SRIGAYATRI EDUCATIONAL INSTITUTIONS

INDIA

DPP-9 **DATE: 18-04-2020**

MATHS-A

Syllabus: Functions(Domain & Range.

1. **The domain of** $f(x)=\sqrt{x-2}+\frac{1}{\log_{(4-x)}}$ **is**

1) $[2,\infty)$ 2) $(-\infty,4)$ 3) $[2,3)\cup(3,4)$ 4) $[3,\infty)$

2. **The domain of** $f(x)=\cot\frac{x}{3}$ **is**

1) $(-\infty,\infty)$ 2) $R-\{n\pi, n\in z\}$ 3) $R-\{3n\pi, n\in z\}$ 4) $(0,\infty)$

3. **The domain of** $f(x)=\frac{1}{\log|x|}$ **is**

1) $R-\{0\}$ 2) $R-\{0,1\}$ 3) $R-\{-1,0,1\}$ 4) $(-\infty,\infty)$

4. **The domain of the function** $f(x)=\sqrt{\log_{16}x^2}$ **is**

1) $x=0$ 2) $|x|\geq 4$ 3) $|x|\geq 1$ 4) $|x|\geq 2$

5. **The domain of** $f(x)=\sqrt{\frac{x+7}{x+5}}$ **is**

1) $(-\infty,-7]\cup(-5,\infty)$ 2) $(5,7)$ 3) $(-5,\infty)$ 4) $(-7,-5]\cup(5,7)$

6. **The domain of** $f(x)=\log|x^2-9|$ **is**

1) $R-\{-3,3\}$ 2) $(-\infty,-3)$ 3) $(3,\infty]$ 4) $(-\infty,\infty)$

7. **The domain of** $f(x)=\sqrt{2-\log_3(x-1)}$ **is**

1) $(2,12]$ 2) $(-\infty,10]$ 3) $(3,12]$ 4) $(1,10]$

8. **The domain of** $f(x)=\frac{1}{[x]-x}$ **is**

1) R 2) Z 3) R-Z 4) Q-$\{0\}$

9. **The set of all real numbers satisfying** $e^{\left(\frac{1}{x}-1\right)}<1$ **is**

1) $(0,\infty)$ 2) $(-\infty,0)\cup(1,\infty)$ 3) $(-\infty,\infty)$ 4) $(0,1)$

10. $f(x)=\sin^{-1}\left(\frac{x-4}{3}\right)+\log(2-x)$ **is**

1) $[1,4]$ 2)$[1,2)$ 3) $[1,3)$ 4) $[0,1)$

11. **The domain of the function** $f(x)=\frac{\sin^{-1}(x-3)}{\sqrt{9-x^2}}$ **is**

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

12. **If** $f=\{(-1,3),(0,2),(1,1)\}$ **then the range of** f^2-1

1) $\{0,8\}$ 2) $\{0,3,8\}$ 3) $\{0,1,3\}$ 4) $\{0,2,8\}$

13. **The range of** $f(x)=\sin^{-1}x-\cos^{-1}x$ **is**

1) $[0,\pi]$ 2) $\left[\frac{-3\pi}{2},\frac{\pi}{2}\right]$ 3) $\left[\frac{-\pi}{2},\frac{\pi}{2}\right]$ 4) $[-\pi,\pi]$

14. **If** $a^2+b^2+c^2=1$ **then the range of** $ab+bc+ca$ **is**

1) $[1,\infty)$ 2) $\left[\frac{-1}{2},\infty\right)$ 3) $\left(\frac{-1}{2},1\right)$ 4) $\left[\frac{-1}{2},1\right]$

15. **If** α,β,γ **are the angles made by a line with the coordinate axes in the positive direction then the range of** $\sin\alpha\sin\beta+\sin\beta\sin\gamma+\sin\gamma\sin\alpha$ **is**

1) $\left[\frac{-1}{2},1\right]$ 2) $[-1,2]$ 3) $\left[\frac{-1}{2},\infty\right)$ 4) $[-1,\infty)$

