Time: 3 hour

CCT - 9 (JEE MAINS)

DATE: 18.12.2023
M. MARKS: 300

TOPICS

PHYSICS: Total Syllabus
CHEMISTRY: Total Syllabus
MATHEMATICS: Total 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.

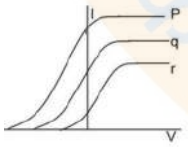
   (i) Section-I: This section contains 20 multiple choice questions which have only one correct answer. Each question carries 4 marks for correct answer and -1 mark for wrong answer.

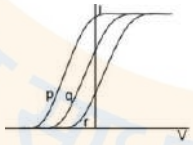
   (ii) Section-II: This section contains 10 questions. In Section II, attempt any five questions out of 10. The answer to each of the questions is a numerical value. Each question carries 4 marks for correct answer and -1 for wrong answer.

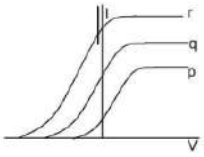
PHYSICS

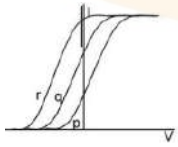
SECTION – A
(Single Correct Type)

1. Photoelectric effect experiments are performed using three different metal plates p, q and r having work functions, $\phi_p = 2.0\text{eV}, \phi_q = 2.5\text{eV}$, and $\phi_r = 3.0\text{eV}$, respectively. A light beam containing wavelengths of $550\ \text{nm}, 450\ \text{nm}$ and $350\ \text{nm}$ with equal intensities illuminates each of the plates. The correct I-V graph for the experiment is

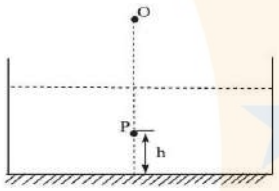
1. 

2. 

3. 

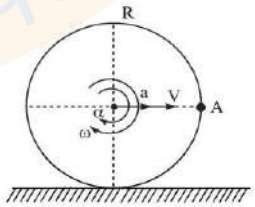
4. 

2. A plane mirror in placed at bottom of a tank containing a liquid of refractive index μ. P is a small object at a height ' h ' above the mirror. An observer "O" vertically above P outside the liquid observes P& its image in the mirror. The apparent distance between these two will be



1. $2\mu h$
2. $\frac{2\,h}{\mu}$
3. $\frac{2\,h}{\mu-1}$
4. $h\left(1+\frac{1}{\mu}\right)$

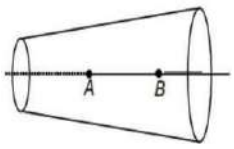
3. A uniform circular disc of radius ' R ' is rolling without slipping on a rough horizontal surface with a constant acceleration ' a '. Then the radius of curvature of trajectory of point ' A ' of the disc relative to the ground at the given instant as shown in the figure is



1. $4R$
2. $2\sqrt{2}R$
3. $2R$
4. $\sqrt{2R}$

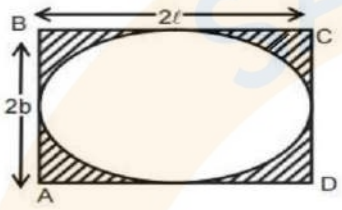
4. A resistance of frustum shape is shown in figure. If a current i passes through the

resistance, the electric field at A and B are related as



1. $E_A > E_B$
2. $E_B > E_A$
3. $E_A = E_B$
4. There is no relation

5. There is a thin plate ABCD with an elliptical hole as shown in the figure. The coefficient of liner expansion of the sheet is α. When the temperature of the plate is increased by TK, the area of the hole increases by an amount:-



1. $\pi\ell b\alpha T$
2. $2\pi\ell b\alpha T$
3. $3\pi\ell b\alpha T$
4. Data insufficient

6. When an ultrasonic waves travels from air into water,
   1. Waves bends towards the normal
   2. Frequency of waves changes from air to water
   3. Speed of ultrasonic wave is greater in water than that in air
   4. Speed of ultrasonic wave is less in water than that in air.

7. **ASSERTION:** Two sound waves of same intensity in a particular medium will have displacement amplitude in ratio of 2:1 if they have frequency in the ratio $1:2$

   REASON: Two wave of same velocity amplitude in a particular medium have equal intensity
   1. ASSERTION is true ,REASON is a correct explanation
   2. ASSERTION is true ,REASON is not a correct explanation
   3. ASSERTION is true ,REASON is false
   4. ASSERTION is false ,REASON is true

8. A particle is vibrating in S.H.M. Its velocities are v_1 and v_2 when the displacements from the mean position are y_1 and y_2, respectively, then its time period is

   1. $2\pi\sqrt{\frac{y_1^2+y_2^2}{v_1^2+v_2^2}}$
   2. $2\pi\sqrt{\frac{v_1^2-v_2^2}{y_1^2-y_2^2}}$
   3. $2\pi\sqrt{\frac{v_1^2+v_2^2}{y_1^2+y_2^2}}$
   4. $2\pi\sqrt{\frac{y_1^2-y_2^2}{v_2^2-v_1^2}}$

