SRIGAYATRI EDUCATIONAL INSTITUTIONS

INDIA

SR MPC
Time: 3 Hours

DPP –7

Date: 13-04-2020

MATHS – A

SYLLABUS: **Hyperbolic functions, Mathematical Induction**

1. $f(x)=\cosh x+\sinh x$ **and** $f(x)f(y)=f(k)$ **then k =**

1) xy 2) $\frac{x}{y}$ 3) x – y 4) x + y

2. $e^{\sinh^{-1}[\tan\theta]}=$

1) $\sec\theta$ 2) $\tan\theta$ 3) $\sec\theta+\tan\theta$ 4) $\sec\theta-\tan\theta$

3. $y=\frac{1}{2}\cos ech^{-1}\left[\frac{1}{2x\sqrt{1+x^2}}\right]$ **then x =**

1) coshy 2) sinhy 3) tanhy 4) cothy

4. $\sinh 3-\cosh 3=$

1) e^{-3} 2) $-e^{-3}$ 3) e^{3} 4) $-e^{3}$

5. $Tanh^{-1}\left[\frac{1}{3}\right]=$

1) $\frac{1}{2}\log(2)$ 2) $2\log 2$ 3) $-\frac{1}{2}\log 2$ 4) $-2\log 2$

6. **If** $x=\log\left[\cot\left[\frac{\pi}{4}+\theta\right]\right]$ **then** $\sinh(x)=$

1) $\tan 2\theta$ 2) $\cot 2\theta$ 3) $-\tan 2\theta$ 4) $-\cot 2\theta$

7. $2\cosh 3\cosh 5=$

1) cosh3 2) cosh5 3) cosh8 cosh2 4) cosh8 + cosh2

8. $\sinh^{-1}\left(2^{3/2}\right)=$

1) $\log\left(2+\sqrt{18}\right)$ 2) $\log_e\left(3+\sqrt{8}\right)$ 3) $\log_e\left(3-\sqrt{8}\right)$ 4) $\log_e\left(\sqrt{8}+\sqrt{27}\right)$

9. **If** $\cosh(x)=\frac{5}{4}$ **then** $\cosh(3x)=$

1) $\frac{61}{16}$ 2) $\frac{63}{16}$ 3) $\frac{65}{16}$ 4) $\frac{61}{63}$

10. **If** $\tanh^2 x=\tan^2\theta$ **then** $\cosh 2x=$

1) $\cos\theta$ 2) $\sin\theta$ 3) $\cos 2\theta$ 4) $\sec 2\theta$

11. $\frac{1+\tanh\frac{x}{2}}{1-\tanh\frac{x}{2}}=$

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

12. **If** $1+\frac{1}{1+2}+\frac{1}{1+2+3}+.....+\frac{1}{1+2+3+.....+n}=\frac{kn}{n+1}$ **for all** $n\in N$ **then k =**

1) 1 2) 2 3) 3 4) 1/2

13. **Fr all** $n\in N$ $1+\frac{1}{\sqrt{2}}+\frac{1}{\sqrt{3}}+\frac{1}{\sqrt{4}}+.....+\frac{1}{\sqrt{n}}$

1) > n 2) $< \sqrt{n}$ 3) $\leq \sqrt{n}$ 4) $\geq \sqrt{n}$

14. $1^3+2^3+3^3+.....+100^3=k^2$ **then k**

1) 1010 2) 10100 3) 5050 4) 50500

15. $\sum_{r=1}^{n}\left(3^r-r\right)=$

1) $\frac{3^n-1}{2}$ 2) $\frac{3^n-1}{2}-\frac{n(n+1)}{2}$ 3) $\frac{3\left(3^n-1\right)}{2}-\frac{n(n+1)}{2}$ 4) None

16. **If** $f(x)$ **is a real function defined on** $[-1,1]$ **then real function** $g(x)=f(5x+4)$ **is defined on the interval**

1) $[-4,9]$ 2) $[-1,9]$ 3) $[-2,9]$ 4) $[-3,9]$

17. **If a, b and n are natural number then** $a^{2n-1}+b^{2n-1}$ **is divisible by**

1) a + b 2) a – b 3) a^3+b^3 4) a^2+b^2

18. **If the sequence** $\{1\},\{2,3\},\{4,5,6\},\{7,8,9,10\}.....$ **of the sum of elements in the 50th set is**

1) 62525 2) 65225 3) 56255 4) 55625

19. **If** $S_n=1^3+2^3+.....+n^3$ **and** $T_n=1+2+3+.....+n$ **then**

1) $S_n=T_n^3$ 2) $S_n=T_n$ 3) $S_n=T_n^2$ 4) $S_n=T_{n^3}$

20. **If** $a_k=\frac{1}{k(k+1)}$ **for** $k=1,2,3,.....n$ **then** $\left[\sum_{k=1}^{n}a_k\right]^2=$

