SRIGAYATRI EDUCATIONAL INSTITUTIONS
INDIA

Time: 3 Hours

JEE MAIN TOT GT-8

Max. Marks: 300 M

SECTION – I
(SINGLE CORRECT ANSWER TYPE)

This section contains 20 multiple choice questions. Each question has 4 options (A), (B), (C) and (D) for its answer, out of which **ONLY ONE** option can be correct.

Marking scheme: +4 for correct answer, 0 if not attempted and -1 if not correct.

MATHEMATICS

***SYLLABUS:* Total Syllabus**

1. **The maximum value of** $(\cot^{-1}x)(\cot^{-1}(-x))$ **.**

A) 0 B) π^2 C) $\frac{\pi^2}{4}$ D) $\frac{\pi}{2}$

2. **Let O be an interior point of** ΔABC **such that** $\overrightarrow{OA}+2\overrightarrow{OB}+3\overrightarrow{OC}=\vec{0}$**. Then find the ratio of the area of** ΔABC **to the area of** ΔAOC **.**

A) 0 B) 2 C) 3 D) 1

3. **Let** $x^2-(m-3)x+m=0\ (m\in R)$ **be a quadratic equation find the Values of m for which the roots are greater than 2.**

A) (9,10) B) [9,10) C) [9,10] D) (9,10]

4. **The remainder left out when** $8^{2n}+(62)^{2n+1}$ **is divided by 9 is**

A) 0 B) 2 C) 7 D) 8

5. **A box contains 10 mangoes out of which 4 are rotten. Two mangoes are taken out together. If found to be good, then find the probability that the other is also good.**

A) $\frac{10}{13}$ B) $\frac{15}{26}$ C) $\frac{6}{13}$ D) $\frac{5}{13}$

6. **Total number of ways of 6 letter word from the letters of word 'PROPORTION'.**

A) 11130 B) 11120 C) 1130 D) 1120

7. **Let** $A=\begin{pmatrix}1&0&0\\2&1&0\\3&2&1\end{pmatrix}$**. If** u_1 **and** u_2 **are column matrices such that** $Au_1=\begin{pmatrix}1\\0\\0\end{pmatrix}$ **and** $Au_2=\begin{pmatrix}0\\1\\0\end{pmatrix}$**, then** u_1+u_2 **is equal to**

A) $\begin{pmatrix}-1\\1\\0\end{pmatrix}$ B) $\begin{pmatrix}-1\\1\\-1\end{pmatrix}$ C) $\begin{pmatrix}-1\\-1\\0\end{pmatrix}$ D) $\begin{pmatrix}1\\-1\\-1\end{pmatrix}$

8. **The statement** $\sim(p\leftrightarrow\sim q)$ **is**

A) equivalent to $p\leftrightarrow q$ B) equivalent to $\sim p\leftrightarrow q$
C) a tautology D) a fallacy

9. **Let** $a,b,c\in R$**. If** $f(x)=ax^2+bx+c$ **is such that** $a+b+c=3$ **and** $f(x+y)=f(x)+f(y)+xy,\forall x,y\in R$**, then** $\sum_{n=1}^{10}f(n)$ **is equal to**

A) 255 B) 330 C) 165 D) 190

10. Let λ and α be real. Then the number of integral values λ for which the system of linear equations

$\lambda x+(\sin\alpha)y+(\cos\alpha)z=0$;

$x+(\cos\alpha)y+(\sin\alpha)z=0$;

$-x+(\sin\alpha)y-(\cos\alpha)z=0$ **has non-trivial solutions is**

A) 0 B) 1 C) 2 D) 3

11. The circumcentre of the triangle formed by the lines $xy + 2x + 2y + 4 = 0$ and $x + y + 2 = 0$, is

A) (–1, –1) B) (0, –1) C) (1, 1) D) (–1, 0)

12. The equation of the circle passing through the point (–1, 2) and having two diameters along the pair of lines $x^2-y^2-4x+2y+3=0$ is

A) $x^2+y^2-4x-2y+5=0$ B) $x^2+y^2+4x+2y-5=0$

C) $x^2+y^2-4x-2y-5=0$ D) $x^2+y^2+4x+2y+5=0$

13. The ellipse $x^2+4y^2=4$ is inscribed in a rectangle aligned with the coordinate axes, which in turn is inscribed in another ellipse that passes through the point (4, 0). Then, the equation of the ellipse is

