SRIGAYATRI EDUCATIONAL INSTITUTIONS

INDIA

JEE MAINS MODEL | **UNIT TEST-4** | **Date: 05-05-2020**

Time: 3 Hours | **Max. Marks: 300 M**

JEE MAIN MODEL

MATHEMATICS

Section	Question type	+Ve Marks	- Ve Marks	No.of Qs	Total marks
Sec – I(Q.N : 01 – 20)	Questions with Single Answer Type	4	-1	20	80
Sec – II(Q.N : 21 – 25)	Questions with Numerical Answer Type (+/ - Decimal Numbers)	4	0	5	20
Total				25	100

PHYSICS

Section	Question type	+Ve Marks	- Ve Marks	No.of Qs	Total marks
Sec – I(Q.N : 26 – 45)	Questions with Single Answer Type	4	-1	20	80
Sec – II(Q.N : 46 – 50)	Questions with Numerical Answer Type (+/ - Decimal Numbers)	4	0	5	20
Total				25	100

CHEMISTRY

Section	Question type	+Ve Marks	- Ve Marks	No.of Qs	Total marks
Sec – I(Q.N : 51 – 70)	Questions with Single Answer Type	4	-1	20	80
Sec – II(Q.N : 71 – 75)	Questions with Numerical Answer Type (+/ - Decimal Numbers)	4	0	5	20
Total				25	100

SECTION – I
(SINGLE CORRECT ANSWER TYPE)

This section contains 20 multiple choice questions. Each question has 4 options (A), (B), (C) and (B) 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: CALCULUS

1. **If** $g(x)=\left(4\cos^4 x-2\cos 2x-\frac{1}{2}\cos 4x-x^7\right)^{1/7}$ **then value of** $\lim_{x\to\infty} g\left(g(x)\right)=$

1) -1 2) 0 3) 1 4)100

2. **A non-zero polynomial with real coefficients has the property that** $f(x)=f'(x).f''(x)$ **the leading coefficient of** $f(x)$ **is**

1) $\frac{1}{6}$ 2) $\frac{1}{9}$ 3) $\frac{1}{12}$ 4) $\frac{1}{18}$

3. $\int \sin x\cos x\cos 2x.\cos 4x\cos 8x\cos 16x\,dx=$

1) $\frac{\sin 16x}{1024}+c$ 2) $\frac{-\cos 2x}{1024}+c$ 3) $\frac{\cos 32x}{1096}+c$ 4) $-\frac{\cos 32x}{1096}+c$

4. $\lim_{n\to\infty}\left(\frac{n!}{n^n}\right)\frac{3n^3+4}{4n^4-1}(n\in N)=$

1) $\left(\frac{1}{e}\right)^{3/4}$ 2) $e^{3/4}$ 3) e^{-1} 4) 0

5. **A given right circular cone has a volume of p, and the largest right circular cylinder that can be inscribed in the cone has a volume q. Then p:q is**

1) 9:4 2) 8:3 3) 7:2 4) 4:9

6. **Area bounded by the curves** $y=\sin x+|\sin x|, y=-x, x=0$ **and** $x=3\pi$ **is**

1) $8+\frac{9\pi^2}{2}$ 2) $4+\frac{9\pi^2}{2}$ 3) $8+9\pi^2$ 4) $4+9\pi^2$

7. **The equation of the trajectories which is orthogonal to the family of curves** $\cos y=a.e^{-x}$

1) $\sin y=c.e^{x}$ 2) $\cos y=c.e^{x}$ 3) $\sin y=c.e^{-x}$ 4) $\cos y=c.e^{-x}$

8. **Let 'f' be a differentiable function satisfying** $f'(x)=2f(x)+10$ **and** $f(0)=0$ **then the number of roots of the equation** $f(x)+5\sec^2 x=0$ **in** $(0,2\pi)$ **is**

1) 0 2) 1 3) 2 4) 3

9. $A=\frac{dy}{dx}$ **of** $x^2+y^2=4$ **at** $\left(\sqrt{2},\sqrt{2}\right)$ $B=\frac{dy}{dx}$ **of** $\sin y+\sin x=\sin x.\sin y$ **at** (π,π) $C=\frac{dy}{dx}$ **of** $2e^{xy}+e^x.e^y-e^x-e^y=e^{xy+1}$ **at** $(1,1)$ **then** $A+B+C=$

1) -1 2) e 3) -3 4) -4

10. $\frac{d}{dx}\left(|x^2+x|\right)=|2x+1|$ **is non derivable at**

1) $x=-1,1$ 2) $x=0,1$ 3) $x=-1,0$ 4) $x=1,2$

11. $\lim\limits_{x\to 1}\dfrac{\left(\sum\limits_{k=1}^{100}x^k\right)-100}{x-1}$

1) 5040 2) 5050 3) 4050 4) 4040

12. **Number of points of discontinuity of** $f(x)=\left[2x^3-5\right]$ **in** $[1,2)$ **is equal ____**

1) 14 2) 13 3) 10 4) 8

13. **Let** $f:R\to R$ **be a continuous onto function satisfying** $f(x)+f(-x)=0\ \forall x\in R$. **If** $f(-3)=2$ **and** $f(5)=4$ **in** $[-5,5]$ **then the equation** $f(x)=0$ **has ___**

1) Exactly 3 real roots 2) Exactly 2 real roots
3) Atleast 5 real roots 4) Atleast 3 real roots

14. $\int e^x\left(\dfrac{2\tan x}{1+\tan x}+\cot^2\left(x+\dfrac{\pi}{4}\right)\right)dx=$

1) $e^x\tan\left(\dfrac{\pi}{4}-x\right)+c$ 2) $e^x\tan\left(x-\dfrac{\pi}{4}\right)+c$ 3) $e^x\tan\left(\dfrac{3\pi}{4}-x\right)+c$ 4) $e^x\tan\left(x-\dfrac{3\pi}{4}\right)+c$

15. $\lim\limits_{n\to\infty}\sum\limits_{r=1}^{r=4n}\dfrac{\sqrt{n}}{\sqrt{r}\left(3\sqrt{r}+4\sqrt{n}\right)^2}$

1) $\dfrac{1}{35}$ 2) $\dfrac{1}{14}$ 3) $\dfrac{1}{10}$ 4) $\dfrac{1}{5}$

16. $\int\limits_0^1\left(\pi\limits_{r=1}^{n}(x+r)\right)\left(\sum\limits_{k=1}^{n}\dfrac{1}{(x+k)}\right)dx=$

1) n 2) $n!$ 3) $(n+1)!$ 4) $(n).(n!)$

17. **The equation** $\sin x+x\cos x=0$ **has at least one root in**

1) $\left(-\dfrac{\pi}{2},0\right)$ 2) $(0,\pi)$ 3) $\left(\pi,\dfrac{3\pi}{2}\right)$ 4) $\left(0,\dfrac{\pi}{2}\right)$