16. **The range of** $f(x)=\sqrt{16-x^2}$ **is**

1) $[-4,4]$ 2) $[0,4]$ 3) $[0,\infty)$ 4) $(-\infty,\infty)$

17. **The range of the function** $\sin^{-1}\sqrt{x}$

1) $\left(0,\frac{\pi}{2}\right)$ 2) $\left[0,\frac{\pi}{2}\right)$ 3) $\left(0,\frac{\pi}{2}\right]$ 4) $\left[0,\frac{\pi}{2}\right]$

18. **The range of** $f(x)=\frac{|x|}{x}$ **is**

1) $x\geq 1$ 2) $x<1$ 3) $\{-1,1\}$ 4) $\{-1,0,1\}$

19. **The range of** $f(x)=\sin^2x+\cos^4x$ **is**

1) $\left[\frac{1}{2},1\right]$ 2) $\left[\frac{3}{4},1\right]$ 3) $[0,1]$ 4) $\left[0,\frac{1}{4}\right]$

20. **The range of** $f(x)=\frac{1}{5-3\cos 2x}$ **is**

1) $[0,1]$ 2) $\left[\frac{3}{4},1\right]$ 3) $\left[\frac{1}{4},1\right]$ 4) $\left[\frac{1}{8},\frac{1}{2}\right]$

MATHS-B

Syllabus: Limits

21. $\lim\limits_{x\to\frac{\pi}{2}}\frac{\cot^2x-\cos x}{\left(\frac{\pi}{2}-x\right)^3}=$

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

22. $\lim\limits_{x\to-1}\frac{\sqrt{\pi}-\sqrt{\cos^{-1}x}}{\sqrt{x+1}}$

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

23. $\lim\limits_{x\to0}\frac{27^x-9^x-3^x+1}{\sqrt{2}-\sqrt{1+\cos x}}=$

1) 0 2) $8\sqrt{2}(\log 3)^2$ 3) $8(\log 3)^2$ 4) 1

24. $\lim\limits_{x\to0}\frac{\sin\left(\pi\cos^2x\right)}{x^2}$

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

25. $\underset{n\to\infty}{Lt}\frac{1+a+a^2+....+a^{n-1}}{1+b+b^2+...+b^{n-1}}=0$ **then**

1) $a=b$ 2) $a<b$ 3) $a>b$ 4) $a=2b$

26. $\underset{x\to 0}{Lt}\left[\frac{a_1^x+a_2^x+...+a_n^x}{n}\right]^{\frac{1}{x}}=$

1) 0 2) 1 3) $a_1.a_2.a_3....a_n$ 4) $\sqrt[n]{a_1.a_2...a_n}$

27. $\underset{x\to 0}{Lt}\left[1+Tan^2\sqrt{x}\right]^{\frac{1}{2x}}=$

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

28. $\underset{x\to 0}{Lt}\int_0^x\frac{\sin^3 x.\cos x.dx}{x^4}$

1) 0.25 2) 2.5 3) 5.2 4) 0.52

29. $\underset{n\to\infty}{Lt}\frac{3.2^{n+1}-4.5^{n+1}}{5.2^n+7.5^n}$

1) $\frac{20}{7}$ 2) $-\frac{20}{7}$ 3) $\frac{7}{20}$ 4) $-\frac{7}{20}$

30. **If** $\underset{x\to 0}{Lt}\frac{x(1+a\cos x)-b\sin x}{x^3}=1$ **then** $(a,b)=$

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

31. **If** $[x]$ **denotes the greatest integer less than or equal to** $\underset{n\to\infty}{Lt}\frac{1}{4}\left\{\left[1^3x\right]+\left[2^3x\right]+\left[3^3x\right]+....+\left[n^3x\right]\right\}$

1) $\frac{x}{2}$ 2) $\frac{x}{4}$ 3) $\frac{x}{6}$ 4) $\frac{x}{3}$

32. $\underset{x\to 0}{Lt}\frac{e^{\frac{1}{x}}-e^{\frac{-1}{x}}}{e^{\frac{1}{x}}+e^{\frac{-1}{x}}}=$

1) 0 2) 1 3) -1 4) does not exist

33. $\underset{n\to\infty}{Lt}\frac{1+\frac{1}{3}+\frac{1}{9}+....+\frac{1}{3^n}}{1+\frac{1}{5}+\frac{1}{25}+...+\frac{1}{5^n}}$

