has fallen on the table. The fallen part does not from heap and does not bounce

1. $\frac{3mg}{4}$
2. $\frac{mg}{2}$
3. $\frac{3mg}{2}$
4. mg

11. A body is projected away from the earth's surface with a speed $3v_e$ where v_e is the escape velocity. The speed of the body at infinity will be:

1. 0
2. $\sqrt{2}v_e$
3. $2v_e$
4. $2\sqrt{2}v_e$

12. A cyclic process contains four steps AB, BC, CD and DA. Heat involved in different processes is given as $Q_{AB} = +200$ J, $Q_{BC} = +600$ J, $Q_{CA} = -300$ J and $Q_{DA} = 0$, then efficiency of process is

1. $\frac{5}{8}$
2. $\frac{3}{8}$
3. $\frac{1}{4}$
4. $\frac{1}{2}$

13. The potential energy of a particle under a conservative force is given by $U(x) = (x^2 - 3x)J$. the equilibrium position of the particle is at

1. $x = 1.5$ m
2. $x = 2m$
3. $x = 2.5$ m
4. x=3m

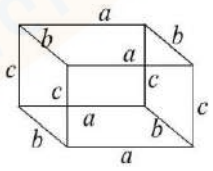
14. In which of the following devices, the eddy current effect is not used?

1. Induction furnace
2. Magnetic braking in train
3. Electromagnet
4. Electric heater

15. Two identical photons of energy $E(4eV \le E \le 8eV)$ fall on two different metals whose work functions are in the ratio of $1:2$. The ratio of the kinetic energies of the most energetic electrons coming from each metal is $2:1$. Work function of one of the metals is 4eV. What is the energy of photon in eV.

1. 6eV.
2. 8eV
3. 4eV
4. 5eV

16. A solid conducting cuboid of dimensions $(a \times b \times c)$, having mass ' m ' resistivity ρ and density ' d ' is connected through ideal battery ' V ' volt across the opposite faces for three different situations, produces power P_1, P_2 and P_3 respectively. Given that $P_1 : P_2 : P_3 = 1:2:8$ choose the correct option. (given $a > b > c$)



1. $c = \sqrt[3]{\frac{3}{4d}}$
2. $c = \sqrt[3]{\frac{m}{4\sqrt{2}d}}$
3. $c = \sqrt[3]{\frac{m}{4d}}$
4. $c = \sqrt[3]{\frac{m}{2d}}$

17. An organ pipe of length L is open at one end and closed at the other end. The air column in the pipe is vibrating in second overtone. The minimum distance from the open end where the pressure amplitude is half of the maximum value is

1. $\frac{L}{4}$
2. $\frac{L}{8}$
3. $\frac{L}{12}$
4. $\frac{L}{15}$

18. A T.V tower has a height $150\ \text{m}$. The population density around the T.V. tower will be, if the population covered is 50 lacs? (Radius of earth $= 6.4 \times 10^6\ \text{m}$)

1. $708.5\ \text{km}^{-2}$
2. $828.6\ \text{km}^{-2}$
3. $856.8\ \text{km}^{-2}$
4. $454\ \text{km}^{-2}$

19. Given below are two statements: One is labelled as Assertion (A) and the other is labelled as Reason(R).

Assertion(A): In an uniform magnetic field, speed and energy remains constant for a moving charged particle

Reason(R): Moving charged particle experiences magnetic force perpendicular to its direction of motion

1. Both (A) and (R) are true and (R) is the correct explanation of (A).
2. Both (A) and (R) are not true and (R) is NOT the correct explanation of (A).
3. (A) is true but (R) is false.
4. (A) is false but (R) is true.

20. Assertion(A): C_p is always greater than C_v in gases.

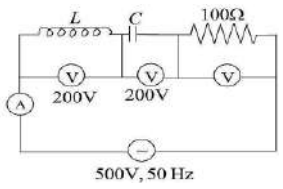
Reason(R): Work done at constant pressure is more than that at constant volume.