18. **Suppose** $\begin{vmatrix} f'(x) & f(x)\\ f''(x) & f'(x)\end{vmatrix}=0$ **where** $f(x)$ **is continuously differentiable function with** $f'(x)=0$ **and** $f(0)=1, f'(0)=2$ **then** $f(x)$

1) x^2+2x+1 2) $2e^x-1$ 3) e^{2x} 4) $4e^{\frac{x}{2}}-3$

19. **Suppose** $A=\int\dfrac{dx}{x^2+6x+25}$ **and** $B=\int\dfrac{dx}{x^2-6x-27}$. **If** $12(A+B)=\lambda\tan^{-1}\left(\dfrac{x+3}{4}\right)+m\log\left|\dfrac{x-9}{x+3}\right|+c$ **then** $\lambda+m=$

1) 3 2) 6 3) 5 4) 4

20. **The equation of the curve through** $(3,4)$ **and satisfying the differential equation** $y\left(\dfrac{dy}{dx}\right)^2+(x-y)\dfrac{dy}{dx}=x$ **can be**

1) $x-y+1=0, x^2+y^2=25$ 2) $y-x+1=0, x^2+y^2+25=0$

3) $x+y-7=0, x^2+y^2-5x-10=0$ 4) $\dfrac{x}{3}+\dfrac{y}{4}=1, x^2+y^2=25$

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. Each question has 4 options (1), (2), (3) and (4) for its answer, out of which **ONLY ONE** option can be correct.
Marking scheme: +4 for correct answer, 0 in all other cases.

21. $f(x)=\{x\}+\left\{x+\left[\frac{x}{1+x^2}\right]\right\}+\left\{x+\left[\frac{x}{1+2x^2}\right]\right\}+....+\left\{x+\left[\frac{x}{1+99x^2}\right]\right\}$ **then the value of** $\left[\lim_{x\to\sqrt{3}} f(x)\right]\{x\}=$ **Fractional part of** x**,** $[x]=$ **step function of** x ____

22. $\frac{d^2x}{dy^2}\left(\frac{dy}{dx}\right)^3+\frac{d^2y}{dx^2}=$_____

23. **If** $\int\left(x^{2010}+x^{804}+x^{402}\right)\left(2x^{1608}+5x^{402}+10\right)^{\frac{1}{402}}dx=\frac{1}{10k}\left(2x^{2010}+5x^{804}+10x^{402}\right)$ **then** $k=$____

24. **The graphs** $y=2x^3-4x+2$ **and** $y=x^3+2x-1$ **intersect in exactly 3 distinct points. The slope of the line passing through two of these points =** ____

25. **Let** $'C'$ **be the curve** $y=x^3\left(\forall x\in R\right)$**. The tangent at 'A' meets the curve again at 'B'. If the gradient at B is 'k' times the gradient at A then k=** ____

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.

PHYSICS

SYLLABUS: MAGENETISM AND OPTICS

26. **Two identical thin barmagnets each of length** l **and pole strength m are placed at right angles to each other, with north pole of one touching south pole of the other, then the magnetic moment of the system is**

1) 1 ml 2) 2 ml 3) $\sqrt{2}\,ml$ 4) $\frac{ml}{\sqrt{2}}$

27. **A compass needle whose magnetic moment is** $60\,Am^2$**, is directed towards geographical north at any place experiencing moment of force of** $1.2\times10^{-3}\,Nm.$ **At that place** $B_H=40\,micro\ w/m^2$**. What is value of dip angle at that place.**

1) 30^0 2) 60^0 3) 45^0 4) 15^0

28. **The materials suitable for making electromagnets should have**

1) high retentivity and low coercivity 2) low rententivity and low coercivity
3) high rententivity and high coercivity 4) low rententivity and high coercivity

29. **If the susceptibility of dia, para and ferro magnetic materials are** χ_d,χ_p,χ_f **respectively, then**

1) $\chi_d<\chi_p<\chi_f$ 2) $\chi_d<\chi_f<\chi_p$ 3) $\chi_f<\chi_d<\chi_p$ 4) $\chi_f<\chi_p<\chi_d$

30. Two short bar magnets P and Q are arranged such that their centres are on he X-axis and are separared by a large distance. The magnetic axes of P and Q are along X and Y axes respectively. At a point R, midway between their centres if 'B' is the magnitude of induction due to Q, the magnitude of total induction at R due to the both magnets is

1) $3B$ 2) $\sqrt{5}B$ 3) $\frac{\sqrt{5}}{2}B$ 4) B

31. A magnetic needle lying parallel to a magnetic field requires W units of work to turn it through 60^0. The torque required to keep the needle in this position will be

1) 2W 2) W 3) $\frac{W}{\sqrt{2}}$ 4) $W\sqrt{3}$

32. A car is fitted with a convex side-view mirror of focal length 20cm. A second car 3.2 m behind the first car is overtaking the first car at a relative speed of 15 m/s. The speed (in m/s) of the image of the second car as seen in the mirror of the first car is

1) $\frac{1}{15}$m/s 2) 10m/s 3) 15m/s 4) $\frac{1}{10}$m/s

33. If the refractive index of the material of a prism is $\cot\frac{A}{2}$ and the angle of prism is A. Then angle of minimum deviation is

1) $\pi-2A$ 2) $\pi-A$ 3) $\frac{\pi}{2}-2A$ 4) $\frac{\pi}{2}-A$

34. A telescope has an objective of focal length 100cm and an eyepiece of focal length 5cm. What is the magnifying power of the telescope when the final image is formed at the least distance of distinct vision?

1) 20 2) 24 3) 28 4) 32

35. A person can see clearly only upto a distance of 30cm. He wants to read a book placed of a distance of 50 cm from his eyes. What is power of the tens of his spectacles?

1) -1.0 D 2) -1.33D 3) -1.67D 4) -2.0D

36. A microscope is focused on a mark on a piece of paper and then a slab of glass of thickness 3cm and refractive index 1.5 is placed over the mark. How should the microscope be moved to get the mark in focus again?

1) 4.5 cm downward 2) 1 cm downward 3) 2 cm downward 4) 1 cm upward

37. A thin prism of angle 15^0 made of glass of refractive index $\mu_1=1.5$ is combined with another prism of glass of refractive index $\mu_2=1.75$. The combination of the prisms produces dispersion without deviation. The angle of the second prism should be

1) 7^0 2) 10^0 3) 12^0 4) 5^0

38. A telescope consists of two thin tenses of focal lengths 0.3m and 3cm respectively. It is focused on moon which subtends an angle of 0.5^0 at the objective. Then the angle subtended at the eye by the final image

1) 5^0 2) 0.25^0 3) 0.5^0 4) 0.35^0

39. Two sources of light of wavelengths $2500A^0$ and $3500A^0$ are used in YDSE simultaneously. Which orders of fringes of two wavelengths patterns coincide?