A) $x^2+16y^2=16$ B) $x^2+12y^2=16$ C) $4x^2+48y^2=48$ D) $4x^2+64y^2=48$

14. If $\lim\limits_{x\to 0}\dfrac{(1+a^3)+8e^{1/x}}{1+(1-b^3)e^{1/x}}=2$, then

A) $a=1,\ b=(-3)^{1/3}$ B) $a=1,\ b=3^{1/3}$ C) $a=-1,\ b=-(3)^{1/3}$ D) $a=-1,\ b=(-3)^{1/3}$

15. If $f(x)$ is a polynomial satisfying $f(x)=x^3+x^2f'(1)+xf''(2)+f'''(3)$ for all $x\in R$. Then,

A) $f(0)+f(2)=f(1)$ B) $f(0)+f(3)=0$ C) $f(1)+f(3)=f(2)$ D) All the above

16. If p and q are positive real numbers such that $p^2+q^2=1$, then the maximum value of $p+q$, is

A) $\dfrac{1}{\sqrt{2}}$ B) $\sqrt{2}$ C) 2 D) $\dfrac{1}{2}$

17. The value of $\displaystyle\int\frac{\sin^2 x\ \cos^2 x}{(\sin^3 x+\cos^3 x)^2}\,dx$, is

A) $\dfrac{1}{3(1+\tan^3 x)}+C$ B) $-\dfrac{1}{3(1+\tan^3 x)}+C$ C) $\dfrac{1}{1+\tan^3 x}+C$ D) $-\dfrac{1}{1+\tan^3 x}+C$

18. The area (in square units) bounded by the curves $y=\sqrt{x}$, $2y-x+3=0$, x–axis, and lying in the first quadrant is

A) 9 B) 36 C) 18 D) 27/4

19. The solution of the differential equation $(x+y)(dx-dy)=dx+dy$, is

A) $x-y=ke^{x-y}$ B) $x+y=ke^{x+y}$ C) $x+y=k(x-y)$ D) $x+y=ke^{x-y}$

20. Find the acute angle between the lines $\dfrac{x-1}{l}=\dfrac{y+1}{m}=\dfrac{z}{n}$ and $\dfrac{x+1}{m}=\dfrac{y-3}{n}=\dfrac{z-1}{l}$, where $l>m>n$ and l,m,n are the roots of the roots of the cubic equation $x^3+x^2-4x=4$

A) $\cos^{-1}\left(\dfrac{2}{9}\right)$ B) $\cos^{-1}\left(\dfrac{4}{9}\right)$ C) $\cos^{-1}\left(\dfrac{14}{3}\right)$ D) $\cos^{-1}\left(\dfrac{12}{5}\right)$

SECTION- II
(Numerical Value Answer Type)

This section contains 5 questions. The answer to each question is a Numerical values comprising of positive or negative decimal numbers. Marking scheme: +4 for correct answer, 0 in all other cases.

21. **ABC is triangular park with AB=AC=100m. A clock tower is situated at the midpoint of BC. The angles of elevation ∝ and β of the top of the tower at A and B, respectively, are such that cot ∝=3.2 and cosec β=2.6. Find the height of the tower.**

22. **Let a random variable x have a binomial distribution with mean 8 and variance 4. If** $P(x \le 2) = \frac{k^2}{2^{16}}$ **then k is equal to**

23. **If the mean deviation of the numbers 1,1+d,1+2d, …,1+100d from their mean is 255 then d is equal to**

24. **If** $f(x) = 3x^{10} - 7x^8 + 5x^6 - 21x^3 + 3x^2 - 7$**, then** $\lim_{\alpha \to 0} \frac{f(1-\alpha) - f(1)}{\alpha^3 + 3\alpha}$ **is**

25. **Area of the trapezium whose vertices lie on the parabola** $y^2 = 4x$ **and its diagonals pass through (1,0) and having length** $\frac{25}{4}$ **unit each, is**

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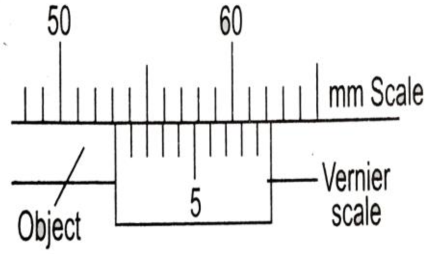
PHYSICS