1. Both (A) and (R) are true and (R) is the correct explanation of (A).
2. Both (A) and (R) are not true and (R) is NOT the correct explanation of (A).
3. (A) is true but (R) is false.
4. (A) and (R) are false.

SECTION – B
(NUMERICAL VALUE TYPE)

21. A rope of length $10\ \text{m}$ and linear density $0.5\ \text{kg/m}$ is lying length wise on a smooth horizontal floor. It is pulled by a force of $25\ \text{N}$. The tension in the rope at a point $6\ \text{m}$ away from the point of application of force is N

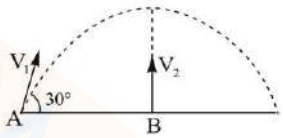
22. The ratio of readings of A.C voltmeter across the resistance and A.C ammeter in the circuit is ' n ' volt per ampere then n is equal to



23. Electrons with de Broglie wavelength λ fall on the target in an X-ray tube. The cut-off wavelength of the emitted X-rays is $\frac{nmc\lambda^2}{h}$ then n is [m is mass of electron, c is speed of light and h is plank's constant]

24. In Young's double slit experiment how many maximas can be obtained on the screen (including the central maximum) on both sides of the central fringe. If $\lambda = 2000$ A and $d = 7000$ A .

25. A body is projected with a velocity v_1 from the point A as shown in the figure. At the same time, another body is projected vertically upwards from B with velocity v_2. The point B lies vertically below the highest point. For both the bodies to collide, $\frac{v_2}{v_1}$ should be $\frac{1}{x}$ then x =



26. In a system of units if force (F), acceleration (A) and time (T) are taken as fundamental units, then the dimensional formula of energy will become $[FAT^{x/3}]$. Find value of x ?

27. A sample contains two radioactive materials A and B with half life of 51 hours and 2 hours respectively. The nucleus A decays into B and B decays into stable nucleus C. At $t = 0$ activities of both samples were equal. The ratio of activity of A to that of B when the activity of B is maximum is

28. $1\ \text{kg}$ of diatomic gas is at a pressure of $8 \times 10^4\ \text{N/m}^2$. The density of the gas is $4\ \text{kg/m}^3$.
The energy of the gas due to its thermal motion is $N \times 10^4 J$ then value of N

29. In an adiabatic change, the pressure P and temperature T of a diatomic gas are related by the relation $P \propto T^C$, where C equal to $\frac{x}{2}$. Then value of the x

30. Unpolarized light of intensity I passes through an ideal polarizer A. Another identical polarizer B is placed behind A. The intensity of light beyond B is found to be I/2. Now another identical polarizer C is placed between A and B. The intensity of light beyond B is now $I/8$. The angle between polarizer A and C is (degrees)

CHEMISTRY

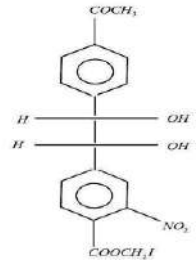
SECTION – A
(SINGLE CORRECT ANSWER TYPE)

31. An organic compound $C_xH_{2y}O_y$ was burnt with twice the amount of O_2 gas as required for complete combustion into CO_2 and H_2O. The hot gases when cooled to 0^0C and $1\ \text{atm}$ pressure measured 2.24 litres. The water collected during the cooling weighs 0.9 grams. The vapour pressure of pure water is

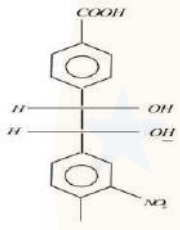
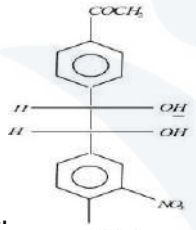
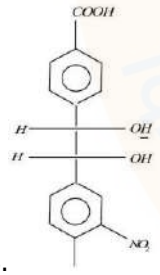
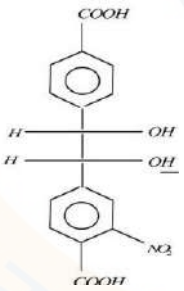
17.5 mm of Hg at $20°C$ and is lowered by 0.104 mm of Hg when 50 grams of organic compound is dissolved in 1000 grams water. (Assume that organic compound is non volatile and does not dissociate or associate). The molecular formula of the compound is

1. $C_5H_{10}O_5$
2. $C_{10}H_{10}O_5$
3. $C_5H_5O_{10}$
4. $C_5H_{10}O_{10}$.