1) 3rd order of 1st source and 5th of the 2nd 2) 7th order of 1st source and 5th of the 2nd
3) 5th order of 1st source and 3rd of the 2nd 4) 5th order of 1st source and 7th of the 2nd

40. In the phenomena of diffraction of light when blue light is used in the experiment inspite of red, then

1) fringer will become narrower 2) fringer will be comes broader
3) no change in the fringe width 4) None of these

41. If yellow light emitted by sodium in young's double slit experiment is replaced by a monochromatic blue light of same intensity

1) fringe width will decrease 2) fringe width will increase
3) fringe width will remain same 4) fringes will becomes less intense

42. The YDSE is performed with blue $\left(4360A^0\right)$ and with green $\left(5460A^0\right)$ lights respectively. If Y is the distance of 4th maxima from central one, then

1) $Y_{Blue} = Y_{Green}$ 2) $Y_{Blue} > Y_{Green}$ 3) $Y_{Blue} < Y_{Green}$ 4) $\frac{Y_{Blue}}{Y_{Green}} = \frac{546}{436}$

43. The intensity at the maximum in YDSE experiment I_0. Distance between two slits is $d = 5\lambda$. Where λ is wave length used in experiment. What will be the intensity in front of one of the slit on screen placed at a distance $D = 10d$?

1) I_0 2) $\frac{I_0}{4}$ 3) $\frac{3}{4}I_0$ 4) $\frac{I_0}{2}$

44. In YDSE, both slits are covered by transparent slabs. Upper slit is covered by slab of R.I 1.5 and thickness 't' and lower is covered by slabs of R.I $\frac{4}{3}$ and thickness '2t', then central maxima

1)shift in upwards 2) shifts in downwards
3) remain at same position 4) shift may upward or downwards

45. A light ray is incident on a transparent medium of $\mu = 1.732$ at the polarizing angle. The angle of refraction is

1) 60^0 2) 30^0 3) 45^0 4) 90^0

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. 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 in all other cases.

46. A bar magnet of moment of inertia $9\times10^{-5} kg\,m^2$ placed in a vibration magnetometer and oscillating in a uniform magnetic field $6\pi\times10^{-15}$ Telsa makes 20 oscillations in 15 sec then what will be the value of magnetic moment of the bar magnet in Am^2

47. The coercivity of a small magnet where the ferromagnet gets demagnetized is $3\times10^3 Am^{-1}$. Then what is the value of current (in Amp) required to be passed in a solenoid of length 10cm and number of turns 100. So that the magnet gets demagnetized when inside the solenoid

48. When a plane mirror is placed horizontally on a level ground at a distance of 60m from the foot of a tower, the top of the tower and its image in the mirror subtend an angle of 90^0 at the eye what is the height of the tower in metre?

49. A fish looking up through the water sees the out side world contained in a circular horizontally. If the refractive index of water is $\frac{4}{3}$ and the fish is $\sqrt{7}\,cm$ below the surface, then what is the radius of this circle in cm?

50. **The sun subtends an angle of $\left(\frac{1}{2}\right)^0$ on earth. The image of sun is obtained on the screen with the help of a convex lens of focal length 100cm the diameter of the image obtained on the screen will be $(\pi = 3.14)$**

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.

CHEMISTRY

SYLLABUS: SECOND YEAR PHYSICAL CHEMISTRY

51. **If 'a' stands for the edge length of the cubic systems : simple cubic, body centred cubic and face centred cubic, then the ratio of radii of the spheres in these systems will be respectively,**

1) $\frac{1}{2}a : \frac{\sqrt{3}}{4}a : \frac{1}{2\sqrt{2}}a$ 2) $\frac{1}{2}a : \sqrt{3}a : \frac{1}{\sqrt{2}}a$ 3) $\frac{1}{2}a : \frac{\sqrt{3}}{2}a : \frac{\sqrt{3}}{2}a$ 4) $1a : \sqrt{3}a : \sqrt{2}a$

52. **A solid compound XY has NaCl structure. If the radius of the cation is 100 pm, the radius of the anion (Y^-) will be :**

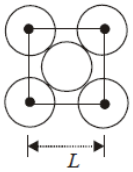
1) 275.1 pm 2) 322.5 pm 3) 241.5 pm 4) 165.7 pm

53. **What type of crystal defect is indicated in the diagram below?**

$Na^+Cl^-Na^+Cl^-Na^+Cl^-$
$Cl^-\square Cl^-Na^+\square Na^+$
$Na^+Cl^-\square Cl^-Na^+Cl^-$
$Cl^-Na^+Cl^-Na^+\square Na^+$

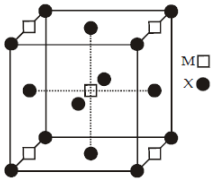
1) Interstitial defect 2) Schottky defect
3) Frenkel defect 4) Frenkel & Schottky defects

54. **The packing efficiency of the two-dimensional square unit cell shown below is :**



1) 39.27% 2) 68.02% 3) 74.05% 4) 78.54%

55. **A compound MpXq has cubic close packing (ccp) arrangement of X. Its unit cell structure is shown below. The empirical formula of the compound is**



1) MX 2) MX_2 3) M_2X 4) M_5X_{14}

56. **The van't Hoff factor *i* for a compound which undergoes dissociation in one solvent and association in other solvent is respectively:**

1) less than one and greater than one 2) less than one and less than one
3) greater than one and less than one 4) greater than one and greater than one

57. P_A and P_B are the vapour pressure of pure liquid components, A and B, respectively of an ideal binary solution. If X_A represents the mole fraction of component A, the total pressure of the solution will be.

1) $P_A + X_A (P_B - P_A)$ 2) $P_A + X_A (P_A - P_B)$ 3) $P_B + X_A (P_B - P_A)$ 4) $P_B + X_A (P_A - P_B)$

58. 18 g of glucose ($C_6H_{12}O_6$) is added to 178.2 g of water. The vapour pressure of water for this aqueous solution at 100°C is

1) 76.00 Torr 2) 752.40 Torr 3) 759.00 Torr 4) 7.60 Torr

59. The molarity of a solution obtained by mixing 750 mL of 0.5(M) HCl with 250 mL of 2(M) HCl will be :

1) 0.875 M 2) 1.00 M 3) 1.75 M 4) 0.975 M

60. Dissolving 120 g of urea (mol. wt. 60) in 1000 g of water gave a solution of density 1.15 g/mL. The molarity of the solution is

1) 1.78 M 2) 2.00 M 3) 2.05 M 4) 2.22 M

61. Which of the following is the use of electrolysis?

1) Electrorefining 2) Electroplating 3) Both (a) and (b) 4) Neither (a) nor (b)

62. What is the amount of chlorine evolved when 2 amperes of current is passed for 30 minutes in an aqueous solution of NaCl?