1) $\frac{3}{5}$ 2) $\frac{5}{3}$ 3) $\frac{6}{5}$ 4) $\frac{5}{6}$

34. **If** α,β **are the roots of** $ax^2+bx+c=0$ **then** $\underset{n\to\alpha}{Lt}\frac{1-\cos\left(ax^2+bx+c\right)}{(x-\alpha)^2}$

1) 0 2) $\frac{1}{2}(\alpha-\beta)^2$ 3) $\frac{a^2}{2}(\alpha-\beta)^2$ 4) $\frac{-a^2}{2}(\alpha-\beta)^2$

35. $\underset{y-x}{Lt}\frac{\sin^2 y-\sin^2 x}{y-x}$

1) $\sin 2y$ 2) $\sin 2x$ 3) $\cos^2 y$ 4) $\cos^2 x$

36. The quadratic equation whose roots are $'l'$ and $'m'$ where $l = \underset{\theta\to 0}{Lt}\dfrac{3\sin\theta - 4\sin^3\theta}{\theta}$ and $m = \underset{\theta\to 0}{Lt}\dfrac{2Tan\theta}{\theta\left(1-Tan^2\theta\right)}$

1) $x^2+5x+6=0$ 2) $x^2-5x+6=0$ 3) $x^2-5x-6=0$ 4)

37. Let $f = R\to R$ be of positive increasing function with $\underset{x\to\infty}{Lt}\dfrac{f(3x)}{f(x)}=1$ then $\underset{x\to\infty}{Lt}\dfrac{f(2x)}{f(x)}=$

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

38. $\underset{x\to\frac{\pi}{4}}{Lt}\dfrac{\sec x Tan(4x-\pi)}{\sin(4x-\pi)}=$

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

39. $\underset{x\to-\infty}{Lt}\dfrac{2x+3}{\sqrt{x^2-4}}$

1) 2 2) -2 3) $\dfrac{1}{2}$ 4) $-\dfrac{1}{2}$

40. $\underset{x\to 0}{Lt}\dfrac{3\sin x^0 - \sin\left(3x^0\right)}{x^3}$

1) $\left(\dfrac{\pi}{180}\right)^3$ 2) $4\left(\dfrac{\pi}{180}\right)^3$ 3) $\left(\dfrac{\pi}{180}\right)$ 4) $\left(\dfrac{\pi}{90}\right)$

PHYSICS

Syllabus: Moment of inertia, Law of conservations of angular momentum, rolling motion, Rotational kinetic energy

41. The radius of gyration of a rotating circular ring is maximum about the following axis of rotation

1) natural axis
2) axis passing through diameter of ring
3) axis passing through tangent of ring in its plane
4) axis passing through tangent of ring perpendicular to plane of rings

42. Four point size bodies each of mass M are fixed at four corners of a light square frame of ride length L .The moment of inertia of four sides about an axis perpendicular to the phase of frame and passing through its centre is

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

43. Angular velocity $'\omega'$ of a body changes from w_1 and w_2 without applying a torque but changing moment of inertia . The ratio of corresponding radii of gyration

1) $w_1 : w_2$ 2) $\sqrt{w_1} : \sqrt{w_2}$ 3) $\sqrt{w_2} : \sqrt{w_1}$ 4) $w_2 : w$

44. The ratio of moment of inertia of a solid sphere about axes passing through its centre and tangent respectively is

1) 2:5 2) 2:7 3) 5:2 4) 7:2

45. If the earth were to suddenly contract to $\dfrac{1}{n^{th}}$ of its present radius without any change in its mass, the duration of the day will be nearly

1) $\dfrac{24}{n}$ hours 2) $24n$ hours 3) $\dfrac{24}{n^2}$ hours 4) $24n^2$ hours

46. A point size body of mass 20 gram is revolving along a circle of radius 0.5 m at a speed $2m/s$ .Its angular momentum is

1) $0.02 kgm^2s^{-1}$ 2) $0.04 kgm^2s^{-1}$ 3) $0.2 kgm^2s^{-1}$ 4) $0.4 kg\, m^2s^{-1}$