32.



One mole of above compound was treated with excess of $NaOH/I_2$ and then acidified. The correct product and the product after acidification has isolated. The least acidic ' H ' in the product will be (the least acidic ' H ' has been underlined).

1. 
2. 
3. 
4. 

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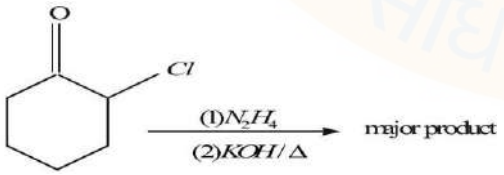

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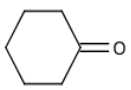
2. 
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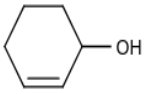
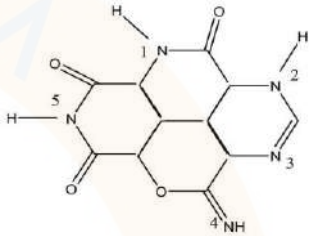
4. 

34. Statement-1: Optical diastereomers differ in specific rotation.

Statement-2: Optical diastereomers may have same or opposite signs of rotation or may be inactive.

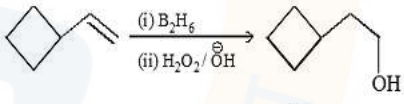
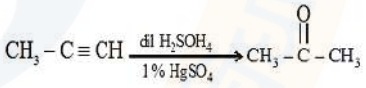
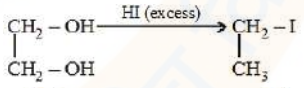
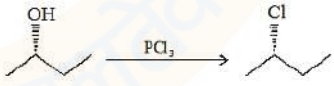
1. Statement -1 is true, Statement -2 true, Statement-2 is a correct explanation for statement1.
2. statement- 1 is true, statement- 2 is true, Statement- 2 is NOT a correct explanation for statement-1.
3. Statement -1 is true, statement -2 is false.
4. Statement -1 is false; Statement -2 is true.

35. Consider the following compound. The correct decreasing order of pK_a values of conjugate acids of the labeled nitrogen atoms in the below compound is.



1. $3 > 2 > 1 > 4 > 5$
2. $4 > 3 > 2 > 1 > 5$
3. $3 > 4 > 2 > 1 > 5$
4. $5 > 1 > 2 > 4 > 3$

36. Which reaction is incorrectly matched with its major product?

1. 
2. 
3. 
4. 

37. In qualitative analysis when H_2S is passed through an aqueous solution of salt acidified with dil. HCl, a black precipitate is obtained. On boiling the precipitate with dil. HNO_3, it forms a solution of blue colour. Addition of excess of aqueous solution of ammonia to this solution gives

1. deep blue precipitate of $Cu(OH)_2$
2. deep blue solution of $[Cu(NH_3)_4]^{2+}$
3. deep blue solution of $Cu(NO_3)_2$
4. deep blue solution of $Cu(OH)_2, Cu(NO_3)_2$

38. Assertion (A) : NaCl reacts with concentrated H_2SO_4 to give colorless fumes with pungent smell. But on adding MnO_2 the fumes become greenish yellow.

Reason(R): MnO_2 oxidizes HCl to chlorine gas which is greenish yellow.

1. Both A and R are correct and R is the correct explanation of A.
2. Both A and R are correct but R is not the correct explanation of A.
3. Both A and R are not correct.
4. A is not correct but R is correct.