1) 66g 2) 1.32g 3) 33g 4) 99g

63. The conductivity of a saturated solution of BaSO4 is $3.06\times10^{-6}\text{ohm}^{-1}\text{cm}^{-1}$ **and its equivalent conductance is** $1.53\text{ohm}^{-1}\text{cm}^2\,\text{equiv}^{-1}$. **The Ksp for BaSO4 will be**

1) 4×10^{-12} 2) 2.5×10^{-9} 3) 2.5×10^{-13} 4) 4×10^{-6}

64. If the rate of the reaction is equal to the rate constant, the order of the reaction is

1) 1 2) 2 3) 3 4) 0

65. Which of the following is correct for a first order reaction?

1) $t_{1/2} \propto a$ 2) $t_{1/2} \propto 1/a$ 3) $t_{1/2} \propto a^0$ 4) $t_{1/2} \propto 1/a^2$

66. The Langmuir adsorption isotherm is deduced by using the assumption

1) the adsorption sites are equivalent in their ability to adsorb the particles
2) the heat of adsorption varies with coverage
3) the adsorbed molecules interact with each other
4) the adsorption takes place in multilayers.

67. Which one of the following characteristics is not correct for physical adsorption ?

1) Adsorption increases with increase in temperature
2) Adsorption is spontaneous
3) Both enthalpy and entropy of adsorption are negative
4) Adsorption on solids is reversible

68. Gold numbers of protective colloids A, B, C and D are 0.50, 0.01, 0.10 and 0.005, respectively. The correct order of their protective powers is

1) D < A < C < B 2) C < B < D < A 3) A < C < B < D 4) B < D < A < C

69. The coagulating power of electrolytes having ions Na^+, Al^{3+} and Ba^{2+} for arsenic sulphide sol increases in the order :

1) $Al^{3+} < Ba^{2+} < Na^+$ 2) $Na^+ < Ba^{2+} < Al^{3+}$ 3) $Ba^{2+} < Na^+ < Al^{3+}$ 4) $Al^{3+} < Na^+ < Ba^{2+}$

70. Among the electrolytes $Na_2SO_4, CaCl_2, Al_2(SO_4)_3$ and NH_4Cl, the most effective coagulating agent for Sb_2S_3 sol is

1) Na_2SO_4 2) $CaCl_2$ 3) $Al_2(SO_4)_3$ 4) NH_4Cl

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. 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 in all other cases.

71. **The rate of reaction $2NO + Cl_2 \rightarrow 2NOCl$ is doubled when concentration of Cl_2 is doubled and it becomes 8 times when concentration of both NO and Cl_2 are doubled. Deduce the order of reaction.**

72. **Succinic acid has normal molecular weight in water. Succinic acid was allowed to distribute in water and benzene by shaking. The concentration of acid in water and benzene are C_1 and C_2 having values.**

73. **Find the molarity and molality of a 15% solution of H_2SO_4 (density of $H_2SO_4 = 1.10\, g/ml$).**

74. **A first order reaction is 20% complete in 10 minutes. Calculate (I) the rate constant of the reaction (II) time taken for the reaction to go to 75% completion.**

75. **Chromium metal crystallizes with a body centred cubic lattice. The length of the unit cell edge is found to be 287 pm. Calculate the atomic radius. What would be the density of chromium in g/cm^3.**

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SRIGAYATRI EDUCATIONAL INSTITUTIONS

INDIA

JEE MAINS MODEL | **UNIT TEST-4** | **Date: 05-05-2020**

Time: 3 Hours | **Max. Marks: 300 M**

KEY SHEET

MATHEMATICS

1) **4**	2) **4**	3) **2**	4) **1**	5) **1**	6) **1**	7) **3**	8) **1**	9) **3**	10) **3**
11) **2**	12) **2**	13) **4**	14) **2**	15) **3**	16) **4**	17) **2**	18) **3**	19) **4**	20) **1**
21) **73**	22) **0**	23) **403**	24) **8**	25) **4**					

PHYSICS

26) **3**	27) **1**	28) **2**	29) **1**	30) **2**	31) **4**	32) **1**	33) **1**	34) **2**	35) **2**
36) **4**	37) **2**	38) **1**	39) **2**	40) **1**	41) **1**	42) **3**	43) **4**	44) **2**	45) **2**
46) **4**	47) **3**	48) **60**	49) **3**	50) **0.87**					

CHEMISTRY

51) **1**	52) **3**	53) **2**	54) **4**	55) **2**	56) **3**	57) **4**	58) **2**	59) **1**	60) **3**
61) **3**	62) **2**	63) **4**	64) **4**	65) **3**	66) **1**	67) **1**	68) **3**	69) **2**	70) **3**
71) **3**	72) **236**	73) **1.64**	74) **62.18**	75) **7.30**					

Paper Setters:

SNO	Subject	Name of the Paper Setter	Phone No	Branch
1	MATHS	SUDHAKAR SIR	9440260683	CO ICC
2	PHYSICS	BHARGAV SHARMA SIR	9618550817	CO ICC
3	CHEMISTRY	KATAMAIAH SIR	9948729934	CO ICC

HINTS & SOLUTIONS

MATHEMATICS

1. $g(x)=\left(4\cos^4 x-2\cos 2x-\frac{1}{2}\cos 4x-x^7\right)^{1/7}$

$=\left(\frac{3}{2}-x^2\right)^{1/7}$

$g(x)$ is self inverse function

So $g(x)=g'(x)$

$\Rightarrow g(g(x))=x$

$\Rightarrow g(g(100))=100$

2. $f(x)=f'(x).f''(x)$

Suppose $f(x)$ is nth degree

$f'(x)(n-1)$ th degree

$f''(x)(n-2)$ th degree

So $n=(n-1)+(n-2)$

$n=2n-3$

$\boxed{n=3}$

$f(x)=ax^3+bx^2+cx+d$

$f(x)=f'(x).f''(x)$

$ax^3+bx^2+cx+d=(3ax^2+2bx+c).(6ax+2b)$

So $a=18a^2$

$1=18a\Rightarrow \boxed{a=\frac{1}{18}}$

3. $F\ \sin 2x=2\sin x\cos x$

$\Rightarrow \cos x=\frac{\sin 2x}{2\sin x}$

$\sin x\cos x\cos 2x\cos 4x\cos 8x\cos 16x$

$\sin x\left(\frac{\sin 2x}{2\sin x}\right)\left(\frac{\sin 4x}{2.\sin 2x}\right)\left(\frac{\sin 8x}{2.\sin 4x}\right)\left(\frac{\sin 16x}{2.\sin 8x}\right)\left(\frac{\sin 32x}{2.\sin 16x}\right)$

$\frac{\sin 32x}{32}$

T.I.O.B.S

$\frac{-\cos 32x}{32\times 32}=\frac{-\cos 32x}{1024}+c$

4. $y=\lim_{n\to\infty}\left(\frac{n!}{n^n}\right)\frac{3n^3+4}{4n^4-1}$

$\log=\lim_{n\to\infty}\frac{3n^3+4}{4n^4-1}\left[\log\left(\frac{1.2.3.....n}{n.n.....n}\right)\right]$