9. Regarding transistor what is not correct
   1. For transistor to act an amplifier EB junction should be forward biased and CB junction should be reverse biased
   2. $I_E = I_B + I_C$ in any configuration and for any transistor.
   3. $\alpha = \frac{\beta}{1+\beta}$ where α and β transistor parameter
   4. $\beta = \frac{\alpha}{1+\alpha}$

10. Number of amplitude modulation broadcast stations that can be accommodated in a 100 KHz bandwidth if the highest frequency modulating a carrier is $5KHz$
    1. 10
    2. 100
    3. 1000
    4. 10000

11. **ASSERTION:** Light of red colour travels faster than the light of violet colour in vacuum.

    REASON: Refractive index of a medium in general, depends on wavelength and its value reduces with the increase of wavelength
    1. ASSERTION is true ,REASON is a correct explanation
    2. ASSERTION is true ,REASON is not a correct explanation
    3. ASSERTION is true , REASON is false
    4. ASSERTION is false ,REASON is true

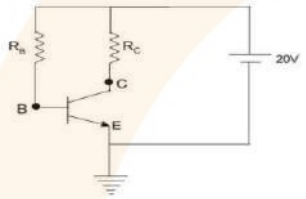
12. The plane of the dip circle is set in the geographical meridian and apparent dip is θ_1. It is then set in a vertical plane perpendicular to the geographical meridian, the apparent dip becomes θ_2. The angle of declination α at that place is given by
    1. $\tan\alpha = \sqrt{\tan\theta_1 \tan\theta_2}$
    2. $\tan\alpha = \sqrt{\tan^2\theta_1 \tan^2\theta_2}$
    3. $\tan\alpha = \frac{\tan\theta_1}{\tan\theta_2}$
    4. $\tan\alpha = \frac{\tan\theta_2}{\tan\theta_1}$

13. **ASSERTION**: In an experiment, the reliable digits plus the first uncertain digit are known as significant digits or significant figures.

REASON: A choice of change of different units does not change the number of significant digits or figures in a measurement

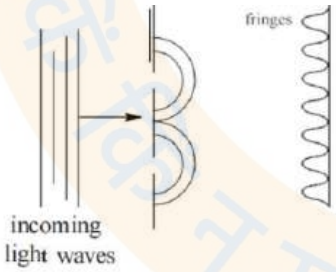
1. ASSERTION is true ,REASON is a correct explanation
2. ASSERTION is true ,REASON is not a correct explanation
3. ASSERTION is true ,REASON is false
4. ASSERTION is false , REASON is true

14. For given CE biasing circuit, voltage across collector-emitter is $12\ \mathrm{V}$, current gain is 100 and base current is $0.04\ \mathrm{mA}$. Then the value of collector resistance ' R_c ' is



1. 1200Ω
2. 200Ω
3. 400Ω
4. 2000Ω

15. In a Young's double slit experiment, green light is incident on the two slits. The interference pattern is observed on a screen. Which of the following changes would cause the observed fringes to be more closely spaced?



1. Reducing the separation between the slits
2. Using blue light instead of green light
3. Used red light instead of green light
4. Moving the light source further away from the slits.

16. **ASSERTION:** Absolute error may be positive or negative

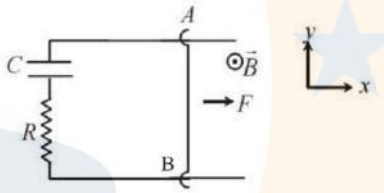
REASON: Absolute error is the magnitude difference between the real value and measured value of a physical quantity

1. ASSERTION is true, REASON is a correct explanation
2. ASSERTION is true ,REASON is not a correct explanation
3. ASSERTION is true, REASON is false
4. ASSERTION is false, REASON is true

17. A solid piece of lead has a mass of $23.94\ \mathrm{g}$ and a volume of $2.10\ \mathrm{cm}^3$.From these data, calculate the density of lead in SI units (kilograms per cubic meter).

1. $1.14 \times 10^4\ \mathrm{kg/m^3}$
2. $2.28 \times 10^4\ \mathrm{kg/m^3}$
3. $2.14 \times 10^3\ \mathrm{kg/m^3}$
4. $1.28 \times 10^3\ \mathrm{kg/m^3}$

18. A conducting rod AB (length l) moves parallel to x-axis in the $\mathrm{x}-\mathrm{y}$ plane. A uniform magnetic field B pointing normally out of the plane exists throughout the region. A force F acts perpendicular to the rod, so that the rod moves with uniform velocity v. The force F is given by (neglect resistance of all the connecting wires)



1. $\frac{vB^2l^2}{R}e^{-t/RC}$
2. $\frac{vB^2l^2}{R}$
3. $\frac{vB^2l^2}{R}\left(1-e^{-t/RC}\right)$
4. $\frac{vB^2l^2}{R}\left(1-e^{-2t/RC}\right)$

19. **ASSERTION:** In photoelectric, the number photoelectrons emitted is always equal to number of photons incident.