39. Which of the following will give gem dichloride:

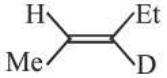
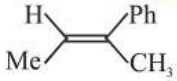
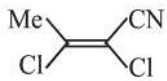
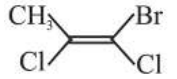
1. $CH \equiv CH \xrightarrow[(2eq)]{HCl}$
2. $CH_3 - CH = O \xrightarrow{PCl_5}$
3. $CH_3 - \underset{Cl}{\underset{|}{C}} = CH_2 \xrightarrow{HCl}$
4. All of the above

40. Match the complex ions given in column I with the hybridization and number of unpaired electrons given in column II and assign the correct code:

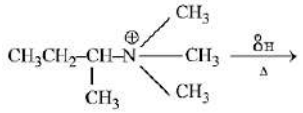
	Column - I (complex ion)	column II (hybridization, number of unpaired electrons)
A.	$[Cr(H_2O)_6]^{3+}$	$dsp^2, 1$
B.	$[Co(CN)_4]^{2-}$	$sp^3d^2, 5$
C.	$[Ni(NH_3)_6]^{2+}$	$d^2sp^3, 3$
D.	$[MnF_6]^{4-}$	$sp^3, 4$
		$sp^3d^2, 2$

1. A(3); B(1); C(5); D(2)
2. A(4); B(3); C(2); D(1)
3. A(3); B(2); C(4); D(1)
4. A(4); B(1); C(2); D(3)

41. Which of the following represent Z form

1. 
2. 
3. 
4. 

42. In which product formation is NOT take place according to Hoffman's rule

1. $CH_3CH_2 - \underset{Br}{\underset{|}{CH}} - CH_3 \xrightarrow[\Delta]{t\text{-}Bu\overset{\ominus}{O}\overset{\oplus}{K}}$
2. $CH_3CH_2 - \underset{Br}{\underset{|}{CH}} - CH_3 \xrightarrow[\Delta]{CH_3CH_2\overset{\ominus}{O}\overset{\oplus}{K}}$
3. 
4. $CH_3CH_2\underset{\overset{\oplus}{S}(CH_3)_2}{\underset{|}{CH}} - CH_3 \xrightarrow[\Delta]{\overset{\ominus}{O}H}$

43. Which of the following options is correct regarding the following statements?

Statement-1: $\Delta S_f^0 NH_3(g) \& \Delta S_f^0 PCl_5(g) < 0$

Statement -2 : On heating a metal entropy of metal increases.

Statement -3: $\Delta S_f^0 N_{2(l)} = 0$

Statement-4: number of radial nodes for 3 s is two.

1. All the statements are correct
2. Only statement -3 is incorrect
3. Only statement - 1 is correct
4. All statements are incorrect

44. Which of the following statement is incorrect?

1. Density and temperature are intensive properties.
2. The value of equilibrium constant is independent on initial concentration of reactants and products.
3. $[CoCl_4]^{-2}_{(aq)}$ when cooled in freezing mixture the colour of the solution turns pink due to formation of $[Co(H_2O)_6]^{+3}$.
4. The basic strength order of OH^-, NH_3, NH_2^- is $OH^- > NH_3 > NH_2^-$

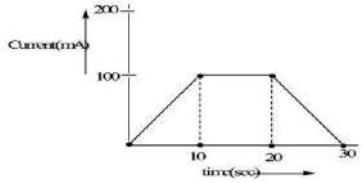
45. A gaseous substance $AB_2(g)$ convert to $AB(g)$ presence of solid $A(s)$ as:

$AB_2(g) + A(s) \rightleftharpoons 2AB(g)$

The initial pressure and equilibrium pressure are 0.7 and 0.95 bar. Now the equilibrium mixture is expanded reversibly and isothermally till the gas pressure falls to 0.4 bar. The volume percentage of $AB_2(g)$ at the final equilibrium is.

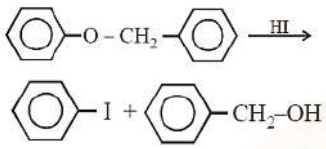
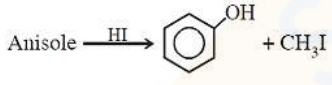
1. 22.5
2. 81
3. 32.5
4. 67.5

46. When copper sulphate solution is electrolyzed in a copper voltameter for 30 seconds, then ' m ' gram of copper was deposited. Time current graph for the electrolysis is shown in the figure. The value of electrochemical equivalent (z) of copper using graph will be.