47. Two particles of mass m,2m are revolving along different circles of radii in the ratio 2:3 whose time periods are in the ratio 2:3, the ratio of their angular momenta is

1) $2:3$ 2) $3:2$ 3) $1:3$ 4) $3:1$

48. If the earth shrinks such that its density becomes 8 times to the present value, then the new duration of the day in hours will be

1) 24 2) 12 3) 6 4) 3

49. The body of mass 0.1kg is moving along a circle of radius 2m with a speed of 4m/s. The workdone by centripetal force during half revolution is

1) $1.6 J$ 2) $3.2 J$ 3) $4.8 J$ 4) *Zero*

50. The ratio of rotational kinetic energy and translators kinetic energy of a rolling circular disc

1) $4:1$ 2) $2:1$ 3) $1:4$ 4) $1:2$

51. Consider a thin uniform square sheet made of rigid material. If its side is 'a' mass m and moment of inertia I about one of its diagonals then

1) $I = \frac{Ma^2}{12}$ 2) $I > \frac{Ma^2}{12}$ 3) $I = \frac{Ma^2}{24}$ 4) $\frac{Ma^2}{24} < I < \frac{Ma^2}{12}$

52. A particle of mass 2 kg is moving such that a time t, its position in meter is given by $\vec{r}(t) = 5\hat{i} - 2t^2\hat{j}$. The angular momentum of the particle at t=2sec about the origin in $kg\, m^2s^{-1}$ is

1) $-80\hat{k}$ 2) $10\hat{i} - 16\hat{j}$ 3) $-40\hat{k}$ 4) $40\hat{k}$

53. A hoop of radius r and mass m rotating with an angular velocity if is placed on a rough horizontal surface . The initial velocity of centre of the hoop is zero .What will be the velocity of the centre of the hoop when it ceases to slip

1) $\frac{r\omega_0}{3}$ 2) $\frac{r\omega_0}{2}$ 3) $r\omega_0$ 4) $\frac{r\omega_0}{4}$

54. A particle is moving with uniform speed in a circular orbit of radius 'r' in a central force inversely proportional to the n^{th} power of R. If the period of rotation of the particle is T, then

1) $T \alpha R^{n+1}$ 2) $T \alpha R^{\frac{n+1}{2}}$ 3) $T \alpha R^{n/2}$ 4) $T \alpha R^{3/2}$ for any n

55. The magnitude of torque on a particle of mass 1kg is 2.5 Nm about the origin. If the force adding on it is 1N and the distance of the particle from the origin is 5m, the angle between the force and position vector is (in radian)

1) $\frac{\pi}{8}$ 2) $\frac{\pi}{6}$ 3) $\frac{\pi}{3}$ 4) $\frac{\pi}{4}$

56. A small hole is made in a circular disc of mass M and radius 'R' at a distance of $\frac{R}{4}$ from the centre .The disc is supported on a horizontal peg through this side hole , the moment of inertia of disc about the horizontal peg is

1) $\frac{9MR^2}{16}$ 2) $\frac{5MR^2}{4}$ 3) $\frac{5MR^2}{16}$ 4) $\frac{MR^2}{9}$

57. A solid sphere of mass 100kg and radius 10m moving in a space becomes a circular disc of radius 20m in one hour. Then the rate of change of moment of inertia in the process is

1) $\frac{40}{9} kgm^2s^{-1}$ 2) $\frac{10}{9} kgm^2s^{-1}$ 3) $\frac{50}{9} kgm^2s^{-1}$ 4) $\frac{25}{9} kgm^2s^{-1}$

58. **A solid sphere rolls down without slipping on a smooth inclined plane of inclination $\sin^{-1}(0.42)$. If the acceleration due to gravity is $10ms^{-2}$. The acceleration of the rolling sphere is**

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

59. **A solid sphere of mass 5kg rolls on a plane surface. Find its kinetic energy at an instant when its centre moves with speed 4m/s.**

1) $56J$ 2) $45J$ 3) $75J$ 4) $105\,J$

60. **A thin circular disc of mass 12kg and radius 0.5m rotates with an angular velocity of 100 rad/s. The rotational K.E of disc is**