SYLLABUS: ***Total Syllabus***

26. **What is the reading of vernier scale shown in figure?**

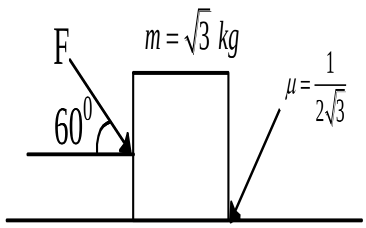


A) 54.6 mm B) 53.2 mm C) 52.7 mm D) 54.7 mm

27. **Starting from rest a particle moves in a straight line with acceleration** $a = \{2 + |t - 2|\}$ **m/s²**. **Velocity of particle at the end of 4s will be**

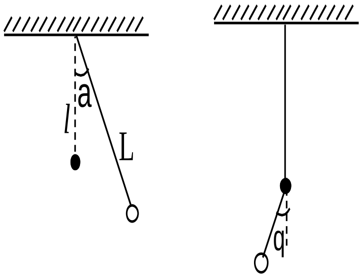
A) 16 m/s B) 20 m/s C) 8 m/s D) 12 m/s

28. **What is the maximum value of the force F such that the block shown in the arrangement, does not move?**



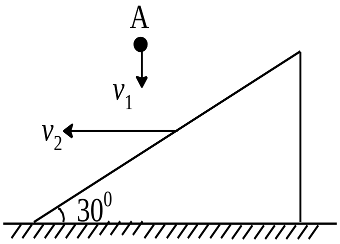
A) 20 N B) 10 N C) 12 N D) 15N

29. A simple pendulum consisting of a mass M attached to a string of length L is released from rest at an angle α. A pin is located at a distance l below the pivot point. When the pendulum swings down, the string hits the pin as shown in figure. The maximum angle θ which string makes with the vertical after hitting the pin is (Note: It is given that after hitting the pin, the pendulum just oscillates).



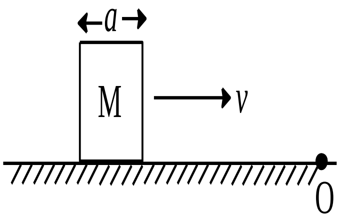
A) $\cos^{-1}\left[\frac{L\cos\alpha+l}{L+l}\right]$ B) $\cos^{-1}\left[\frac{L\cos\alpha+l}{L-l}\right]$ C) $\cos^{-1}\left[\frac{L\cos\alpha-l}{L-l}\right]$ D) $\cos^{-1}\left[\frac{L\cos\alpha-l}{L+l}\right]$

30. A ball A is falling vertically downwards with velocity v_1. It strikes elastically with a wedge moving horizontally with velocity v_2 as shown in figure. What must be the ratio $\frac{v_1}{v_2}$, so that the ball bounces back in vertically upward direction relative to the wedge



A) $\sqrt{3}$ B) $\frac{1}{\sqrt{3}}$ C) 2 D) $\frac{1}{2}$

31. A cubical block of side a moving with velocity v on a horizontal smooth plane as shown. It hits a ridge at point O. The angular speed of the block after it hits O is



A) $3v/4a$ B) $3v/2a$ C) $\sqrt{\frac{3}{2}}\frac{v}{a}$ D) Zero

32. Imagine a light planet revolving around a very massive star in a circular orbit of radius R with a period of revolution T. If the gravitational force of attraction between the planet and the star is proportional to $R^{-5/2}$, then T^2 is proportional to

A) R^3 B) $R^{7/2}$ C) $R^{3/2}$ D) $R^{9/2}$

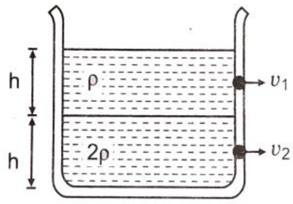
33. Two masses M and m are suspended together by a massless spring of force constant k. When the masses are in equilibrium, M is removed without disturbing the system. The amplitude of oscillation is