1. $z = m$
2. $z = \frac{m}{2}$
3. $z = \frac{m}{5}$
4. $z = 2m$

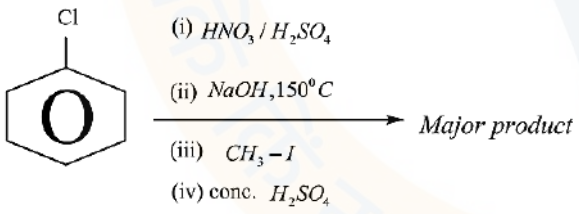
47. In which case correct products are formed:

1. $Me_3C\text{-}O\text{-}CH_3 \xrightarrow{HI} Me_3C\text{-}OH + CH_3I$
2. $H_3C\text{-}O\text{-}CH_2\text{-}CH_3 \xrightarrow{HI} CH_3OH + ICH_2CH_3$
3. 
4. 

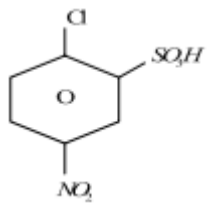
48. $CH_3\text{-}C \equiv CH \xrightarrow[1\%\,HgSO_4]{40\%\,H_2SO_4} A \xrightarrow{\text{Isomerisation}} CH_3\text{-}\overset{\overset{O}{\|}}{C}\text{-}CH_3$

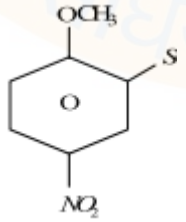
Structure of ' A ' and type of isomerism in the above reaction are respectively

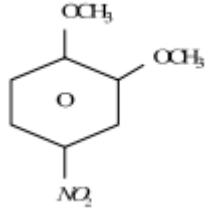
1. Prop - 1 - en - 2-ol,metamerism
2. Prop -1-en-1-ol,tautomerism.
3. Prop -2-en-2-ol, geometrical isomerism.
4. Prop -1-en-2-ol,tautomerism

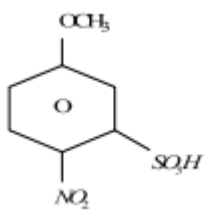
49. 

Product is

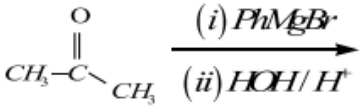
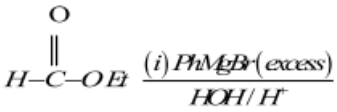
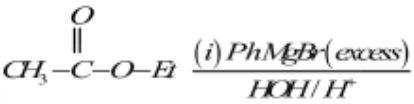
1. 

2. 

3. 

4. 

50. In which of the following reactions alcohol is formed as product which gives positive idoform test?

1. 
2. $CH_3CH_2CHO \xrightarrow[(ii)\ HOH/H^+]{(i)MeMgBr}$
3. 
4. 

SECTION – B
(NUMERICAL VALUE TYPE)

51. 21.4mg of salt XCl is completely dissolved in some amount of water to form 2 litre of a solution. If pH of the following solution is observed to be 5& the salt in solid state forms rock salt structure with ionic radii of $X^+ = 0.8A^0 \& C^- = 1.7A^0$ then calculate density of the solid crystal in terms of gm/cm^3.

[Data: $N_A = 6 \times 10^{23}, K_b(XOH) = 10^{-9}$]

52. Find the total number of complexes are following Sidgwick EAN rule.
(Atomic number: Mo ⇒ 42, Pt ⇒ 78, Ag = 47)
$[Mo(\sigma - C_3H_5)Br(NH_3)_2]$, $[Fe(\eta^5 - C_5H_5)_2]$, $[Ni(DMG)_2]$, $[MnMn_2(CO)_{10}]$, $[Fe(CO)_2(NO)_2]^0$, $[PtCl_3(\eta^2 - C_2H_4)]^{\ominus}$, $[Ag(CN)_2]^{-1}$, $[Fe_2(CO)_9]^0$

53. A certain mass of a substance when dissolved in $100\ \text{gC}_6\text{H}_6$ lowers the freezing point by 1.28^0C. The same mass of solute dissolved in $100\ \text{g}$ of water lowers the freezing point by 1.40°C. If the substance has normal molecular mass in benzene and is completely dissociated in water, into how many ions does it dissociate in water? K_f for H_2O and C_6H_6 are 1.86 and $5.12\ \text{K mol}^{-}\text{kg}$ respectively.