1) $\frac{n}{n+1}$ 2) $\frac{n^2}{(n+1)^2}$ 3) $\frac{n^4}{(n+1)^4}$ 4) $\frac{n^6}{(n+1)^6}$

MATHS – B

SYLLABUS: **3D – coordinate system, direction cosines and direction ratios**

21. **If** $A(1,2,3)$ **and** $B(3,5,7)$ **and P, Q are the points on AB such that AP = PQ = QB, then the midpoint of PQ is**

1) $(2,3,5)$ 2) $(2,3.5,5)$ 3) $(2,4,5)$ 4) $(4,7,10)$

22. **If A, B are the feet of the perpendiculars from** $P(2,4,5)$ **to the X – axis and Y – axis respectively then the distance AB is**

1) $2\sqrt{5}$ 2) $\sqrt{29}$ 3) $\sqrt{41}$ 4) 42

23. **If** $A(1,2,3),B(2,3,4)$ **and C is a point of trisection of AB such that** $C_x+C_y=\frac{13}{3}$ **then** $C_z=$

1) $\frac{10}{3}$ 2) $\frac{11}{2}$ 3) $\frac{11}{3}$ 4) 11

24. **The area of the triangle whose vertices are** $(1,1,1)(1,2,3)(2,0,1)$ **is**

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

25. **The perimeter of the triangle formed by the points** $(2,5,3),(5,3,2),(3,2,5)$ **is**

1) $\sqrt{14}$ 2) $3\sqrt{14}$ 3) $3\sqrt{6}$ 4) $3\sqrt{12}$

26. **In** $\Delta ABC, D, E, F$ **are mid points of the sides BC, CA, AB respectively, If** $A(2,3,4),D(1,-4,2)$ **and** $E(-5,2,-3)$ **then F =**

1) $(1,6,3)$ 2) $(1,2,3)$ 3) $(8,-3,9)$ 4) $(3,4,9)$

27. **If** $(k,1,5),(1,0,3)$ **and** $(7,-2,m)$ **are collinear points then** $2k+3m=$

1) -3 2) -5 3) -8 4) -7

28. **If the length of the projections of $\overline{PQ}$ on the coordinate axes are $\sqrt{3},\sqrt{5},\sqrt{12}$ then the distance PQ =**

1) $2\sqrt{5}$ 2) $\sqrt{10}$ 3) $2\sqrt{10}$ 4) $5\sqrt{2}$

29. **If the line joining $A(-2,4,7)$ and $B(3,-5,8)$ intersects the YZ plane at P then the harmonic conjugate of P with respect to $\overline{AB}$ is**

1) $\left(0,\frac{2}{5},\frac{37}{5}\right)$ 2) $(-12,22,5)$ 3) $(12,-22,-5)$ 4) $\left(\frac{2}{5},\frac{-22}{5},-1\right)$

30. **In the ΔABC if $A(0,0,4), AB=4, BC=3, CA=5, I(1,0,1)$ is the in-centre and the internal bisector of intersects BC at D then D_x =**

1) $\frac{4}{3}$ 2) $\frac{-4}{3}$ 3) $\frac{8}{5}$ 4) 0

31. $A(4,3,5), B(0,-2,2)$ **and** $C(3,2,1)$**are three points. The coordinates of the point in which the bisector of $\lfloor BAC$ meets the side $\overline{BC}$ is**

1) $\left(\frac{15}{8},\frac{4}{8},\frac{11}{8}\right)$ 2) $\left(\frac{12}{7},\frac{2}{7},\frac{10}{7}\right)$ 3) $\left(\frac{9}{5},\frac{2}{5},\frac{7}{5}\right)$ 4) $\left(\frac{-3}{2},0,\frac{3}{2}\right)$

32. **If x – coordinate of a point P on the line joining the points $Q(2,2,1)$ and $R(5,1,-2)$ is 4 then the z – coordinate of P is**

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

33. **If $A(3,1,-2), B(-1,0,1)$ and l,m are the projections of AB on the Y–axis, ZX–plane respectively then $3l^2-m+1=$**

1) 9 2) 0 3) 1 4) -1

34. **The foot of the perpendicular from the origin to the join of $A(-9,4,5)$ and $B(11,0,-1)$ is**

1) A point of trisection of AB 2) A point dividing $\overline{AB}$ I the ratio 2 : 3

3) The midpoint of AB 4) $\left(6,1,\frac{1}{2}\right)$

35. **The angle between the two lines whose d.c's are given by $l+m-n=0, l^2+m^2-n^2=0$ is**