REASON: The photons falling on the surface will eject photoelectrons, is not necessary

1. ASSERTION is true, REASON is a correct explanation
2. ASSERTION is true, REASON is not a correct explanation
3. ASSERTION is true, REASON is false
4. ASSERTION is false, REASON is true

20. Consider the following statements

(i) Young's modulus is numerically equal to the stress which will double the length of a wire

(ii) The surface tension of a liquid decreases due to the presence of insoluble contamination

(iii) Viscosity of gases is greater than that of liquids.

The number of above statements that are true is

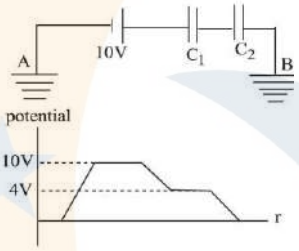
1. Zero
2. Three
3. Two
4. One

SECTION – B

(Integer/Numerical Type)

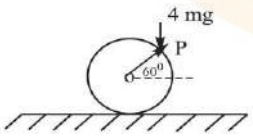
21. A particle is projected horizontally from the top of a tower with a velocity v_0. If v be its velocity at any instant, then the radius of curvature of the path of the particle at the point (where the particle is at that instant) is directly proportional to v^n, then find the value of ' n '.

22. Figures shows two capacitors C_1 and C_2 connected with 10 V battery and terminal A and B are earthed. The graph shows the variation of potential as one moves from left to right. Then the ratio of C_1/C_2 is $\frac{N}{3}$. Then N is



23. Suppose the potential energy between the electron and proton at a distance r is given by $-\frac{Ke^2}{3r^3}$. Application of Bohr's theory of hydrogen atom in this case shows that energy in the nth orbit is proportional to n^x. Then x is

24. A solid sphere of mass m and radius R is lying on a rough horizontal plane. A constant force $4mg$ acts vertically at point P such that OP makes an angle $60°$ with horizontal. Minimum coefficient of friction is $n \times 10^{-2}$ so that sphere starts pure rolling. Then the value of n is



25. Consider the following reaction: ${}_1^1H + {}_6^{13}C \rightarrow {}_7^{13}N + {}_0^1n$

The atomic masses of the nuclei are

$M({}_1^1H) = 1.007825amu$,

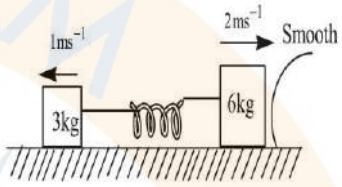
$M({}_0n^1) = 1.008665amu$,

$M({}_6^{13}C) = 13.00336amu$,

$M({}_7^{13}N) = 13.00574amu$ and $1amu = 931MeV$.

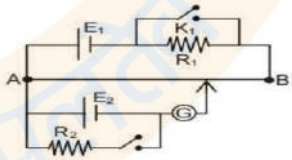
The minimum kinetic energy of proton $({}_1^1H)$ required to initiate the reaction is in Mev

26. Two blocks of masses 3 kg and 6 kg are placed on a smooth horizontal surface. They are connected by a light spring of force constant, $k = 200Nm^{-1}$. Initially the spring is unstretched. The indicated velocities are imparted to the blocks. The maximum extension of the spring is in cm

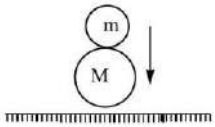


27. The critical angle for a prism and its surrounding interface is $36°$. The minimum angle of prism for which no emergent ray is possible is degrees.

28. Figure shows the circuit of a potentiometer. The length of the potentiometer wire AB is 50 cm. The e.m.f. of the battery E_1 is 4 volt, having negligible internal resistance. Values of resistances R_1 and R_2 are $15ohm$ and $5ohm$ respectively. When both the keys are open, the null point is obtained at distance of 31.25 cm from end A but when both the keys are closed. The balance length reduces to 5 cm only. Given $R_{AB} = 10\Omega$. The e.m.f. of the cell E_2 is V.



29. A small ball of mass m is placed on top of the "super ball" of mass M and the two ball are dropped to the floor from height h. Height rise of small ball after the collision is Nh, then ' N ' is: (Assume that the collision with the super ball are elastic, and the $m << M$)



30. The sound from a trumpet is emitted uniformly in all directions at $20°C$. At point ' P ' in space

the sound intensity level is $30\ \mathrm{dB}$. The density of air in the medium is $1.5\ \mathrm{kg/m^3}$, the velocity of sound at $20^\circ\mathrm{C}$ is $300\ \mathrm{m/sec}$. Find the displacement amplitude (in A°) at point ' P '. The frequency of sound wave in the medium is $600\ \mathrm{Hz}$. (Take $\pi^2 = 10$)

CHEMISTRY

SECTION – A

(Single Correct Type)

31. The complex ions $[\mathrm{Fe(CN)_6}]^{3-}$ and $[\mathrm{Fe(CN)6}]^{4-}$

1. Are both octahedral and paramagnetic.
2. Are both octahedral and diamagnetic.
3. Having same structure but different magnetic character.
4. Have different structures but same magnetic character.