1) $12.2KJ$ 2) $5.5KJ$ 3) $9.2KJ$ 4) $7.5KJ$

CHEMISTRY

Syllabus: Thermodynamics

61. **The ΔH_f^0 for $CO_{2(g)}$, $CO_{(g)}$ and $H_2O\,(l)$ are -393.5,-110.5 and -241.8 $KJmol^{-1}$ respectively. The standard enthalpy changes $(in\ KJ)$ for the reaction $CO_{2(g)} + H_{2(g)} \dashrightarrow CO_{(g)} + H_2O_{(l)}$ is**

1) 524.1 2) 41.2 3) -262.5 4) -41.2

62. **The molar enthalpies of combustion of $C_2H_{2(g)}$, $C_{(graphite)}$ and $H_{2(g)}$ are -1300,-394,-286 $KJmol^{-1}$ respectively. The standard enthalpy of formation of $C_2H_{2(g)^1}$ is**

1) $-226\ KJmol^{-1}$ 2) $-626\ KJmol^{-1}$ 3) $226\,KJmol^{-1}$ 4) $626\,KJmol^{-1}$

63. **The heat of formation of SO_2 is**

$S + 3/2O_2 \rightarrow SO_3 + 2x\,KJ$

$SO_2 + 1/2O_2 \rightarrow SO_3 + yKJ$

1) $y - 2x$ 2) $2x + y$ 3) $x + y$ 4) $2\dfrac{x}{y}$

64. **The heat of dissociation (in kcal/mole) of CH_4 and C_2H_6 are 360 and 620 respectively. From these the C-C bond energy in ethane can be evaluated as**

1) 260 2) 130 3) 80 4) 200

65. **Human body requires 2370 K.cal of energy daily. If the heat of combustion of glucose is 790 K.cal/mole the amount of glucose required for daily consumption is**

1) $650\,g$ 2) $540\,g$ 3) $327\,g$ 4) $490\,g$

66. **A gas expands from 1.5 to 6.5 L against a constant pressure of 0.5 atm and during this process the gas also absorbs 100J of heat the change in the internal energy of the gas is**

1) $153.3\,J$ 2) $353.3\,J$ 3) $-153.3\,J$ 4) $-35.3\,J$

67. **One mole of ideal gas expands freely at 310 K from five litre volume to 10 litre volume. Then $\Delta E\ and\ \Delta H$ of the process are respectively**

1) $0\ and\ 5\ cal$ 2) $0 and 5\times300\ cal$ 3) $0 and 0$ 4) $5 and 0\ cal$

68. **If a gas absorbs 200J of heat and expands by 500 cm^3 against a constant pressure of $2\times10^5\ N/m^{-2}$, than change in internal energy is**

1) $-300\,J$ 2) $-100\,J$ 3) $+100\,J$ 4) $+300\,J$

69. **Combustion of hydrogen in a fuel cell at 300 KJ is represent as $2H_{2(g)} + O_{2(g)} \dashrightarrow 2H_2O_{(g)}$. If ΔH and ΔG are -241.60 $KJmol^{-1}$ and -228.40 $KJmol^{-1}$ of H_2O. The value of ΔS for the above process is**

1) $4.4\,KJ$ 2) $-88\,J$ 3) $+88\,J$ 4) $-44J$

70. **Which of the following does not follow first law of thermodynamics (w = work; q = heat; ΔU = change in internal energy?**

1) $w>0; q>0; \Delta U<0$ 2) $w=0; q=0; \Delta U=0$

3) $w>0; q=0;\ \Delta U>0$ 4) $w>0; q<0; \Delta U<0$

71. **The heat required to rise the temperature of 54g of aluminum from 40^0c *to* 60^0c in J is (molar heat capacity of aluminum in this temperature range is 24 $Jmol^{-2}k^{-1}$; atomic weight of Al is 27)**

1) 480 2) 800 3) 960 4) 1280

72. **What is the standard enthalpy of reaction (in KJ) when two moles of $Fe_2O_{3(s)}$ reacts with H_2 gas to give Fe metal? (ΔfH^0 *of* $Fe_2O_{3(s)}$ *and* $H_2O_{(l)}$ -824.2 and -285.83 KJ mol^{-1} respectively)**