1) 0 2) $\frac{\pi}{6}$ 3) $\frac{\pi}{3}$ 4) $\frac{\pi}{4}$

36. **If $(2,1,-1)$ and $(1,-1,-1)$ are the direction ratios of two lines then the direction cosines of the line perpendicular to these lines are**

1) $\left(\frac{1}{3},\frac{-1}{3},\frac{2}{3}\right)$ 2) $\left(\frac{2}{3},\frac{-1}{3},\frac{2}{3}\right)$ 3) $\left(\frac{-2}{3},\frac{-1}{3},\frac{2}{3}\right)$ 4) $\left(\frac{2}{\sqrt{14}},\frac{-1}{\sqrt{14}},\frac{3}{\sqrt{14}}\right)$

37. **The d.r's of the line $x=ay+b, z=cy+d$ are**

1) $(1,a,c)$ 2) $(a,1,c)$ 3) $(b,1,c)$ 4) $(c,a,1)$

38. **If a line makes angle $\frac{\pi}{3}$ and $\frac{\pi}{4}$ with x–axis and y–axis respectively, then the angle made by the line with the z–axis is**

1) $\frac{\pi}{3}$ 2) $\frac{\pi}{2}$ 3) $\frac{\pi}{4}$ 4) $\frac{5\pi}{12}$

39. **If the angle between the lines whose direction cosines are $\left(\frac{-2}{\sqrt{21}},\frac{c}{\sqrt{21}},\frac{1}{\sqrt{21}}\right)$ and $\left(\frac{3}{\sqrt{54}},\frac{3}{\sqrt{54}},\frac{6}{\sqrt{54}}\right)$ is $\frac{\pi}{2}$, then the value of c is**

1) 4 2) 6 3) 2 4) – 4

40. The projection of the line segment joining the points $(3,4,2),(5,1,8)$ on the line whose d.c's are $\left(\frac{2}{7},\frac{-3}{7},\frac{6}{7}\right)$ is

1) 7 2) $\frac{46}{13}$ 3) $\frac{42}{13}$ 4) $\frac{38}{13}$

PHYSICS

SYLLABUS: **Momentum and kinetic energy, Collisions**

41. When the momentum of body is doubled, the kinetic energy is
1) Doubled 2) Halved 3) Becomes four times 4) Three times

42. Momentum of a particle is plotted on X–axis and kinetic energy on the Y–axis, the graph is
1) Straight line 2) Parabola 3) Hyperbola 4) Circle

43. A stationary shell explodes into two fragments with masses in the ratio 2 : 3. The ratio of magnitudes of their momenta is
1) 2 : 3 2) 3 : 2 3) 3 : 4 4) 1 : 1

44. When two bodies of same mass undergo head on elastic collision
1) Their velocities are interchanged 2) Their speeds are interchanged
3) Their momenta are interchanged 4) All the above are true

45. A mass m_1 moves with a greater velocity. It strikes another mass m_2 at rest in a head on collision. It comes back along its path with low speed after collision. Then
1) $m_1 > m_2$ 2) $m_1 < m_2$ 3) $m_1 = m_2$ 4) Data insufficient

46. If the coefficient of restitution is 0.5, the collision is
1) Perfectly elastic collision 2) Perfectly inelastic collision
3) Semi elastic collision 4) None of the above

47. A car and lorry are moving with same momentum. If equal amount of brake force is applied, then
1) Car comes to rest in shorter time 2) Lorry comes to rest in shorter time
3) Both takes same time to come to rest 4) None of the above

48. The coefficient of restitution is
1) Varies from –1 to 1 2) Varies from 0 to 1 3) Varies from 0 to –1 4) A positive number

49. If the kinetic energy the body is increased by 125%. Then percentage increase in its momentum
1) 75 2) 50 3) 25 4) 100

50. The kinetic energy of a body is k. If one-fourth of its mass removed and velocity is doubled, its kinetic energy is
1) k 2) 3k 3) 4k 4) $9k/4$

51. A proton and a deuteron have kinetic energies in the ratio 1 : 2. The ratio of their linear momenta is
1) $1:\sqrt{2}$ 2) $\sqrt{2}:1$ 3) 2 : 1 4) 1 : 2

52. If the mass of a moving body is decreased by one-third of its mass and velocity is tripled. The percentage change in its kinetic energy is
1) 500% 2) 600% 3) 300% 4) 200%

53. A block of wood of mass 9.8kg is suspended by a string a bullet of mass 200gm strikes horizontally with a velocity of 100m/s and get embedded in it. What height will the block rise ($g = 10m/s^2$)
1) 0.1m 2) 0.2m 3) 0.3m 4) 0m