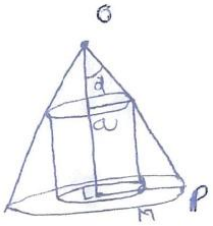
$=\lim_{n\to\infty}\frac{1}{n}\left[\frac{3n^3+4}{4n^3-\frac{1}{n}}\right]\sum_{n=1}^{n}\log\left(\frac{r}{n}\right)$

$=\frac{3}{4}\int_0^1\log x\,dx=\frac{3}{4}\left(x\log x-x\right)_0^1$

$=\frac{3}{4}\left[(0-1)-(0)\right]=\frac{-3}{4}$

$y=e^{-3/4}=\left(\frac{1}{e}\right)^{3/4}$

5. H = height of cone
h = height of cylinder
x = radius of cylinder



$h=QL=OL-OQ=H-x\cot\alpha$

$v=\pi r^2h=\pi x^2(H-x\cot\alpha)$

$H=OL, h=QL$

$\frac{dv}{dx}=\pi(2Hx-3x^2\cot\alpha)$

$\frac{dv}{dx}=0\Rightarrow x=0\Rightarrow x=\frac{2}{3}H\tan\alpha$

$\left.\frac{d^2v}{dx^2}\right|_{x=\frac{L}{3}H\tan\alpha}=-2\pi H<0$

$\therefore\frac{p}{q}=\frac{\frac{1}{3}\pi(H\tan\alpha)^2 1.1}{\pi.\frac{4}{9}|A|^1\tan^2\alpha.\frac{1}{3}H}=\frac{9}{44}$

6. $y=\begin{cases}2\sin x & if\ \ \sin x>0 \ \ means \ \ x\in(0,\pi)\\ 0 & if\ \ \sin x<0 \ \ means \ \ x\in(\pi,2\pi)\\ 2mx & if\ \ \sin x>0 \ \ means \ \ x\in(2\pi,3\pi)\end{cases}$

$\text{Area}=2.\int_0^{\pi}2\sin x\,dx+\frac{1}{2}(3\pi)(3\pi)$

$=4\times 2+\frac{9\pi^2}{2}=9+\frac{9\pi}{2}$

7. $\cos y=a.e^{-x}$

$\sin y.\frac{dy}{dx}=a.(+e^{-x})$

Replace $\frac{dy}{dx}$ by $-\frac{dx}{dy}$

$\sin y\left(\frac{-dx}{dy}\right)=a.e^{-x}$

$\sin y\left(\frac{-dx}{dy}\right)=\cos y$

$-dx=\cot y\,dy$

T.I.O.B.S

$-x=\log_e|\sin y|$

$\Rightarrow e^{-x}=\sin y$

$\therefore \boxed{\sin y=c.e^{-x}}$

8. $f'(x)=2f(x)+10$

$\frac{dy}{dx}=2y+10$

$\Rightarrow \frac{dy}{2y+10}=dy$

$\Rightarrow \frac{dy}{y+5}=2dx$

T.I.O.B.S

$\log|y+5|=2x+c$

$\log|f(x)+5|=2x+c$

$f(0)=0\Rightarrow \log 5=c$

$\log|f(x)+5|=2x+\log 5$

$\log_e\left|\frac{y+5}{5}\right|=2x\Rightarrow \frac{y+5}{5}=e^{2x}$

$f(x)+5\sec^2 x=$

$e^{2x}=-\sec^2 x+1\Rightarrow e^{2x}=-\tan^2 x$

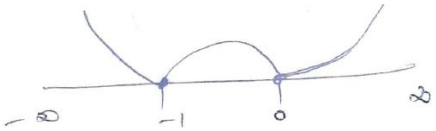
9. $A=-1$

$B=-1$

$C=-1$

$A+B+C=-3$

10. $y=|x^2+x|=|x+(x+1)|$



11. $\lim\limits_{x\to 1}\frac{\left(\sum\limits_{r=1}^{110}x^{\Omega}\right)-100}{x-1}$

$\lim\limits_{x\to 1}\frac{\left(x+x^2+x^3+....x^{100}\right)-100}{x-1}$

$L.H\ \lim\limits_{x\to 1}\frac{1+2x+3x^3+....+100x^{99}}{1}$

$1+2+3+.....+100=\frac{100(100+1)}{2}=5050$

12. $f(x)=\left[2x^3-5\right]=\left[2x^3\right]-5$

Take $2x^3-t\Rightarrow g(t)=[t]$ where $t\in[2,16)$

$\Rightarrow$ g is continuous at $t=2$

Discontinuous at $t=3,4,....15$

$\therefore$ 13 points

13. $f(x)+f(-x)=0\Rightarrow f(x)=-f(-x)$

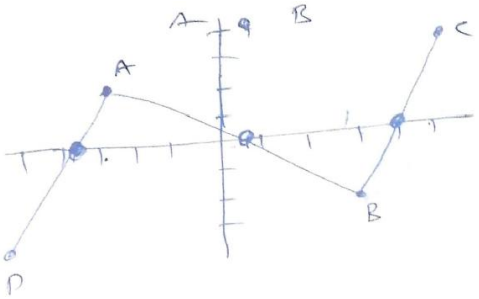
$\Rightarrow \boxed{f(-x)=-f(x)}$

Odd function

$f(-3)=2\Rightarrow f(3)=-2$

$f(5)=4\Rightarrow f(-5)=-4$

$pt\ (-3,2)(3,-2)(5,4)\ (-5,-4)$



14. $\int e^x\left(\frac{2\tan x}{1+\tan x}+\cot^2\left(x+\frac{\pi}{4}\right)\right)dx$

$\int e^x\left(\frac{2\tan x}{1+\tan x}-1+1+\cot^2\left(x+\frac{\pi}{4}\right)\right)dx$

$\int e^x\left(\frac{\tan x-1}{1+\tan x}+\cos ec^2\left(x+\frac{\pi}{4}\right)\right)dx$

$\int e^x\left(\tan\left(x-\frac{\pi}{4}\right)+\sec^2\left(x-\frac{\pi}{4}\right)\right)dx$

$=e^x\tan\left(x-\frac{\pi}{4}\right)+c$

15. $\lim\limits_{n\to\infty}\sum\limits_{r=1}^{4n}\frac{1}{n}.\frac{n\sqrt{n}}{\sqrt{r}.r\left(3+4\sqrt{\frac{n}{r}}\right)^2}$

$=\lim\limits_{n\to\infty}\sum\limits_{r=1}^{4n}\frac{1}{n}.\frac{1}{\left(\frac{r}{n}\right)^{3/2}\left(3+4\left(\frac{r}{n}\right)^{-\frac{1}{2}}\right)^2}$

$=\lim\limits_{n\to\infty}\sum\limits_{r=1}^{4n}\frac{1}{n}\frac{1}{\sqrt{\frac{r}{n}}\left(3\sqrt{\frac{r}{n}}+4\right)^2}$