1) -66.58 2) -33.3 3) -538.37 4) -1110.03

73. **6g of graphite is burnt in a bomb calorimeter at 25^0c to 31^0c if ΔH of this reaction is $-248\,KJ\,mol^{-1}$ .Find out C_v $\left(in\ KJ\ K^{-1}\right)$ of bomb calorimeter**

1) 20.667 2) 41.33 3) 1488 4) 0.145

74. **If enthalpy of combustion of carbon to CO_2 is $-394\,KJmol^{-1}$ .The enthalpy change for the information of 17.6g of CO_2 from carbon and dioxygen at the same temperature in KJ is**

1) -157.6 2) 315.2 3) 157.6 4) -315.5

75. **If 100 moles of H_2O_2 decompose at 1bar and 300k, the work done (KJ) by one mole of $O_2(g)$ as it expands against 1 bar pressure is $2H_2O_{2(l)} \rightleftharpoons 2H_2O_{(l)} + O_{2(g)}$ (R = $8.3JK^{-1}mol^{-1}$)**

1) 124.50 2) 249.00 3) 498.00 4) 62.25

76. **Given**

$(i)\,C_{(graphite)} + O_{2(g)} \rightarrow CO_{2(g)}\ \Delta H_r^- = x\,KJmol^{-1}$

$(ii)\,C_{(graphite)} + \frac{1}{2}O_{2(g)} \rightarrow CO_{2(g)}\Delta H_r^- = yKJmol^{-1}$

$(iii)\,CO + \frac{1}{2}O_{2(g)} \rightarrow CO_{2(g)}\Delta H_r^- = zKJmol^{-1}$

Based on the above thermo chemical equations find out which one of the following algebraic relationship is correct?

1) $x = y - z$ 2) $y = 2z - x$ 3) $x = y + z$ 4) $z = x + y$

77. **Bond energy of $N-H, H-H$ *and* $N \equiv N$ are a, b, c respectively. The ΔH for the reaction $2NH_3 \rightarrow N_2 + 3H_2$ is**

1) $6a - 3b - c$ 2) $6a + 3b + c$ 3) $a + 6b - c$ 4) $\mathbf{6a + b - 3c}$

78. **If 9.8 gms, of H_2SO_4 is neutralized exactly with strong alkali, the heat evolved is (ΔH of neutralization is 13.6 Kcal)**

1) 13.6 *Kcal* 2) 1.36 *Kcal* 3) 2.72. *Kcal* 4) 27.2 *Kcal*

79. **When enthalpy and entropy change for a chemical reaction are $-2.5\times10^3\,cals$ and $7.4\,cal\,\deg^{-1}$ respectively. Predict that reaction at 298 K is**

1) Spontaneous 2) reversible 3) irreversible 4) Non- Spontaneous

80. **What will be the value of ΔG^0 if equilibrium constant for a reaction is 10**

1) $-50.44\,KJmol^{-1}$ 2) $-57.44\,KJmol^{-1}$

3) $-25.44\,KJmol^{-1}$ 4) $-10\,KJmol^{-1}$

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SRIGAYATRI EDUCATIONAL INSTITUTIONS