32. Which of the following electronic configuration of the corresponding element is wrongly matched?

1. Thulium - $[\mathrm{Xe}]4\mathrm{f}^{13}6\ \mathrm{s}^2$
2. Americium - $[\mathrm{Rn}]5\mathrm{f}^{7}7\ \mathrm{s}^2$
3. Uranium - $[\mathrm{Rn}]5\mathrm{f}^{4}7\ \mathrm{s}^2$
4. Terbium - $[\mathrm{Xe}]4\mathrm{f}^{9}6\ \mathrm{s}^2$

33. **Assertion:** In co-ordination entity of type $[\mathrm{PtCl_2(en)_2}]^{2+}$, only cis-isomer shows optical activity ; Trans isomer shows optical inactive

Reason: Trans isomer has plane of symmetry, hence optically inactive.

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

34. For the reaction

$2\mathrm{NO(g)} + \mathrm{H_2(\ g)} \rightarrow \mathrm{N_2O(g)} + \mathrm{H_2O}(\ell).$

Experiments were done to determine rate law expression.

Experiment 1: The values of $-\frac{\mathrm{dp}}{\mathrm{dt}}$ (rate of reaction in terms of pressure change per unit time), obtained by experiment were 2.25 torr/sec and 0.25 torr/sec, when pressures of $\mathrm{NO(g)}$ were 450 torr and 150 torr respectively. The pressure of $\mathrm{H_2(\ g)}$ being constant in given experiment.

Experiment 2: The values of $-\frac{\mathrm{dp}}{\mathrm{dt}}$ (rate of reaction in terms of pressure change per unit time), obtained by experiment were 1.90 torr/sec and $0.95\mathrm{torr/sec}$, when pressures of $\mathrm{H_2(\ g)}$ were 290 torr and 145 torr respectively. The pressure of $\mathrm{NO(g)}$ being constant in given experiment.

Which analytical statement is correct on the basis of above experiment(s)
(I) Order of reaction is 3
(II) Order with respect to $\mathrm{NO(g)}$ and $\mathrm{H_2(\ g)}$ are 3 and 0 respectively
(III) Order with respect to $\mathrm{H_2(\ g)}$ and $\mathrm{NO(g)}$ are 1 and 2 respectively
(IV) Rate of reaction depend upon the concentration/pressure of reactant(s)

1. I, II and IV
2. I and III
3. I, III and IV
4. I only

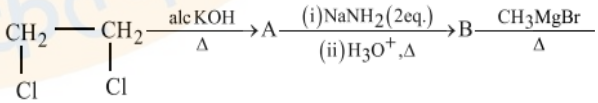
35. Calculate the work done in Joules when 1.0 mole of $\mathrm{N_2H_4}$ decomposed completely against a pressure of $1.0\ \mathrm{atm}$ at $27^\circ\mathrm{C}$, (Take $\mathrm{R} = 8.3\ \mathrm{J/K}$ mole)

$3\ \mathrm{N_2H_4}(\ell) \longrightarrow 4\mathrm{NH_3(\ g)} + \mathrm{N_2(\ g)}$

1. -4980
2. -14940
3. -2490
4. -4150

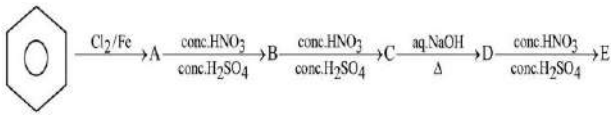
36. The number of acyclic isomers (including stereo isomers) for $\mathrm{C_5H_{10}}$ is/are ?

1. 4
2. 5
3. 6
4. 7

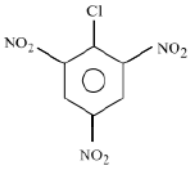
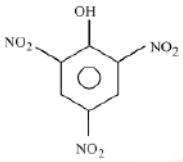
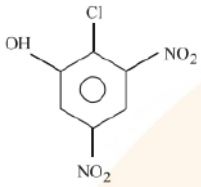
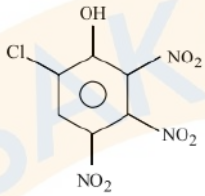
37. 

Then C is

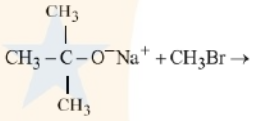
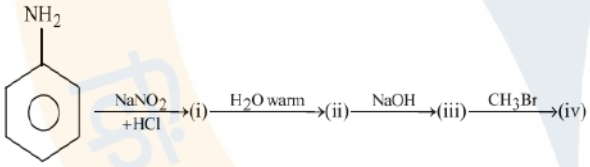
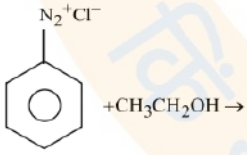
1. $\mathrm{HC \equiv C - CH_3}$
2. $\mathrm{CH_3 - C \equiv C - CH_3}$
3. $\mathrm{CH_2 = CH - CH_3}$
4. $\mathrm{CH_4}$

38. 