54. A body of mass 10kg moving with velocity of 5m/s hit a body of 1gm at rest. The velocity of second body after perfectly elastic collision
1) 10m/s 2) 5m/s 3) 15m/s 4) 20m/s

55. A ball drops from a height 'h' after rebounding twice from the ground. It rises to h/2. The coefficient of restitution is

1) $\frac{1}{2}$ 2) $\left(\frac{1}{2}\right)^{1/2}$ 3) $\left(\frac{1}{2}\right)^{1/4}$ 4) $\left(\frac{1}{2}\right)^{1/6}$

56. A steel ball dropped from a height of 6.4m on a steel plate. If the ball rebounds to a height of 3.6m the coefficient of restitution is

1) 0.4 2) 0.7 3) 0.75 4) 0.9

57. A bullet weighing 200gm and moving at 200m/s strikes a 4kg block of ice at rest on a frictionless surface and drops dead. The speed of the block is

1) 200m/s 2) 100m/s 3) 50m/s 4) 10m/s

58. A particle of mass m moving with velocity 2v collides another particle of mass 3m moving velocity v in the same direction. If it is perfectly inelastic collision the loss of K. E of the system is

1) $\frac{3}{8}mv^2$ 2) $\frac{27}{8}mv^2$ 3) $\frac{3}{4}mv^2$ 4) Zero

59. A ball after falling freely from a height of 40cm strikes a horizontal plane. If the coefficient of restitution is 3/4, ball will strike second time with the plane after

1) $\frac{1}{2}$sec 2) 1sec 3) $\frac{5}{7}$sec 4) $\frac{3}{4}$sec

60. A bullet of mass 20gm is fired from a riffle of mass 20kg with a muzzle velocity of 200m/s. Find the velocity of recoil of the riffle

1) 0.4m/s 2) 0.5m/s 3) 0.2m/s 4) 0.3m/s

CHEMISTRY

SYLLABUS: **Chemical equilibrium**

61. In reversible reaction $A \underset{k_2}{\overset{k_1}{\rightleftharpoons}} B$, the initial concentration of A and B are a and b in moles per litre and the equilibrium concentration are $(a-x)$ and $(b+x)$ respectively; express x in terms of k_1, k_2, a and b

1) $k_1a - k_2b$ 2) $\frac{k_1a - k_2b}{k_1 - k_2}$ 3) $\frac{k_1a - k_2b}{k_1k_2}$ 4) $\frac{k_1a + k_2b}{k_1 + k_2}$

62. The active mass of 5.6 liters of O_2 at STP is

1) $\frac{5.6}{22.4}$ 2) $\frac{8}{5.6}$ 3) $\frac{32}{5.6}$ 4) $\frac{0.25}{5.6}$

63. If the equilibrium constant for the reaction $2AB \rightleftharpoons A_2 + B_2$ is 36. What is the equilibrium constant for $AB \rightleftharpoons \frac{1}{2}A_2 + \frac{1}{2}B_2$

1) 49 2) 24 3) 6 4) 2

64. In the process $N_2 + 3H_2 \rightleftharpoons 2NH_3$ the initial concentration of Nitrogen and Hydrogen are one mole per litre and 3 moles per litre respectively. The equilibrium constant of the reaction is x. Then K_C for $2NH_3 \rightleftharpoons N_2 + 3H_2$ is

1) x 2) 2x 3) 1/x 4) 3x

65. For $A_{(g)} + B_{(g)} \underset{K_b=15}{\overset{K_f=5}{\rightleftharpoons}} 2AB_{(g)}$, K_C for $2AB \rightleftharpoons A_{(g)} + B_{(g)}$ is

1) 3 2) 75 3) $\sqrt{3}$ 4) $\frac{1}{\sqrt{3}}$

66. $A_{(s)} + B_{(g)} + heat \rightleftharpoons 2C_{(s)} + 2D_{(g)}$ at equilibrium the pressure of B is doubled. By what factor the concentration of D should change to retain the equilibrium

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

67. **In the reaction** $H_{2_{(g)}} + I_{2_{(g)}} \rightleftharpoons 2HI_{(g)}$

1) $K_P = K_C$ 2) $K_P \neq K_C$ 3) $K_P > K_C$ 4) $K_P < K_C$

68. **1 mole of** $A_{(g)}$ **is heated at 300^{0}C in closed one litre vessel till the following equilibrium is reached** $A_{(g)} \rightleftharpoons B_{(g)}$**. The equilibrium constant for the reaction is 4. What is the concentration of B at equilibrium?**