A) $\frac{Mg}{k}$ B) $\frac{mg}{k}$ C) $\frac{(M+m)g}{k}$ D) $\frac{(M-m)g}{k}$

34. A particle executes simple harmonic motion with frequency f. The frequency with which its kinetic energy oscillates is

A) $f/2$ B) f C) $2f$ D) $4f$

35. Equal volumes of two immiscible liquids of densities ρ and 2ρ are filled in a vessel as shown in figure. Two small holes are punched at depths $h/2$ and $3h/2$ from the surface of lighter liquid. If v_1 and v_2 are the velocities of efflux at these two holes, then v_1/v_2 is

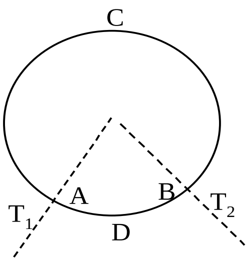


A) $\frac{1}{2\sqrt{2}}$ B) $\frac{1}{2}$ C) $\frac{1}{4}$ D) $\frac{1}{\sqrt{2}}$

36. The amplitude of a wave disturbance propagating in positive x–axis is given by $y=\frac{1}{1+x^2}$ at $t = 0$ and $y=\frac{1}{1+(x-1)^2}$ at $t = 2s$, where x and y are in metres. The shape of the disturbance does not change during the propagation. The velocity of the wave is

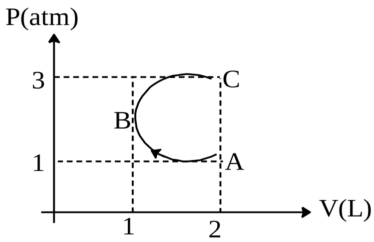
A) 1 m/s B) 0.5 m/s C) 2 m/s D) 4 m/s

37. A ring consisting of two parts ADB and ACB of same conductivity K carries an amount of heat H. The ADB part is now replaced with another metal keeping the temperature T_1 and T_2 constant. The heat carried increases to 2H. What should be the conductivity of the new ADB part? (Given $\frac{\text{ACB}}{\text{ADB}} = 3$)



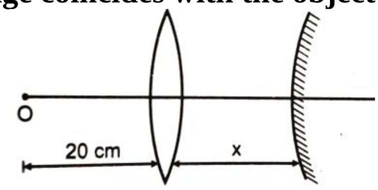
A) $\frac{7}{3}K$ B) 2K C) $\frac{5}{2}K$ D) 3K

38. In the P–V diagram shown in figure ABC is a semicircle. The work done in the process ABC is



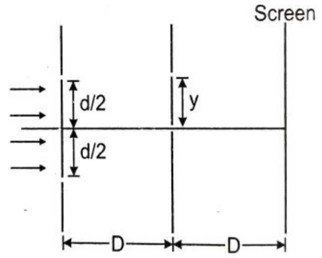
A) Zero B) $\frac{\pi}{2}$ atm–L 3) $-\frac{\pi}{2}$ atm–L D) 4 atm–L

39. A point object O is placed at a distance of 20cm from a convex lens of focal length 10cm as shown in figure. At what distance x from the lens should a concave mirror of focal length 60 cm, be placed so that final image coincides with the object?



A) 10 cm B) 40cm C) 20 cm
D) Final image can never coincide with the object in the given conditions

40. In the Young's double slit experiment apparatus shown in figure, the ratio of maximum to minimum intensity on the screen is 9. The wavelength of light used is λ, then the value of *y* is

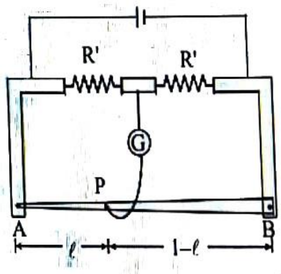


A) $\frac{\lambda D}{d}$ B) $\frac{\lambda D}{2d}$ C) $\frac{\lambda D}{3d}$ D) $\frac{\lambda D}{4d}$

41. *n* identical cells are joined in series with two cells A and B with reversed polarities. EMF of each cell is E and internal resistance is *r*. Potential difference across cell A or B is (*n* > 4).