The compound E is

1. 
2. 
3. 
4. 

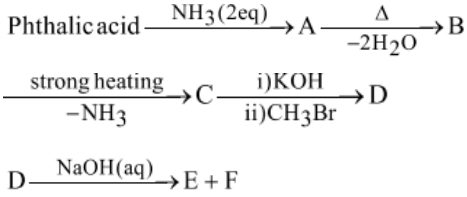
39. Which of the following doesn't produce an ether compound as a major product

1. $CH_3CH_2OH \xrightarrow[140°C]{H_2SO_4}$
2. 
3. 
4. 

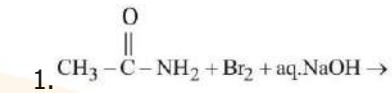
40. **Assertion:-** Phenoxide ion is more stable than carboxylate ion hence phenol is more acidic than carboxylic acids

Reason:- The negative charge is delocalised over two electronegative oxygen atoms in carboxylate ion

1. Both A and R are true and R is the correct explanation of A
2. Both A and R are 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

41. 

(Nitrogen containing compound) F cannot be prepared by

1. 
2. $CH_3C\ell \xrightarrow{\text{Ethanolic NaCN}} \text{(i)} \xrightarrow{H_2/Ni} \text{(ii)}$
3. $CH_3NO_2 \xrightarrow[]{Sn+HCl}$
4. $CH_3CH_2OH \xrightarrow{CrO_3-H_2SO_4} \text{(i)} \xrightarrow{NH_3} \text{(ii)} \xrightarrow{\Delta} -H_2O \rightarrow \text{(iii)} \xrightarrow{Br_2\cdot aq,NaOH} \text{(iv)}$

42. Which of the following statement is incorrect

1. Glucose give Schiff's test and forms the hydrogen sulphite addition product with $NaHSO_3$
2. The pentaacetate of glucose does not react with hydroxyl amine indicating the absence of free - CHO group
3. On oxidation with conc. HNO_3, both glucose and gluconic acid yield saccharic acid
4. Glucose reacts with hydroxylamine to form an oxime

43. For the nuclear reaction ;

$${}^{A}_{Z}X \longrightarrow {}^{A-8}_{Z-4}Y; t_{1/2} = 1600 \text{yrs.}$$

If initial activity of sample of ' X ' was 10^7dps, how many α-particles will be emitted per second after 4800 years?

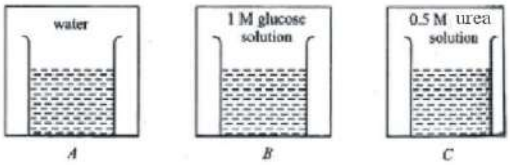
1. $1.25 \times 10^6\ s^{-1}$
2. $2.5 \times 10^6\ s^{-1}$
3. $1.25 \times 10^7\ s^{-1}$
4. $2.5 \times 10^7\ s^{-1}$

44. Consider the ions/molecule $O_2^+, O_2, O_2^-, O_2^{2-}$ For increasing bond order the correct option.

1. $O_2^{2-} < O_2^- < O_2 < O_2^+$
2. $O_2^- < O_2^{2-} < O_2 < O_2^+$
3. $O_2 < O_2^{2-} < O_2^- < O_2^+$
4. $O_2^- < O_2^+ < O_2^{2-} < O_2$

45. In three beakers labelled as 1., 2. and 3., 100 mL of water, 100 mL of 1M aqueous

solution of glucose and 100 mL of 0.5M aqueous solution of urea are taken respectively and kept at same temperature. Which of the following statements is correct?



1. Vapour pressure in all the three beakers is same.
2. Vapour pressure of beaker B is highest among all.
3. Vapour pressure of beaker C is highest among all.
4. Vapour pressure of beaker B is lower than that of C and vapour pressure of beaker C is lower than that of A.

46. From each pair given below, identify the ion which is larger in size

Pair-1: Li^+, Mg^{2+}

Pair-2: Cu^{+2}, Zn^{+2}

Pair-3: Na^+, F^-

Pair-4: Ce^{3+}, Pr^{3+}

1. $Li^+, Zn^{+2}, F^-, Ce^{3+}$
2. $Mg^{2+}, Zn^{+2}, F^-, Ce^{3+}$
3. $Mg^{2+}, Zn^{+2}, F^-, Pr^{3+}$
4. $Mg^{2+}, Cu^{+2}, F^-, Pr^{3+}$