54. In the ionic reaction,
$xBrO_3^- + yCr^{3+} + zH_2O \rightarrow pBr_2 + qHCrO_4^- + rH^+$
{x, y, z, p, q, r, are in simplest whole number ratio }
Find the value of $(x + y + z)$

55. Assuming there no $2s - 2p$ mixing, the number of paramagnetic species amongst the following:
$H_2, He_2^+, Li_2, Be_2, B_2, C_2, C_2^{2-}, N_2^+, N_2, O_2, O_2^-, S_2 \& F_2$
are _____.

56. Alkene $+ O_3 \xrightarrow[H_2O]{zn} CH_3CHO + CH_3CH_2CH_2COCH_3 + CH_3COCH_2CHO$

How many different isomers (inclusive of stereo isomers) of alkene (x) can give the above reaction?

57. The initial concentration of N_2O_5 in the following first order reaction

$N_2O_{5(g)} \rightarrow 2NO_{2(g)} + \frac{1}{2}O_{2(g)}$ was $.1.24 \times 10^{-2}$ mol/L. at 318 K. The concentration of N_2O_5 after 60 minutes was 0.20×10^{-2} mol/L. The rate constant of the reaction in min^{-1} is $x \times 10^{-2}$, value of x is $\{\log 6.2 = 0.792\}$.

58. A 1 litre solution containing x millimoles each of FeO and $Fe_{0.8}O$ was completely titrated with 35 ml of 0.3M $KMnO_4$ in acidic medium. Find value of 'x'?

59. The graph of compressibility factor (Z) vs P for one mole of a real gas is plotted at constant temperature 273 K. If the slope of graph at very high pressure $\left(\frac{dZ}{dp}\right)$ is $\frac{1}{10}$ atm^{-1}, the volume of one molecule of real gas in cm^3 is $\times\times 10^{-22}$. Find ' x '. [Take $N_A = 6 \times 10^{23}, R = 0.0821$ lit atm/K mole]

60. How many of the following exist only in solution state.

I) $LiHCO_3$ ii) $NaHCO_3$
iii) $KHCO_3$ iv) $Mg(HCO_3)_2$
v) $Ca(HCO_3)_2$ vi) $Ba(HCO_3)$
vii) $RbHCO_3$ viii) $CsHCO_3$

MATHEMATICS

SECTION – A
(SINGLE CORRECT ANSWER TYPE)

61. Let $f(x) = 3x^2 - 7x + c$, where ' c ' is a variable co-efficient and $x > \frac{7}{6}$. The value of ' c ' such that $f(x)$ touches $f^{-1}(x)$ is.....

1. 6 2. 7
3. $\frac{16}{3}$ 4. $\frac{4}{3}$

62. Let $f: R \rightarrow R$ be continuous and periodic with period $T > 0$. Then

1. $f(x_0 + T/2) = f(x_0)$ for some $x_0 \in [k, k + T/2], k \in R$
2. $f(x_0 + T/2) = f(x_0)$ for some $x_0 \in (k, k + T/4), k \in R$
3. $f(x_0 + T/2) = f(x_0)$ for some $x_0 \in (k, k + T/3), k \in R$
4. $f(x_0 + T/2) = f(x_0)$ for some $x_0 \in (k, k + T/6), k \in R$