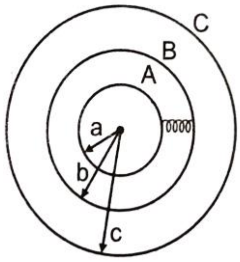
A) $\frac{2E}{n}$ B) $2E\left(1-\frac{1}{n}\right)$ C) $\frac{4E}{n}$ D) $2E\left(1-\frac{2}{n}\right)$

42. In a meter bridge, the wire of length 1m has a non–uniform cross–section such that, the variation $\frac{dR}{dl}$ of its resistance R with length *l* is $\frac{dR}{dl} \propto \frac{1}{\sqrt{l}}$. Two equal resistances are connected as shown in the figure. The galvanometer has zero deflection when the jockey is at point P. What is the length AP?



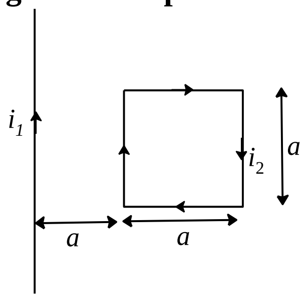
A) 0.3m   B) 0.25m   C) 0.35m   D) 0.2m

43. Three conducting spheres A, B and C are as shown in figure. The radii of the spheres are *a*, *b* *c* respectively. A and B are connected by a conducting wire. The capacity of the system is



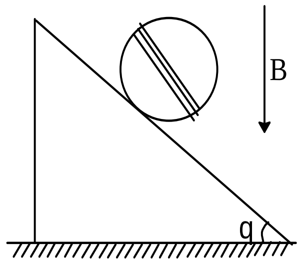
A) $4\pi\varepsilon_0(a+b+c)$ B) $4\pi\varepsilon_0\left(\frac{bc}{c-b}\right)$ C) $4\pi\varepsilon_0\left(\frac{1}{a}+\frac{1}{b}+\frac{1}{c}\right)$ D) $4\pi\varepsilon_0\left(\frac{abc}{ab+c+ca}\right)$

44. A current carrying square loop is placed near an infinitely long current carrying wire as shown in figure. The torque acting on the loop is



A) $\frac{\mu_0}{2\pi}\left(\frac{i_1 i_2 a}{2}\right)$ B) $\frac{\mu_0 i_1 i_2 a}{2\pi}$ C) $\frac{\mu_0 i_1 i_2 a}{2\pi}$ in (2)   D) zero

45. **In the figure shown a coil of single turn is wound on a sphere of radius R and mass *m*. The plane of the coil is parallel to the plane and lies in the equatorial plane of the sphere. Current in the coil is *i*. The value of B if the sphere is in equilibrium is**



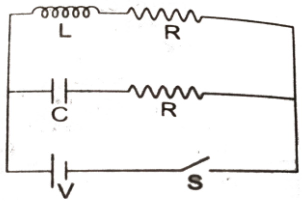
A) $\frac{mg\cos\theta}{\pi iR}$ B) $\frac{mg}{\pi iR}$ C) $\frac{mg\tan\theta}{\pi iR}$ D) $\frac{mg\sin\theta}{\pi iR}$

SECTION-II
(Numerical Value Answer Type)

This section contains 5 questions. The answer to each question is a Numerical values comprising of positive or negative decimal numbers.

Marking scheme: +4 for correct answer, 0 in all other cases.

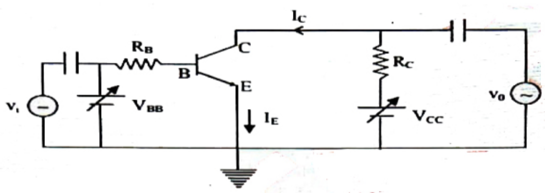
46. **In the circuit shown in figure,** $R=\sqrt{\frac{L}{C}}$. **Switch S is closed at time t = 0. The current through C and L would be equal after a time t equal to CR ln (x). Where x =**



47. **The number n of β particles emitted with energy E is given by** $n\propto(E_{\max}-E)^2\times\sqrt{E}$ **, where** $E_{\max}$ **is the maximum energy released in β decay. The maximum number of antineutrinos would come out with energy approximately equal to** $\frac{4E_{\max}}{y}$**. Where y =**

48. **A stationary hydrogen atom of mass M emits a photon corresponding to the first line of Lyman series. If R is the Rydberg's constant, the speed of recoil of the atom after the emission of the photon is** $\frac{xRh}{4M}$**. Where x is**

49. **In the figure, given that V_{BB} supply can vary from 0 to 5.0 V, V_{CC} = 5V, β_{dc} = 200, R_B = 100 kΩ, R_C = 1kΩ and V_{BE} = 1.0V. The minimum base current at which the transistor will go to saturation, will be** $x\times10^{-8}$.