47. Identify correct statements:

(a) Hybridisation of Al in $[Al(H_2O)_6]^{3+}$ is Sp^3 d

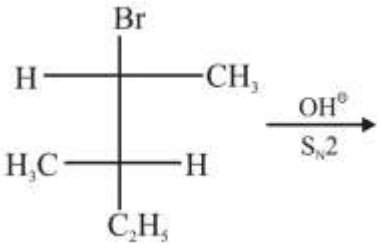
(b) Boran is able to form BF_6^{3-}

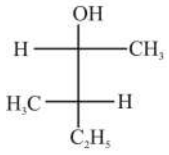
(c) $4BF_3 + 3LiAlH_4 \rightarrow 2\ B_2H_6 + 3LiF + 3AlF_3$

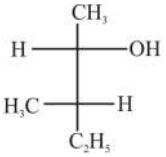
(d) $[SiCl_6]^{2-}$ is known whereas $[SiF_6]^{2-}$ not

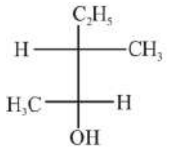
1. a,b,c,d
2. a, b
3. a, c
4. c only

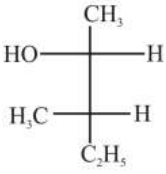
48. In the following reaction the most probable product will be :



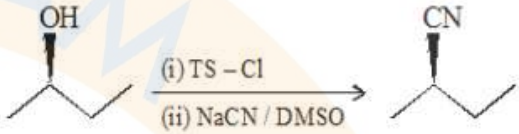
1. 

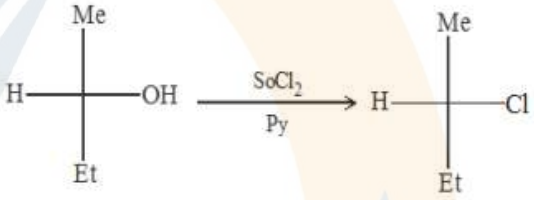
2. 

3. 

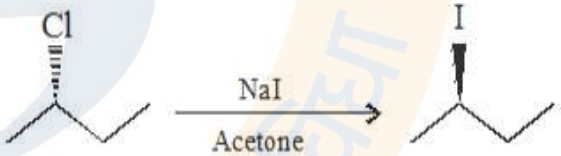
4. 

49. Identify reaction correctly matched with their major product?

1. 

2. 

3. 

4. 

50. In carius method 0.3905 g of an organic compound gave 0.7175 g of silver chloride calculate the percentage of Chlorine in the compound

1. 48.45
2. 54.56
3. 45.45
4. 40

SECTION – B

(Integer/Numerical Type)

51. For 3 s orbital of hydrogen atom normalised wave function is

$\psi_{3\,s} = \frac{1}{81\sqrt{3\pi}}\left(\frac{1}{a_0}\right)^{3/2}\left(1 - \frac{13r}{36a_0} + \frac{r^2}{36a_0^2}\right)e^{-r/3a_0}$ if the distance between the radial nodes is

xa_0 then the value of x is _____.

52. value of K_p for equilibrium reaction $N_2O_4(g) \rightleftharpoons 2NO_2(g)$ at 288 K is 47.9 . The K_c for reaction at same temperature is_____. $(R = 0.083 L bar K^{-1} mol^{-})$

53. On dissolving 0.25 g of a non-volatile non-ionic solute to 39 g of benzene, its vapour decreases from 650 mm of Hg to 640 mmHg. The depression of freezing point of benzene (in k) upon addition of solute is _____.

(Molal freezing point depression constant of benzene is $5.12\ Kkgmol^{-1}$)

54. For the reaction $In^{+2} + Cu^{2+} \longrightarrow In^{+3} + Cu^{+}$of 298 K, the equilibrium constant is 10^X then x =

$\left[E^o_{cu^{+2}/cu^{+1}} = 0.15\ V, E^0_{In^{+3}/In^{+1}} = -0.42vE^0_{In^{+2}/In^{+1}} = -0.4v\right]$

55. The decomposition reaction

$2\ N_2O_5(g) \xrightarrow{\Delta} 2\ N_2O_4(g) + O_2(g)$

is started in a closed cylinder under isothermal isochoric condition at an initial pressure of 1 atm. After $Y \times 10^2 sec$ the pressure inside the cylinder is found to be 1.45 atm. If the rate constant of reaction is $5 \times 10^{-4}\ s^{-1}$, assuming ideal behavior of gases, the value of Y is

56. 3.12 g of O_2 is adsorbed on 1.2 g of platinum metal. The volume of O_2 adsorbed per gram of adsorbent at 1 atm and 300k in L is _____. $(R = 0.0821\ L\ atm k^{-1}\ mol^{-1})$

57. $2MnO_4^- + bC_2O_4^{2-} + cH^+ \rightarrow xMn^{2+} + yCO_2 + zH_2O$

If the above equation is balanced with integer coefficients the value of $(b + c) - (x + y + z) =$ _____.