$=\int\limits_0^4\frac{dx}{\sqrt{x}\left(3\sqrt{x}+4\right)^2}=\frac{1}{10}$

16. If $y=\prod\limits_{r=1}^{n}(x+n)$

$\log y=\log(x+1)+\log(x+2)+....+\log(x+n)$

T.D.O.B.S

$\frac{1}{y}.\frac{dy}{dx}=\frac{1}{x+1}+\frac{1}{x+2}+....+\frac{1}{x+n}$

$\frac{dy}{dx}=y.\sum\limits_{x=1}^{n}\frac{1}{x+k}$

$$\frac{dy}{dx}=\prod_{r=1}^{n}(x+r).\sum_{x=1}^{n}\frac{1}{x+k}$$

$$\int_0^1 \prod_{r=1}^{n}(x+r)\sum_{k=1}^{n}\frac{1}{x+k}.dx$$

$$\int_0^1 \frac{dy}{dx}dx=(y)_0^1$$

$$=\left(\prod_{r=1}^{n}(x+r)\right)_0^1$$

$$=(n+1)!-n!=n(n!)$$

17. $\sin x+x\cos x=0\Rightarrow \frac{d}{dx}(x)\sin x+x.\frac{d}{dx}(\sin x)=0$

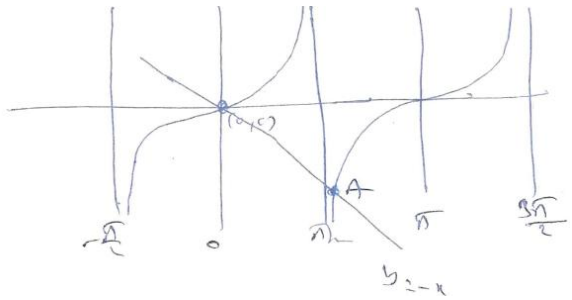
$f'(x)=0\Rightarrow \frac{d}{dx}(x\sin x)=0$

$\therefore f(x)=x\sin x$

By rolle's theorem $\sin x+x\cos x=0$

$\sin x=-x\cos x$

$\tan x=-x$



18. $(f'(x))^2=f(x).f''(x)$

$\Rightarrow \int\frac{f''(x)}{f'(x)}dx=\int\frac{f'(x)}{f(x)}dx$

$\Rightarrow \log|f'(x)=\log f(x)|+c$

$\Rightarrow \log\left|\frac{f'(x)}{f(x)}\right|=\log c$

$\Rightarrow f'(x)=cf(x)$

At $x=0\Rightarrow c=2\Rightarrow \frac{f'(x)}{f(x)}=2$

$\log|f(x)|=2x$

$\therefore f(x)=e^{2x}$

$y=e^{2x}$

19. $A=\int\frac{dx}{x^2+6x+25}=\int\frac{dx}{(x+3)^2+4^2}$

$=\frac{1}{4}\tan^{-1}\left(\frac{x+3}{4}\right)$

$B=\int\frac{dx}{x^2-6x-27}=\int\frac{dx}{(x-9)(x+3)}$

$=\frac{1}{12}\int\frac{(x+3)-(x-9)}{(x-4)(x+3)}dx$

$=\frac{1}{12}\log\left|\frac{x-9}{x+3}\right|$

$12(A+B)$

$=3\tan^{-1}\left(\frac{x+3}{4}\right)+\log\left|\frac{x-9}{x+3}\right|$

$\therefore \lambda=3,\ \mu=1\Rightarrow \boxed{\lambda+\mu=4}$

20. $\frac{dy}{dx}=\frac{(x-n)\pm\sqrt{(x-y)^2+4xy}}{2y}=1,\frac{-x}{y}$

$\boxed{y=x+c}$ satisfy $(3,4)\Rightarrow y=x+1$

$y^2+x^2=k$ satisfy $(3,4)\Rightarrow x^2+y^2=25$

21. $f(x)=\{x\}+\{x\}+.....100\text{ times}$

$=100\{x\}$

$\left[f\left(\sqrt{3}\right)\right]=\left[100\left\{\sqrt{3}\right\}\right]$

$=\left[100\{1.732\}\right]$

$=\left[100(0.7321)\right]=[73.2]=73$

22. $\frac{d^2x}{dy^2}=\frac{d}{dy}\left(\frac{dx}{dy}\right)=\frac{dx}{dt}.\frac{d}{dx}\left(\frac{-1}{\frac{dy}{dx}}\right)$

$=\left(\frac{dy}{dx}\right)^{-1}\left[\frac{-1}{\left(\frac{dy}{dx}\right)^2}.\frac{d^2y}{dx^2}\right]$

$\frac{d^2x}{dy^2}=\frac{\frac{-d^2y}{dx^2}}{\left(\frac{dy}{dx}\right)^3}\Rightarrow \frac{d^2x}{dy^2}\left(\frac{dy}{dx}\right)^3+\frac{d^2y}{dx^2}=0$

23. $\int x\left(x^{2009}+x^{803}+x^{401}\right)\left(2x^{1608}+5x^{402}+10\right)^{\frac{1}{402}}dx$

$=\int\left(x^{2009}+x^{803}+x^{401}\right)\left(2x^{2010}+5x^{804}+10x^{402}\right)^{\frac{1}{402}}dx$

Take $2x^{2010}+5x^{804}+10x^{402}=t$

$\therefore$ Ans $\frac{1}{4030}\left(2x^{2010}+5x^{804}+10x^{402}\right)^{\frac{403}{402}}$

$\therefore k=403$

24. $A(x_1y_1)\ B(x_2y_2)C(x_3y_3)$ are POIS of

$y=2x^3-4x+2,\ y=x^3+2x-1$

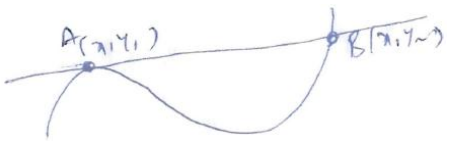
Condition (1):

$$\begin{array}{rl} y_1 & = 2x_1^3-4x_1+2 \\ \pm 2y_1 & = 2x_1^3\pm 4x_1-2 \\ \hline -y_1 & = -8x_1+4 \end{array}$$

$y_1 = 8x_1 - 4$

line $y = 8x - 4$ $\boxed{\text{slope=8}}$

25. $y = x^3 \Rightarrow \dfrac{dy}{dx} = 3x^2$



Slope of $\overline{AB}$ = sloped tangent at 'A'

$\dfrac{y_2 - y_1}{x_2 - x_1} = 3x_1^2$

$\Rightarrow \dfrac{x_2^3 - x_1^3}{x_2 - x_1} = 3x_1^2$

$\Rightarrow \dfrac{(x_2 - x_1)(x_2^2 + x_2x_1 + x_1^2)}{x_2 - x_1} = 3x_1^2$

$\Rightarrow x_2^2 + x_2x_1 - 2x_1^2 = 0$

$\Rightarrow x_2^2 + 2x_2x_1 - x_2x_1 - 2x_1^2 = 0$

$\Rightarrow x_2(x_2 + 2x_1) - x_1(x_2 + 2x_1) = 0$

$\Rightarrow (x_2 - x_1)(x_2 + 2x_1) = 0$

$\Rightarrow x_2 \neq x_1$ so $\boxed{x_2 = -2x_1}$

Sloped tangent at $B = k$ (sloped tangent at A)