1) 0.2 2) 0.6 3) 0.8 4) 0.1

69. **In the equilibrium** $NH_4HS_{(g)} \rightleftharpoons NH_{3_{(g)}} + H_2S_{(g)}$**. If the equilibrium pressure is 2atm at 80^{0}C K_P for the reaction is**

1) 0.5 2) 2 3) 1 4) 1.5

70. **Backward reaction is favoured by increase in the pressure of the equilibrium**

1) $2SO_2 + O_2 \Leftrightarrow 2SO_3$ 2) $N_2 + O_2 \Leftrightarrow 2NO$ 3) $N_2 + 3H_2 \Leftrightarrow 2NH_3$ 4) $PCl_5 \Leftrightarrow PCl_3 + Cl_2$

71. **In the manufacture of NH_3, which are favourable conditions**

1) High pressure & low temperature 2) High pressure & high temperature
3) Low pressure & low temperature 4) Low pressure and high temperature

72. **If the equilibrium constant for the reaction** $2AB \rightleftharpoons A_2 + B_2$ **is 49. What is the value of equilibrium constant for** $AB \rightleftharpoons \frac{1}{2}A_2 + \frac{1}{2}B_2$ **?**

1) 49 2) 4 3) 7 4) 0.02

73. **In which of the following reaction goes to more completion.**

1) $K_C = 1$ 2) $K_C = 10^{10}$ 3) $K_C = 10^{-10}$ 4) $K_C = 10$

74. **For the following reactions, equilibrium constants are indicated on the arrow**

$H_3PO_4 \overset{K_1}{\rightleftharpoons} H^+ + H_2PO_4^-$

$H_2PO_4^- \overset{K_2}{\rightleftharpoons} H^+ + HPO_4^{-2}$

$HPO_4^{-2} \overset{K_3}{\rightleftharpoons} H^+ + PO_4^{-3}$

Then equilibrium constant for the reaction $H_3PO_4 \rightleftharpoons 3H^+ + PO_4^{-3}$ **will be**

1) $K_1 + K_2 + K_3$ 2) $\sqrt{K_1K_2K_3}$ 3) $K_1 \times K_2 \times K_3$ 4) $\frac{1}{K_1.K_2.K_3}$

75. **The equilibrium constant of a reaction is 300, if the volume of the reaction flask is tripled, the equilibrium constant will be**

1) 100 2) 300 3) 250 4) 150

76. $A_{(g)} + 2B_{(g)} \rightleftharpoons 2C_{(g)} + D_{(g)}$ **was studied using an initial concentration of B which was 1.5 times that of A. But the equilibrium concentration of A and B were found to be equal. Then K_C for the equilibrium is**

1) 4 2) 8 3) 6 4) 12

77. **Units of K_C for** $XA_{(g)} \rightleftharpoons YB_{(g)}$ **is** $lit^2 - mol^{-2}$**, then the values of X & Y cannot be**

1) 1, 2 2) 3, 2 3) 1, 3 4) All

78. **At 27^0 C and 1 atmosphere pressure N_2O_4 is 20% dissociated into NO_2 find K_P**

1) 0.2 2) 0.166 3) 0.15 4) 0.10

79. **The value of** (K_P/K_C) **for the reversible reaction** $SO_{2_{(g)}} + \frac{1}{2}O_{2_{(g)}} \rightleftharpoons SO_{3_{(g)}}$ **at constant temperature T is**

1) $(RT)^{1/2}$ 2) RT 3) $(RT)^{-1/2}$ 4) $\frac{1}{RT}$

80. **K_P for the reaction** $CaCO_{3_{(s)}} \rightleftharpoons CaO_{(s)} + CO_{2_{(g)}}$ **is correctly expressed as**

1) $K_P = \frac{P_{CaO} \times P_{CO_2}}{P_{CaCO_3}}$ 2) $K_P = \frac{P_{CaCO_3}}{P_{CaO}.P_{CO_2}}$ 3) $K_P = P_{CO_2}$ 4) $K_P = \frac{P_{CO_2}}{P_{CaCO_3}}$

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SR MPC
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KEY SHEET

MATHS – A

1	4	**2**	3	**3**	2	**4**	2	**5**	1	**6**	3	**7**	4	**8**	2	**9**	3	**10**	4
11	2	**12**	2	**13**	4	**14**	3	**15**	3	**16**	2	**17**	1	**18**	1	**19**	3	**20**	2

MATHS – B

21	2	**22**	1	**23**	3	**24**	4	**25**	2	**26**	3	**27**	4	**28**	1	**29**	2	**30**	1
31	1	**32**	2	**33**	4	**34**	3	**35**	3	**36**	4	**37**	2	**38**	1	**39**	1	**40**	1