63. The function f(x) = maximum $\{\sqrt{x(2-x)}, 2-x\}$ is non-differentiable at x equal to

1. 1 2 0.2
3. 0.1 4. 0.4

64. Let $f: [0,4] \rightarrow R$, be a differentiable function. Then, there exists real numbers $a, b \in (0,4)$ such that, $(f(4))^2 - (f(0))^2 = Kf^1(a)f(b)$ Where K, is

1. $\frac{1}{4}$ 2. 8
3. $\frac{1}{12}$ 4. 4

65. If the standard deviation of $x_1, x_2 \ldots x_n$ is 3.5 , then the standard deviation of $-2x_1 - 3, -2x_2 - 3, \ldots, -2x_n - 3$ is

1. -7 2. -4
3. 7 4. 1.75

66. The number of positive divisors of $(2008)^8$ that are less than $(2008)^4$ are

1. 28 2. 112
3. 224 4. 56

67. From 50 students taking examinations in mathematics, physics and chemistry. 37 passed mathematics, 24 physics, and 43 in chemistry, At most 19 passed mathematics and physics, at most 29 mathematics and chemistry and at most 20 physics and chemistry. The largest possible number that could have passed all three exams is

1. 10 2. 12
3. 9 4. 14

68. (a, b) is the mid-point of the chord $\overline{AB}$ of the circle $x^2 + y^2 = r^2$. The tangent at A, B meet at C. then area of $\triangle ABC =$

1. $\frac{(a^2+b^2+r^2)^{\frac{3}{2}}}{\sqrt{a^2+b^2}}$ 2. $\frac{(r^2-a^2-b^2)^{\frac{3}{2}}}{\sqrt{a^2+b^2}}$
3. $\frac{(a^2-b^2-r^2)^{\frac{3}{2}}}{\sqrt{a^2+b^2}}$ 4. $\frac{(a^2-b^2+r^2)^{\frac{3}{2}}}{\sqrt{a^2+b^2}}$

69. The number of solutions of the equation $16(\sin^5 x + \cos^5 x) = 11(\sin x + \cos x)$ in the interval $[0,2\pi]$ is

1. 6 2. 7
3. 8 4. 9

70. If $\frac{z+2i}{z-2i}$ is purely imaginary then $|z|$ is

1. 1 2. 2
3. $\frac{1}{2}$ 4. $\frac{1}{4}$

71. If a tangent of slope 2 on the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ is normal to the circle $x^2 + y^2 + 4x + 1 = 0$, then the maximum value of ab is

1. 1 2. 2
3. 3 4. 4

72. Let a variable point $P(x, y)$ is lying on the curve $y^2 = 8x$, then maximum value of $\frac{y-3}{x+2}$ is equal to

1. ½
2. 1
3. 2
4. 3

73. Let p, q, r be three logical statements. Consider the compound statements

$S_1: ((\sim p) \vee q) \vee ((\sim p) \vee r)$ and $S_2: p \rightarrow (q \vee r)$

Then which of the following is NOT TRUE?

1. If S_2 is true, then S_1 is true
2. If S_2 is false, then S_1 is false
3. If S_2 is false, then S_1 is true
4. If S_1 is false, then S_2 is false

74. The value of the definite integral $\int_{\frac{-3\pi}{4}}^{\frac{5\pi}{4}} \frac{\cos x + \sin x}{1+e^{x-\frac{\pi}{4}}} dx$ equals

1. 0
2. 1
3. 3
4. 4

75. If $y_1(x)$ is a solution of the differential equation $\frac{dy}{dx} - f(x)y = 0$, then a solution of the differential equation $\frac{dy}{dx} + f(x)y = r(x)$ can be $y =$

1. $\frac{1}{y_1(x)} \int r(x) y_1(x) dx$
2. $y_1(x) \int \frac{r(x)}{y_1(x)} dx$
3. $\int r(x) y_1(x) dx$
4. $\int (r(x) + y_1(x)) dx$