$\Rightarrow 3x_2^2 = k(3x_1^2)$

$\Rightarrow 4x_1^2 = kx_1^2 \Rightarrow \boxed{k = 4}$

PHYSICS

26. $M = m\sqrt{l^2 + l^2}$

27. $C = MB_H \sin\theta$

$\sin\theta = \dfrac{C}{MB_H} = \dfrac{1.2 \times 10^{-3}}{60 \times 40 \times 10^{-6}}$

$\Rightarrow \theta = 30^0$

28. Conceptual

29. Conceptual

30. $B_R = \sqrt{B_P^2 + B_Q^2}$

$= \sqrt{(2B)^2 + B^2} \quad = \sqrt{5}B$

Where $B = \dfrac{\mu_0}{4\pi}\dfrac{M}{d^3}$

31. $W = MB(\cos\theta_1 - \cos\theta_2)$

$= MB(\cos 0^0 - \cos 60^0) \quad = \dfrac{MB}{2}$

$C = MB\sin\theta \quad = MB\sin 60^0$

$C = \dfrac{MB\sqrt{3}}{2}$

$C = \sqrt{3}W$

32. $\dfrac{dv}{dt} = -\left[\dfrac{f}{u - f}\right]^2 \dfrac{du}{dt}$

33. $\mu = \dfrac{\sin\left(\dfrac{A + D}{2}\right)}{\sin A/2}$

$\mu = \cot A/2$

$\cos\dfrac{A}{2} = \cos\left[\dfrac{\pi}{2} - \left(\dfrac{A + D}{2}\right)\right]$

$\Rightarrow A = \pi - A - D$

$\therefore D = \pi - 2A$

34. $M = \dfrac{f_0}{f_e}\left(1 + \dfrac{f_e}{d}\right) = \dfrac{100}{5}\left(1 + \dfrac{5}{25}\right)$ $[\because d = 25cm]$

$M = 24$

35. $D = \dfrac{1}{f} = \dfrac{1}{v} - \dfrac{1}{u} = -\dfrac{1}{0.3} + \dfrac{1}{0.5} = -1.33D$

36. Shift = Real depth – App depth

$= 3 - \dfrac{3}{1.5}$

1 cm upward

37. As deviation is zero

$\delta_1 + \delta_2 = 0$

$(\mu_1 - 1)A_1 = -(\mu_2 - 1)A_2$

$\therefore A_2 = -\dfrac{(\mu_1 - 1)}{(\mu_2 - 1)}A_1$

$A_2 = -10^0$

38. $m = \dfrac{f_0}{f_e} = \dfrac{\theta_{image}}{\theta_{object}}$

$\dfrac{0.3}{3} = \dfrac{B}{0.5^0} \Rightarrow B = 5^0$

39. $\lambda_1 n_1 = \lambda_2 n_2$

$\dfrac{n_1}{n_2} = \dfrac{\lambda_2}{\lambda_1} \Rightarrow \dfrac{n_1}{n_2} = \dfrac{3500}{2500} \Rightarrow n_1 = 7k,\ n_2 = 5k$

40. $\lambda_R > \lambda_B$

$W = \dfrac{2D\lambda}{a}$

41. $\beta = \dfrac{\lambda D}{d}$ $\lambda_B < \lambda_{yellow}$

$\therefore$ Fringe width β will decrease

42. $y = \dfrac{\lambda D}{d}$ $\lambda_B < \lambda_G \Rightarrow Y_B < Y_G$

43. Path difference $= \sqrt{D^2 + d^2} - D$

$$= D\left[1+\frac{d^2}{2D}-1\right]$$

$$\Delta x = \frac{d^2}{2D}$$

$$\Delta x = \frac{d^2}{2(10d)} = \frac{d}{20} = \frac{5\lambda}{20} = \frac{\lambda}{4}$$

$$\Delta\phi = \frac{2\pi}{\lambda}.\Delta x = \frac{2\pi}{\lambda}.\frac{\lambda}{4} = \frac{\pi}{2}$$

$$I = I_0\cos^2\phi/2 = I_0\cos^2\left(\frac{\pi}{4}\right) = \frac{I_0}{2}$$

44. Shift α path difference (Δx)

$$\Delta x_1 = (\mu_1 - 1)t_1 = (1.5-1)t = 0.5t$$

$$\Delta x_2 = (\mu_2 - 1)t_2 = \left(\frac{4}{3}-1\right)2t = \frac{2}{3}t = 0.66t$$

$$\therefore \Delta x_2 > \Delta x_1$$

Hence shift takes place in downwards.

45. $\mu = \tan\theta_p \Rightarrow \sqrt{3} = \tan\theta_p \Rightarrow \theta_p = 60^0$

$$\theta_p + r = 90^0$$

$$60 + r = 90$$

$$r = 90 - 60$$

$$r = 30^0$$

46. $$T = 2\pi\sqrt{\frac{I}{MB_H}}$$

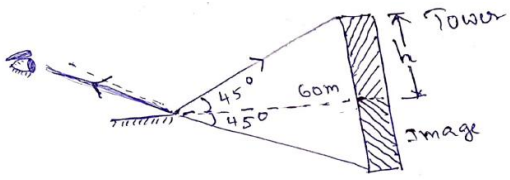
$$M = \frac{4\pi^2 I}{BT^2}$$

$$= \frac{4\pi^2 \times 9\times 10^{-5}}{16\pi^2\times 10^{-5}\times\left(\frac{3}{4}\right)^2} = 4Am^2$$

47. $$B = \frac{\mu_0 Ni}{L} \Rightarrow i = \frac{BL}{\mu_0 N} = \frac{3\times 10^3\times\mu_0\times 10^{-1}}{\mu_0\times 100} = 3A$$

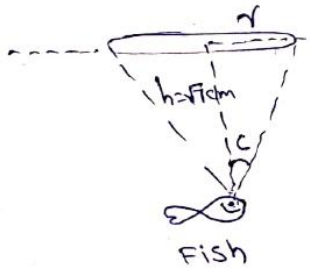
48. $$\tan 45 = \frac{h}{60}$$

$$h = 60m$$



49. $$\sin c = \frac{1}{\mu} = \frac{1}{4/3} = \frac{3}{4}$$

$$\tan c = \frac{r}{h}$$



$$r = h\tan c$$

$$= \sqrt{7}\times\frac{3}{\sqrt{7}} \Rightarrow r = 3cm$$

50. $$D = f\theta$$

$$D = 100\times\frac{2\pi}{360}\left(\frac{1}{2}\right)$$

$$= 100\times\frac{\pi}{360} = 0.87$$

CHEMISTRY

51. Following generalization can be easily derived for various types of lattice arrangements in cubic cells between the edge length (a) of the cell and r the radius of the sphere.