50. **A stationary nucleus disintegrates suddenly in two nuclei X and Y. The ratio of the kinetic energy of the two nuclei X and Y after the disintegration is 1 : 2, the ratio of the radii of the nuclei X and Y will be** $2^{1/x}$**. Where x is**

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CHEMISTRY

SYLLABUS: ***Total Syllabus***

51. Two liquids A and B are mixed at temperature T in a certain ratio to from an ideal solution. It is found that the partial pressure of A i.e P_A is equal to P_B. The pressure of the B for liquid Mixture. What is the total pressure of the liquid mixture in terms of P_A^O and P_B^O

A) $\frac{P_A^O P_B^O}{P_A^O + P_B^O}$ B) $\frac{2P_A^O P_B^O}{P_A^O + P_B^O}$ C) $\frac{2P_A^O}{P_A^O + P_B^O}$ D) $\frac{2P_B^O}{P_A^O + P_B^O}$

52. The molal elevation constant of water is 0.52K kg mol^{-1}. The boiling point of 1.0 molal aqueous KCl solution (assuming complete dissociation of KCl), should be

A) 98.96^0C B) 100.52^0C C) 101.04^0C D) 107.01^0C

53. IE for He^+ is 1.96×10^{-19} J mol^{-1} calculate the energy of the first stationary state of Be^{+3}

A) 7.84×10^{-19}J atom^{-1} B) 7.84×10^{-23}J atom^{-1}
C) 7.84×10^{19}J atom^{-1} D) 7.84×10^{23}J atom^{-1}

54. Consider the following isomerisms

i) Ionisation ii) Linkage iii) Geometrical

Which of the above isomerism(s) is/are exhibited by the complex $CoCl_2\left(NO_2\right)\left(en\right)_2$

A) only I B) Only I and II C) Only II and III D) I, II, and III

55. Number of $sp^3 - s - sp^3$ bonds in Diborane molecule

A) 2 B) 4 C) 6 D) 6

56. $C_6H_5NH_2 \xrightarrow[\text{HCl, 278K}]{NaNO_2} A \xrightarrow{KI} B$ **In this reaction A and B are**

A) Nitrobenzene and Iodobenzene B) Phenol and Benzene
C) Benzene diazonium chloride and Iodobenzene D) Nitrobenzene and phenol

57. The correct decreasing order of ionic size among the following species is K^+, Cl^-, S^{-2} *and* Ca^{+2}

A) $Ca^{+2} > K^+ > Cl^- > S^{-2}$ B) $K^+ > Ca^{+2} > Cl^- > S^{-2}$
C) $S^{-2} > Cl^- > K^+ > Ca^{+2}$ D) $S^{-2} > Cl^- > Ca^{+2} > K^+$

58. Inter molecular forces present in the nylon – 66 are

A) Vander Waal's B) Dipole – Dipole C) Ion – Dipole D) Hydrogen bonding

59. The Gibbs energy for the decomposition of FeO at 600^0C is as follows $FeO \rightarrow Fe + \frac{1}{2}O_2$, $\Delta_r G = 856 kJ/mole$ **the potential difference needed for electrolyte reduction of FeO at 600^0C is at least**

A) –3.6V B) –4.73V C) –5.2V D) –4.43V

60. A certain compound gives negative test with nin–hydrin and positive with Benedict's solution the compound is

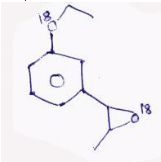
A) A protein B) An amino acid C) A lipid D) A monosacchride

61. For the reaction $2NO_2 + F_2 \rightarrow 2NO_2F$ the rate expression is $r = k[NO_2][F_2]$. Which is the rate determining step

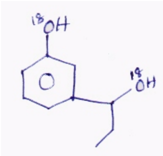
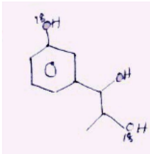
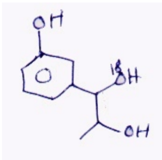
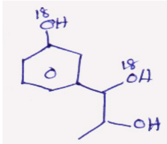
A) $NO_2 + F_2 \rightarrow NO_2F + F(slow)$ B) $NO_2 + F \rightarrow NO_2F(fast)$
C) $NO_2 + \frac{1}{2}F_2 \rightarrow NO_2F(slow)$ D) All