PHYSICS

41	3	**42**	2	**43**	4	**44**	4	**45**	2	**46**	3	**47**	3	**48**	2	**49**	2	**50**	2
51	4	**52**	1	**53**	2	**54**	1	**55**	3	**56**	3	**57**	4	**58**	1	**59**	3	**60**	3

CHEMISTRY

61	1	**62**	4	**63**	3	**64**	3	**65**	1	**66**	1	**67**	1	**68**	3	**69**	3	**70**	4
71	1	**72**	3	**73**	2	**74**	3	**75**	2	**76**	1	**77**	4	**78**	2	**79**	3	**80**	3

HINTS & SOLUTIONS

MATHS – A

1. $f(x)=e^x$

   $\Rightarrow f(x)f(y)=e^xe^y=f(x+y)$

2. $e^{\sinh^{-1}(\tan\theta)}=e^{\log(\tan\theta+\sec\theta)}$

   $=\sec\theta+\tan\theta$

3. Put $x=\sinh\theta$

4. $-(\cosh 3-\sinh 3)=-e^{-3}$

5. $\tanh^{-1}(x)=\frac{1}{2}\log\left[\frac{1+x}{1-x}\right]$

   $Put\ x=\frac{1}{3}$ and solve

6. $e^x=\cot\left(\frac{\pi}{4}+\theta\right)=\frac{\cot\theta-1}{\cot\theta+1}$

   Now $\sinh x=\frac{e^x-e^{-x}}{2}$ and simplify

7. $\cosh(x+y)+\cosh(x-y)$

   $=2\cosh x\cosh y$

8. $\sinh^{-1}x=\log\left(x+\sqrt{x^2+1}\right)$

9. $\cosh(x)=\frac{5}{4}$

   $\cosh(3x)=4\cosh^3(x)-3\cosh(x)$

10. $\cosh 2x=\frac{1+\tanh^2 x}{1-\tanh^2 x}$

    $=\frac{1+\tan^2\theta}{1-\tan^2\theta}=\sec 2\theta$

11. $\tanh\frac{x}{2}=\frac{e^{x/2}-e^{-x/2}}{e^{x/2}+e^{-x/2}}$ Simplify

12. Put $n=1\Rightarrow 1=\frac{k}{2}\Rightarrow k=2$

13. Put $n=2\Rightarrow 1+\frac{1}{\sqrt{2}}=1+0.7=1.7$

and $\sqrt{n}=\sqrt{2}=1.4$ verify the answer

14. Sum of the cubes $\sum n^3=\frac{n^2(n+1)^2}{4}$

$\left[\frac{(100)(101)}{2}\right]^2=k^2\Rightarrow k=5050$

15. $\sum_{r=1}^{n}3^r-\sum_{r=1}^{n}r\Rightarrow\frac{3\left(3^n-1\right)}{2}-\frac{n(n+1)}{2}$

Apply G.P and sum of natural numbers

$\Rightarrow\frac{3\left(3^n-1\right)}{2}-\frac{n(n+1)}{2}$

16. $-1\le 5x+4\le 1\Rightarrow -5\le 5x\le -3$

$\Rightarrow -1\le x\le\frac{-3}{5}$

But $-1\le x\le 1\Rightarrow -5+4\le 5x+4\le 9$

$\therefore[-1,9]$

17. Put n = 1 or 2 and verify by options

18. Last term in the 2nd bracket = 1 + 2

Last term in the 3rd bracket = 1 + 2 + 3

Last term in the 50th bracket = 1 + 2 + 3 + …… + 50 = 1275

50th bracket contains 50 terms

1226 + …… + 1275

$=\frac{50}{2}(1226+1275)=62525$

19. $S_n=\frac{n^2(n+1)^2}{4}\qquad t_n=\frac{n(n+1)}{2}$

20. $a_k=\frac{1}{k}-\frac{1}{k+1}$

$\sum_{k=1}^{n}a_k=1-\frac{1}{2}+\frac{1}{2}-\frac{1}{3}+.....+\frac{1}{n}-\frac{1}{n+1}$