For simple cubic : $a = 2r$ or $r = \frac{a}{2}$

For body centred cubic :

$a = \frac{4}{\sqrt{3}}r$ or $r = \frac{\sqrt{3}}{4}a$

For face centred cubic :

$a = 2\sqrt{2}r$ or $r = \frac{1}{2\sqrt{2}}$ a

Thus the ratio of radii of spheres for these will be simple : bcc : fcc

$= \frac{a}{2} : \frac{\sqrt{3}}{4}a : \frac{1}{2\sqrt{2}}$ a i.e. option (a) is correct answer.

52. Radius ratio of NaCl like crystal

$$= \frac{r^+}{r^-} = 0.414$$

$$r^- = \frac{100}{0.414} = 241.5\,pm$$

53. Conceptual

54. Packing efficiency

$$= \frac{\text{Area occupied by circles within the square}}{\text{Area of square}}$$

$$= \frac{2\pi r^2}{L^2}\times 100 = \frac{2\pi r^2}{2\left(\sqrt{2}r^2\right)}\times 100 = \frac{\pi}{4}\times 100 = 78.54\%$$

55. No. of M atoms $= \frac{1}{4}\times 4 + 1 = 1+1 = 2$

No. of X atoms $= \frac{1}{2}\times 6 + \frac{1}{8}\times 8 = 3+1 = 4$

So, formula $= M_2X_4 = MX_2$

56. If compound dissociates in solvent $i > 1$ and on association $i < 1$.

57. $p = p_A x_A + p_B x_B$

$= p_A x_A + p_B (1 - x_A)$

$\Rightarrow p_A x_A + p_B - p_B x_A$

$\Rightarrow p_B + x_A (p_A - p_B)$

58. Moles of glucose $= \frac{18}{180} = 0.1$

Moles of water $= \frac{178.2}{18} = 9.9$

Total moles = 0.1 + 9.9 = 10

p_{H_2O} = Mole fraction × Total pressure $= \frac{9.9}{10} \times 760$

59. From molarity equation :

$M_1V_1 + M_2V_2 = M \times V$

$M = \frac{M_1V_1 + M_2V_2}{V}$ where V=total volume

$= \frac{750 \times 0.5 + 250 \times 2}{1000} = 0.875M$

60. Number of moles of urea $= \frac{120}{60} = 2$

Total mass of solution = 1000 + 120 = 1120 g

Total volume of solution (in L) $= \frac{\text{Mass}}{\text{Density}}$

$= \frac{1120}{1.15 \times 10^3} = \frac{112}{115} L$

Molarity of the solution $= \frac{\text{Number of moles}}{\text{Volume of solution in litre}}$

$= \frac{2 \times 115}{112} = 2.05 \text{mol L}^{-1}$

61. Electrorefining and electroplating are done by electrolysis.

62. Apply $m = \frac{E \times i \times t}{96500}$

63. Solubility $= \frac{k \times 1000}{\wedge_{eq}} = \frac{3.06 \times 10^{-6} \times 1000}{1.53} = 2 \times 10^{-3}$

$K_{sp} = S^2 = 4 \times 10^{-6}$

64. Rate $= k[A]^0$

$\therefore$ Rate = k for zero order.

65. $t_{1/2} \propto a^0 . t_{1/2}$ is independent of initial concentration.

66. Langmuir adsorption isotherm is based on the assumption that every adsorption site is equivalent and the ability of a particle to bind there is independent of whether nearby sites are occupied or not.

67. As adsorption is an exothermic process.

$\therefore$ Rise in temperature will decrease adsorption

68. For a protective colloid lesser the value of gold number more will be the protective power. Thus the correct order of protective power of A, B, C and D is

$\Rightarrow$ (A) < (C) < (B) < (D)

Gold number 0.50 0.10 0.01 0.005

Hence (c) is the correct answer

69. According to Hardy Schulze rule, greater the charge on cation, greater is its coagulating power for negatively charged sol(As_2S_3), hence the correct order of coagulating power:

$Na^+ < Ba^{2+} < Al^{3+}$

70. As Sb_2S_3 is a negative sol, so $Al_2(SO_4)_3$ will be the most effective coagulant due to higher positive charge on Al (Al^{3+})-**Hardy-Schulze rule**.

71. Rate is doubled when $[Cl_2]$ is doubled

Rate w.r.t. $Cl_2 = k[Cl_2]^1$

Rate becomes 8 times when concentration of both NO and Cl_2 is doubled

Rate $= k[2][2]^x$

$\therefore x = 2$

Rate law is Rate $= K[Cl_2][NO]^2$

Total order $1 + 2 = 3$

72. Calculating the value of k_D by applying the relation C_1/C_2 and $C_1/\sqrt{C_2}$

In (i) $\frac{C_1}{C_2} = \frac{0.152}{2.420} = 0.062; \frac{C_1}{\sqrt{C_2}} = \frac{0.150}{\sqrt{2.420}} = 0.096$

In (ii) $\frac{C_1}{C_2} = \frac{0.195}{4.120} = 0.047; \frac{C_1}{\sqrt{C_2}} = \frac{0.195}{\sqrt{1.120}} = 0.096$

In (iii) $\frac{C_1}{C_2} = \frac{0.289}{9.600} = 0.030; \frac{C_1}{\sqrt{C_2}} = \frac{0.289}{\sqrt{9.600}} = 0.093$

Since constant value of K_D is obtained by relation $C_1/\sqrt{C_2}$ hence succinic acid forms a dimer in benzene

Therefore its molecular weight in benzene $= 2 \times 118 = 236$

73. Molarity $= \frac{\text{Wt} \times 1000}{\text{M.Wt} \times \text{Volume}} = \frac{15 \times 1000}{98 \times 100} = 1.53M$

Molarity $= \frac{\text{Wt of solute} \times 1000}{\text{M.Wt} \times \text{Wt.of solvent}}$

Mass of 100 ml soln. $= 1.10 \times 100 = 110 \text{g}$

Mass of solvent $= 110 - 15 = 95 \text{g}$

$m = \frac{15 \times 1000}{98 \times 95} = 1.64$

74. (I) For Ist order reaction $k = \frac{2.303}{t}\log\frac{a}{a-x}$

$$k = \frac{2.303}{10}\log\frac{100}{100-20} = 0.0223\,\text{min}^{-1}$$

(II) $$t = \frac{2.303}{0.0223}\log\frac{100}{100-75} = 62.18\,\text{min}$$

75. In bcc lattice

$$r = \frac{\sqrt{3}.a}{4} = \frac{\sqrt{3}\times 287}{4} = 124.24\,\text{pm}$$

$$\text{Density} = \frac{z\times M}{N_A\times a^3}$$

$$\rho = \frac{2\times 51.99}{6.023\times 10^{23}\left(287\times 10^{-10}\right)^3} = 7.30\,\text{g/ml}$$