76. Area of the region defined by $\| x| + |y \| \geq 1$ and $x^2 + y^2 \leq 1$ is

1. 1
2. 2
3. $\pi - 2$
4. $2\pi - 1$

77. Coefficient of x^{2009} in $(1 + x + x^2 + x^3 + x^4)^{1001}(1 - x)^{1002}$ is

1. 0
2. 4. ${}^{1001}C_{501}$
3. -2009
4. 2009

78. The reflection of the point $P(1,0,0)$ in the line $\frac{x-1}{2} = \frac{y+1}{-3} = \frac{z+10}{8}$ is

1. $(3, -4, -2)$
2. $(5, -8, -4)$
3. $(1, -1, -4)$
4. $(2, -3, 8)$

79. If $\bar{u}, \bar{m}, \bar{r}$ be three mutually perpendicular vectors with same magnitude. If $\bar{e}$ satisfies the relation $\bar{u} \times \{(\bar{e} - \bar{m}) \times \bar{u}\} + \bar{m} \times \{(\bar{e} - \bar{r}) \times \bar{m}\} + \bar{r} \times \{(\bar{e} - \bar{u}) \times \bar{r}\} = \bar{0}$ then $\bar{e} =$

1. $\frac{1}{3}(\bar{u} + \bar{m} + \bar{r})$
2. $\frac{1}{2}(\bar{u} + \bar{m} + \bar{r})$
3. $\frac{1}{4}(\bar{u} + \bar{m} + \bar{r})$
4. $\bar{0}$

80. If $p + q + r = 0$ and $\begin{vmatrix} pa & qb & rc \\ qc & ra & pb \\ rb & pc & qa \end{vmatrix} = K \begin{vmatrix} a & b & c \\ b & c & a \\ c & a & b \end{vmatrix}$ then the value of K is

1. $p + q - r$
2. $p + q + r$
3. pqr
4. $-pqr$

SECTION – B
(NUMERICAL VALUE TYPE)

81. Find the number of ways in which four different toys and five indistinguishable marbles can be distributed between Amar, Akbar and Anthony, if each child receives at least one toy and one marble.

82. Three balls are marked 1,2 and 3 . They are placed in a bowl and a ball is drawn, its number is recorded and the ball is returned to the bowl. The process is repeated two more times. If the sum of the three numbers is 6 then $P = \frac{a}{b}$ is the probability (express in lowest form) that the ball numbered 2 was drawn all the three times, then find the value of $(a + b)$.

83. The shortest distance between the z-axis and the line of intersection of, $x + y + 2z - 3 = 0$ and $2x + 3y + 4z - 4 = 0$ is:

84. If $A = \begin{bmatrix} 1 & -1 & 1 \\ 0 & 2 & -3 \\ 2 & 1 & 0 \end{bmatrix}$ and $B = (\text{adj } A)$ and $C = 5A$, then find the value of $\frac{|\text{adj } B|}{|C|}$.

85. If L be the length of common tangent to the ellipse $\frac{x^2}{25} + \frac{y^2}{4} = 1$ and the circle $x^2 + y^2 = 16$ intercepted by the coordinate axis then $\frac{\sqrt{3}L}{2}$ is

86. ABCD is a square of side length 1 unit. P and Q are points on AB and BC such that $\angle PDQ = 45°$. Find the perimeter of $\triangle PBQ$.

87. The number of normal(s) of a rectangular hyperbola which can touch its conjugate is equal to

88. A concrete pillar is 30 feet. high and has a flag staff at its top. The pillar and the flag staff subtend equal angles at a point distant 50 feet from the foot of the tower. Height of the flag staff in feet is

89. Consider a complex number z on the argand plane satisfying $\arg(z^2 - \omega^2) = \frac{\pi}{2} + \arg(z^2 - \omega)$(where $\omega = e^{\frac{i2\pi}{3}}$). If minimum value of $|z - 2 - 2i||z + 2 + 2i|is\left(\frac{\sqrt{a}-\sqrt{b}}{2}\right)(a, b \in N)$ then find the value of $\left(\frac{a+b}{52}\right)$.

90. If R be a relation $<$ from . $A = \{1,2,3,4\}$. to $B = \{1,3,5\}$, i.e. $(a, b) \in R$ iff a < b, then number of elements in RoR^{-1} is (where R^{-1} is inverse relation of R)