MATHS – B

21. Midpoint of PQ = Midpoint of AB

22. $A(2,0,0)\,B(0,4,0)$

$AB=\sqrt{20}$

23. C divide AB in the ratio 2 : 1

$C=\left(\frac{5}{3},\frac{8}{3},\frac{11}{3}\right)$

$C_x+C_y=\frac{13}{3}$

$\therefore C_z=\frac{11}{3}$

24. Area of triangle = $\frac{1}{2}\left|\overline{AB}\times\overline{AC}\right|$

25. Perimeter = AB + BC + CA

26. F = A + D – E

27. Use $\frac{x_1-x_2}{x_2-x_3}=\frac{y_1-y_2}{y_2-y_3}=\frac{z_1-z_2}{z_2-z_3}$

28. $PQ=\sqrt{d_1^2+d_2^2+d_3^2}$

29. YZ plane divides in the ratio $-x_1:x_2=2:3$

Harmonic conjugate of P divides AB in the ratio = -2 : 3

30. I divides $\overline{AD}$ in the ratio $b+c:a$

31. D divide BC in the ratio AB : AC

$AB:AC=5:3$

$D=\left(\frac{15}{8},\frac{4}{8},\frac{11}{8}\right)$

32. $\frac{x-2}{2-5}=\frac{z-1}{1+2}$

$\Rightarrow z=-1$

33. $l=\left|y_1-y_2\right|=1$

$m=\sqrt{(x_1-x_2)^2+(z_1-z_2)^2}=5$

34. $OA=OB=\sqrt{122}$

$\therefore$ The foot of the perpendicular from the origin is the midpoint of AB.

35. Solve the given equations for dc's of lines and use $\cos\theta$ formula

36. $2l+m-n=0$

$l-m-n=0$

$\frac{l}{-2}=\frac{m}{1}=\frac{n}{-3}$

$(a,b,c)=(+2,-1,+3)$

$(l,m,n)=\left(\frac{+2}{\sqrt{14}},\frac{-1}{\sqrt{14}},\frac{+3}{\sqrt{14}}\right)$

37. $\frac{x-b}{a}=\frac{y}{1}=\frac{z-d}{c}$

$Dr's=(a,1,c)$

38. $\cos^2\alpha+\cos^2\beta+\cos^2\gamma=1$

39. $l_1l_2+m_1m_2+n_1n_2=0$

40. $\left|l(x_2-x_1)+m(y_2-y_1)+n(z_2-z_1)\right|$

PHYSICS

41. $K.E\alpha P^2$

42. Conceptual
43. Conceptual
44. Conceptual
45. Conceptual
46. Conceptual
47. Conceptual
48. Conceptual
49. $K.E\alpha P^2$

$P=\sqrt{K.E}$

50. $k=\frac{1}{2}mv^2$

$k^1=\frac{1}{2}\left(m-\frac{m}{4}\right)(2v)^2$

$k^1=3k$

51 $\frac{p_1}{p_2}=\sqrt{\frac{m_1}{m_2}\frac{k_1}{k_2}}$

52. $m_1=m, m_2=m-\frac{m}{3}$

$\left(\frac{k_2}{k_1}-1\right)100=\left(\frac{m_2v_2^2}{m_1v_1^2}-1\right)100$

53. $V_b=\left(\frac{M+m}{m}\right)\sqrt{2gh}$

54. $v_2=\left(\frac{2m_1}{m_1+m_2}\right)u_1$

55. $h_n=e^{2n}h$

56. $e=\sqrt{\frac{h_2}{h_1}}$

57. $v=\frac{m_1u_1+m_2u_2}{m_1+m_2}$

58. $\Delta K.E=\frac{1}{2}\frac{m_1m_2}{(m_1+m_2)}(u_1-u_2)^2$

59. $Time=t+2t_1=(1+2e)t$

$Tme=(1+2e)\sqrt{\frac{2h}{g}}$

60. $m_1v_1+m_2v_2=0$

CHEMISTRY

61. $A \underset{K_2}{\overset{K_1}{\rightleftharpoons}} B$

$r_f=K_1(a-x) \quad r_b=K_2(b+x)$

But at equilibrium $r_f=r_b$

$K_1(a-x)=K_2(b+x)$

$K_1a-K_1x=K_2b+K_2x$

$K_1a-K_2b=K_1x+K_2x$

$\frac{K_1a-K_2b}{K_1+K_2}=x$

62. Active mass = $\frac{\text{No. of moles}}{\text{Volume in litre}}$

At STP 22.4 lit contains – 1mole

5.6 lit ---------- ?

$=\frac{5.6}{22.4}=0.25mole$

$\therefore$ Active mass $=\frac{0.25}{5.6}$

63. Given equation

$2AB \rightleftharpoons A_2+B_2 \quad K_C=36------(1)$

Required equation

$AB \rightleftharpoons \frac{1}{2}A_2+\frac{1}{2}B_2 \quad K_C{}^1=?-----(2)$

Total equation (1) is divided by 2 will get equation (2) then the equilibrium constant is taken as square root

$K_C^1=(K_C)^{1/2}=(36)^{1/2}=\sqrt{36}=6$

64. Given equation

$N_2+3H_2 \rightleftharpoons 2NH_3 \quad K_1=x-----(1)$

Required equation

$2NH_3 \rightleftharpoons N_2+3H_2 \quad K_2=?------(2)$

Reverse equation (1) will get equation (2)