58. Standard entropy of X_2, Y_2 and XY_3 are 40,20 and $30 JK^{-1}\ mol^{-1}$ respectively for reaction

$\frac{1}{2}X_2 + \frac{3}{2}Y_2 \rightarrow XY_3, \Delta H = -10KJ$ to be at equilibrium the temperature would be (in K)

59. The CFSE for octahedral $[CoCl_6]^{4-}$ is $18{,}000\ cm^{-1}$. If the CFSE for tetrahedral $[CoCl_4]^{2-}$ is x (in cm^{-1}). Find out value of $\frac{x}{100}$

59. A solution is prepared by mixing 0.01 mol of each of $H_2CO_3, NaHCO_3, Na_2CO_3$ and

NaOH in 100ml of water P^H of resulting solution is nearly

[Pka_1 and Pka_2 of H_2CO_3 are 6.37 and 10.31 respectively. log 2 = 0.3010]

MATHEMATICS

SECTION – A

(Single Correct Type)

61. In a certain town 25% families own a cell phone, 15% families own a scooter and 65% families own neither a cell phone nor a scooter. If 1500 families own both a cell phone and a scooter, then the total number of families in the town is

1. 10000
2. 20000
3. 30000
4. 40000

62. If the ordered tried (α, β, γ) is a solution of the system of linear equations $3x - 2y + z + 6 = 0, 2x + 5y - 3z = 2, 4x - 9y + 5z + 14 = 0$ then the straight line in the $xy-$ plane which contains the point (α, β) is

1. $31x + 15y = 76$
2. $209x - 19y + 304 = 0$
3. $79x - 53y + 14 = 0$
4. $11x - 99y + 56 = 0$

63. If $\bar{a} = 2\bar{i} - x\bar{j} + \bar{k}$ and $\bar{b} = \bar{i} - \bar{j} + 2\bar{k}, \forall x \in R$ and $|\bar{a} \times \bar{b}| = r$ then the value of r cannot be

1. 4
2. $3\sqrt{3}$
3. $3\sqrt{80}$
4. 3

64. Two vertical poles of heights ' a ' m and ' b ' m stand apart on a horizontal plane. The height (in meters) of the point of intersection of the lines joining the top of each pole to the foot of the other from this horizontal plane is

1. $\frac{a+b}{2}$
2. $\sqrt{ab}$
3. $\frac{ab}{a+b}$
4. $\frac{2ab}{a+b}$

65. A right circular cone is inscribed in a sphere of radius $3\sqrt{2}$ units. The radius of the base of the cone so that the volume of the cone is maximum is

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

66. The point $P(\alpha,\beta),\beta>0$ is a point of intersection of the curves C_1, C_2 whose equations are $y^2=24x$ and $\frac{x^2}{100}+\frac{y^2}{225}=1$ respectively. The normal to the curve C_1 at the point P passes through the point

1. $(-11,4)$
2. $\left(\frac{-7}{3},\frac{61}{3}\right)$
3. $\left(\frac{-15}{2},\frac{1}{2}\right)$
4. $(2,-3)$

67. Statement-1 $\sim(p\leftrightarrow\sim q)$ is equivalent to $p\leftrightarrow q$.

Statement-2 $\sim(p\leftrightarrow\sim q)$ is a tautology.

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

68. The equation of the tangent at the point on the curve $9y^2=x^3$, where the normal to the curve makes equal intercepts with positive coordinate axes, is

1. $3x+3y-4=0$
2. $3x+3y+5=0$
3. $3x-3y-4=0$
4. $3x-3y+10=0$

69. The value of the $\int_0^1 \frac{\sqrt{x}}{(1+x)(3+x)}dx$ is

1. $\frac{\pi}{4}\left[\frac{2}{\sqrt{3}}-1\right]$
2. $\frac{\pi}{8}\left[1-\frac{\sqrt{3}}{2}\right]$
3. $\frac{\pi}{8}\left[1-\frac{\sqrt{3}}{8}\right]$
4. $\frac{\pi}{4}\left[1-\frac{\sqrt{3}}{4}\right]$

70. The solution of the D.E $\left\{\frac{1}{x}-\frac{y^2}{(x-y)^2}\right\}dx+\left\{\frac{x^2}{(x-y)^2}-\frac{1}{y}\right\}dy=0$ (Where C is the parameter)

1. $\ln\left|\frac{x}{y}\right|+\frac{xy}{x-y}=c$
2. $\ln|xy|=c+\frac{xy}{x-y}$
3. $\ln|xy|=c+\frac{2xy}{x-y}$
4. $\frac{xy}{x-y}=ce^{x/y}$

71. The area of the region bounded by the curves $4y=|4-x^2|$ and $y=7-|x|$ in sq.units is

1. 30
2. 31
3. 32
4. 33

72. If $\sum_{i=1}^{20}\sin^{-1}x_i=10\pi$ then $\frac{\sum_{i=1}^{20}x_i}{10}$ is equal to (sin x is invertible in principle interval)

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

73. Let $S_1=x^2+y^2-4x-8y+4=0$ and its image in the line $y=x$ is S_2. The radius of the circle touching $y=x$ at $(1,1)$ and orthogonal to S_2 is $\frac{3}{\sqrt{\lambda}}$ then $\lambda^2+2=$

1. 3
2. 5
3. 6
4. 10

74. Define $F(x)$ as the product of two real functions

$f_1(x)=x, x\in R$, and $f_2(x)=\begin{cases}\sin\frac{1}{x}, & \text{if } x\neq 0\\ 0, & \text{if } x=0\end{cases}$

as follows:

$F(x)=\begin{cases}f_1(x)\cdot f_2(x) & \text{if } x\neq 0\\ 0, & \text{if } x=0\end{cases}$

Statement -1: $F(x)$ is continuous on R.