62. **At 25^0C the solubility product of $Mg(OH)_2$ is** 9.0×10^{-12} **. At which P^H, Mg^{+2} ions get precipitating in the form of $Mg(OH)_2$ from a solution of 0.01M Mg^{+2} ions**

A) 10.5 B) 9.5 C) 8.5 D) 9.0

63.  $\xrightarrow{H_3O^{\oplus}}$ **A+B**

B is Ethyl alcohol then 'A' is

A)  B)  C)  D) 

64. **Which of the following transition in H Spectrum has the same wave length as the Balmer transition $n_4 \to n_2$ of He^+ Spectrum.**

A) $n_2 \to n_1$ B) $n_3 \to n_2$ C) $n_4 \to n_2$ D) $n_5 \to n_3$

65. **The decrease in the weight will be ____ when dry air is passed through two bulbs one containing the solvent and other solution containing Non-Volatile solute.**

A) More in the solution bulb B) More in the solvent bulb

C) Loss in the solvent bulb D) Same in both the bulbs

66. **For the given reaction** $CH_3-C\equiv C-CH_3 \xrightarrow{[x]}$ $\underset{H}{\overset{CH_3}{>}}C=C\underset{H}{\overset{CH_3}{<}}$ **[x] is _____**

A) $H_2/pd.Baso_4-caco_3$ B) $Na/liq.NH_3$

C) Ni_2B/H_2 D) A and C both

67. **In the following statements which combination of true(T) and false(F) options is correct?**

1) $HOCl < HClO_2 < HClO_3 < HClO_4$ _ oxidizing power.

2) $HF < Hcl < HBr < HI$ ….acidic strength

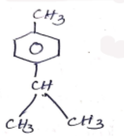
3) $Hcl < HBr < HI < HF$ ….Boiling point

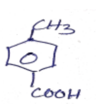
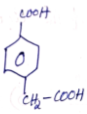
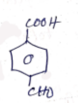
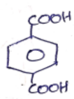
4) $F_2 < cl_2 < Br_2 < I_2$….Boiling point

A) TFTF B) FTTT C) TFFF D) FTFT

68. $CaC_2 \xrightarrow{H_2O} A \xrightarrow[\text{Polymerisation}]{\text{Red Hot Cu tubes}} B \xrightarrow[\text{Anhydrus } AlCl_3]{CH_3Cl} C \xrightarrow{KMnO_4} D$

A) C is Benzyl chloride B) D is Benzoic acid C) D is Methyl benzene D) D is Benzaldehyde

69.  $\xrightarrow[\Delta]{KMnO_4/H^+}$ **final product is**

A)  B)  C)  D) 

70. **2 – Methyl 2 – Butene on ozonolyisis gives**

A) Acetone + acetaldehyde B) 2 moles acetone

C) Two moles acetaldehyde D) Propanone + Methanol

SECTION-II

(Numerical Value Answer Type)

This section contains 5 questions. The answer to each question is a Numerical values comprising of positive or negative decimal numbers. Marking scheme: +4 for correct answer, 0 in all other cases.

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71. **The difference in the oxidation states of central Sulphur and terminal Sulphur of the Compound** $H_2S_2O_3$ **is**

72. **The equilibrium constant for the following reaction is** 10^{2x}**. The value of 'x' is**

$In^{+2} + cu^{+2} \rightarrow In^{+3} + cu^{+}$ **(at 298k)**

[Given $E^0_{cu^{+2}/cu}$ **=0.15V;** $E^0_{In^{+3}/In^{+}} = -0.42V$ **;** $E^0_{In^{+2}/In^{+1}} = -0.40V$

73. **The edge of unit cell of FCC ionic crystal is 620pm. The radius of cation is 134pm what is the radius of anion in _____ pm**

74. **In a first order reaction initial concentration of a substance become half in 100 sec then calculate the time required (in sec) to reduce the concentration of reaction 0.125M from 0.5M**

75. **Number of Hydrogen bonds present between C and G**