Equilibrium constant $K_2=\frac{1}{K_1}=\frac{1}{x}$

65. Given equation $A_{(g)}+B_{(g)} \underset{K_b=15}{\overset{K_f=5}{\rightleftharpoons}} 2AB$

$K_C=\frac{K_f}{K_b}=\frac{5}{15}=\frac{1}{3}$

Required equation $2AB \rightleftharpoons A_{(g)}+B_{(g)}$

$\therefore K_C^1=\frac{1}{K_C}=\frac{1}{1/3}=3$

66. $A_{(g)}+B_{(g)} \rightleftharpoons 2C_{(s)}+2D_{(g)}$

2 x

At equilibrium

$K_P=\frac{P^2D}{P_D} \quad [K_P=1]$

$1=\frac{x^2}{2} \Rightarrow x^2=2$

$\therefore x=\sqrt{2}$

67. Relation between K_P and K_C:

$K_P=K_C(RT)^{\Delta n}$

Case – 1: If $\Delta n=0 \quad K_P=K_C$

In the given equation

Δn = No. of moles of products – No. of moles of reactant in gaseous state

$\Delta n = 2-2 = 0$

$\therefore \Delta n = 0 \quad K_P = K_C$

68.
$$A_{(g)} \rightleftharpoons B_{(g)}$$

Initial 1 0

At equilibrium $1-x$ x

$$\therefore K_C = \frac{[B]}{[\lambda]}$$

$$\therefore 4 = \frac{x}{1-x}$$

$$\therefore x = 0.8$$

69.
$$NH_4HS_{(g)} \rightleftharpoons NH_{3_{(g)}} + H_2S_{(g)}$$

x x

At equilibrium

Total equilibrium pressure $= x + x$

$2 = 2x : x = 1$

$\therefore K_P = P_{NH_3}.P_{H_2S}$

$= 1\times 1 = 1$

70. Pressure increases the reaction favours in a number of moles decreases side. In backward number of moles decreases in (4) option

71. $N_{2_{(g)}} + 3H_{2_{(g)}} \rightleftharpoons 2NH_{3_{(g)}} \quad \Delta H = -92.0KJ$

$\rightarrow$ Manufacture of NH_3 means no. of moles decreases side.

According to leachatlier pressure required

$\rightarrow$ It is exothermic reaction: So high temperature required

72. $2AB \rightleftharpoons A_2 + B_2 \qquad K_1 = 49$

$$AB \rightleftharpoons \frac{1}{2}A_2 + \frac{1}{2}B_2 \qquad K_2 = ?$$

$$K_2 = (K_1)^{1/2} = \sqrt{K_1} = \sqrt{49} = 7$$

73. More K_C value more completion

74. For consecutive reactions K_C for the resultant equilibrium reaction is the product of individual equilibrium constant.

$\therefore K_1 \times K_2 \times K_3$

75. Equilibrium constant does'not depends on volume

76.
$$A_{(g)} + 2B_{(g)} \rightleftharpoons 2C_{(g)} + D_{(g)}$$

Initial: 1 1.5 0 0

At eqn: $1-x$ $1.5-2x$ $2x$ x

But at equilibrium $[A] = [B]$

$\therefore 1-x = 1.5-2x$

$\therefore x = 0.5$

$$\therefore K_C = \frac{[C]^2.[D]}{[A][B]^2} = 4$$

77. $K_C = \dfrac{[B]^Y}{[A]^X}$ Hit and trial all options

78.
$$N_2O_{4_{(g)}} \rightleftharpoons 2NO_{2_{(g)}}$$

Initial: 1 0

At eqn: $1-0.2$ 2×0.2

0.8 0.4

Total moles at equilibrium $= 0.8 + 0.4 = 1.2$

$\dfrac{0.8}{1.2}\times 1 \qquad \dfrac{0.4}{1.2}\times 1$

$$\therefore K_P = \frac{P_{NO_2}^2}{P_{N_2O_4}} = \frac{1}{6} = 0.166$$

79. $K_P = K_C.(RT)^{\Delta n}$

$\Delta n = n_{P_{(g)}} - n_{R_{(g)}}$

$$= 1-\left(1+\frac{1}{2}\right) = 1-\frac{3}{2} = \frac{-1}{2}$$

$$\therefore \frac{K_P}{K_C} = (RT)^{-1/2}$$

80. $$K_P = \frac{P_{CaO_{(s)}} \times P_{CO_{2_{(g)}}}}{P_{CaCO_{3_{(s)}}}}$$

But solids partial pressure = 1

$\therefore K_P = P_{CO_2}$