Statement -2: $f_1(x)$ and $f_2(x)$ are continuous on R.

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

75. The absolute value of difference of the solutions of the equation $\sum_{m=1}^{6}\text{Cosec}\left[\theta+\frac{(m-1)\pi}{4}\right]\text{Cosec}\left[\theta+\frac{m\pi}{4}\right]=4\sqrt{2}$ where $\theta\in[0,\pi/2]$ is _____.

1. $\pi/2$
2. $\pi/3$
3. $\pi/4$
4. $\pi/6$

76. The number of times the digit 3 will be written when listing the integers from 1 To 1000 is

1. 269
2. 300
3. 271
4. 302

77. If $b_1, b_2, b_3 (b_1 > 0)$ are three successive terms of $G.P$ with common ratio r, the value of r for which the inequality $b_3 > 4b_2 - 3b_1$, holds is

1. 1.5
2. 2
3. 2.5
4. 3.5

78. The farthest point on the circle $x^2 + y^2 - 2x - 4y - 11 = 0$ from the origin is

1. $\left(\frac{4}{\sqrt{5}}, \frac{8}{\sqrt{5}}\right)$
2. $\left(1 + \frac{4}{\sqrt{5}}, 2 + \frac{8}{\sqrt{5}}\right)$
3. $\left(1 + \frac{4}{\sqrt{5}}, 2 - \frac{8}{\sqrt{5}}\right)$
4. $\left(1 + \frac{3}{\sqrt{5}}, 2 - \frac{8}{\sqrt{5}}\right)$

79. The value of $\lim_{x \to 0} \frac{\cos(\sin^2 x) - \cos(x^2)}{x^6}$ is

1. 0
2. ½
3. $1/3$
4. ¾

80. If $f(x) = (2x - 3\pi)^{25} + \frac{4}{3}x + \cos x$ and $g(x)$ is inverse of $f(x)$ Then find $\frac{d}{dx}(g(x))$ at $x = 2\pi$

1. $\frac{7}{3}$
2. $\frac{3}{7}$
3. $\frac{30^{25}+4}{3}$
4. $\frac{-3}{7}$

SECTION – B

(Integer/Numerical Type)

81. A target is to be destroyed in a bombing exercise. There is 75% chance that any one bomb will strike the target. Assume that two direct hits are required to destroy the target completely. The minimum number of bombs that must be dropped in order that the chance of destroying the target is greater than or equal to 99% is

82. The minimum length of intercept on any tangent to the ellipse $\frac{x^2}{4} + \frac{y^2}{9} = 1$ cut by the circle $x^2 + y^2 = 25$ is

83. Mean and variance of numbers 12 and 14 is same as the mean and variance of the four numbers $12, 14, \alpha$ and $\beta (\alpha > \beta)$ then $|\alpha - \beta| =$

84. The value of x such that the four points $A(3,2,1), B(4,x,5), C(4,2,-2)$ and $D(6,5,-1)$ are coplanar is

85. Two finite sets have m and n elements. If the Total number of subsets of the first set is 56 more than the Total number of subsets of second set, then $m + n$ is

86. If $2f(x^2) + 3f\left(\frac{1}{x^2}\right) = x^2 - 1$ for $x \in R - \{0\}$. Then $5f\left(\frac{1}{2}\right)$ is equal to _____.

87. If $z \in C - R$, and $\frac{1+z+z^2}{1-z+z^2} \in R$ then $|z|$ is _____.

88. The number of irrational solutions of the equation $\sqrt{x^2 + \sqrt{x^2 + 11}} + \sqrt{x^2 - \sqrt{x^2 + 11}} = 4$ is

89. What is the value of x for which the sixth term of the expansion of

$\left(3^{\log_3 \sqrt{9^{|x-2|}}} + 7^{\frac{1}{5}\log_3 [4 \times 3^{|x-2|} - 9]}\right)^7$ is 567 where $(x \neq 1)$

90. Let $f: [-1,3] \to R$ is designed by $f(x) =$

$$\begin{cases} |x| + [x], & -1 \leq x < 1 \\ x + \{x\}, & 1 \leq x < 2 \\ |x - 1| + \{x\} & 2 \leq x \leq 3 \end{cases}$$

Where $[x], \{x\}$ denotes the integral part and the fractional part of x respectively. If ' a ' denotes the number of points of discontinuity and ' b ' denotes the number of points of nondifferentiability of $f(x)$ then $a + b$ is equal to