INDIA

SR MPC | **EMACET MODEL** | **Date: 18/04/2020**

Time: 3 Hours | **Max. Marks: 160**

KEY SHEET

MATHS-A

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

MATHS-B

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

PHYSICS

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

CHEMISTRY

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

HINTS AND SOLUTIONS

MATHS-A

1. $x-2\geq 0, 4-x>0$ *and* $x\neq 3$

   $\Rightarrow x\geq 2, x<4$ *and* $x\neq 3$

   $\Rightarrow x\in[2,\infty)$ *and* $(-\infty,4)$ *and* $x\neq 3$

   $\Rightarrow x\in[2,4)-\{3\}$

   $\text{Domain}=[2,4)-\{3\}$

   Or

   $[2,3)\cup(3,4)$

2. Domain of $\cot x = R-\{n\pi, n\in z\}$

   Domain of $\cot\frac{x}{3}=R-\{3n\pi, n\in z\}$

3. $\log|x|\neq 0$ *and* $x\neq 0$

$\Rightarrow x \neq \{0,1,-1\}$

Domain $= R - \{-1,0,1\}$

4. $x \neq 0$ *and* $x^2 \geq 1 \Rightarrow |x| \geq 1$

5. $(x+7)(x+5) \geq 0$ *and* $x \neq -5$

$x \in (-\infty,-7] \cup [-5,\infty)$ *and* $x \neq -5$

Domain $= (-\infty,-7] \cup (-5,\infty)$

6. $\Rightarrow x^2 - 9 \neq 0$

$\Rightarrow (x+3)(x-3) \neq 0$

$\Rightarrow x \neq -3,3$

Domain $R - \{-3,3\}$

7. $2 - \log_3 (x-1) \geq 0$ *and* $x-1 > 0$

$\Rightarrow \log_3 (x-1) \leq 2$ *and* $x > 1$

$\Rightarrow x - 1 \leq 9$ *and* $x > 1$

$\Rightarrow x \leq 10$ *and* $x > 1$

Domain $= (1,10]$

8. $[x] - x \neq 0$

$[x] \neq x$

Domain = R-Z

9. $\frac{1}{x} - 1 < 0$

$\Rightarrow \frac{1-x}{x} < 0$

$\Rightarrow \frac{x-1}{x} > 0$

$\Rightarrow (x-1)x > 0$

$\Rightarrow (x-0)(x-1) > 0$

$x \in (-\infty,0) \cup (1,\infty)$

10. $-1 \leq \frac{x-4}{3} \leq 1$ *and* $2 - x > 0$

11. $9 - x^2 > 0$ *and* $-1 \leq x - 3 \leq 1$

$\Rightarrow x^2 - 9 < 0$ *and* $-1+3 \leq x-3+3 \leq 1+3$

$\Rightarrow (x+3)(x-3)<0$ *and* $2 \le x \le 4$

$\Rightarrow x \in (-\infty,-3) \cup (3,\infty)$ *and* $[2,4]$

Domain $= [2,3)$

12. Range of $f^2 - 1 = \{3^2-1, 2^2-1, 1^2-1\}$

$= \{8,3,0\}$

13. $\sin^{-1} x - \cos^{-1} x = \dfrac{\pi}{2} - 2\cos^{-1} x = f(x)$

$\Rightarrow 0 \le \cos^{-1} x \le \pi$

$0 \ge -2\cos^{-1} x \ge -2\pi$

$-2\pi \le -2\cos^{-1} x \le 0$

$\dfrac{\pi}{2} - 2\pi \le \dfrac{\pi}{2} - 2\cos^{-1} x \le 0 + \dfrac{\pi}{2}$

$\dfrac{-3\pi}{2} \le f(x) \le \dfrac{\pi}{2}$

$f(x) \in \left[\dfrac{-3\pi}{2}, \dfrac{\pi}{2}\right]$

Domain$= \left[\dfrac{-3\pi}{2}, \dfrac{\pi}{2}\right]$

14. If $a^2 + b^2 + c^2 = k$ then

$ab + bc + ca \in \left[\dfrac{-k}{2}, k\right]$

15. Let $a = \sin\alpha, b = \sin\beta, c = \sin\gamma$ then

$a^2 + b^2 + c^2 = 2$

$a^2 + b^2 + c^2 - ab - bc - ca \ge 0$

$\Rightarrow 2 \ge ab + bc + ca, (a+b+c)^2 \ge 0$

$\Rightarrow ab + bc + ca \ge -1$

$\therefore Range = [-1,2]$

16. $\sqrt{16 - x^2} = f(x)$

$\Rightarrow 16 - x^2 \ge 0$

$\Rightarrow x^2 - 16 \le 0$

$(x+4)(x-4) \le 0$

$x \in [-4,4]$

$\text{Domain} = [-4,4]$

$f(x) = \sqrt{16-x^2}$

$f(-4) = \sqrt{16-16} = 0$

$f(-3) = \sqrt{16-9} = \sqrt{7}$

$f(0) - \sqrt{16} = 4$

$\therefore Range = [0,4]$

17. $0 \le \sqrt{x} \le 1$

$\Rightarrow 0 \le \sin^{-1}\sqrt{x} \le \frac{\pi}{2}$

$Range = \left[0, \frac{\pi}{2}\right]$

18. $\frac{|x|}{x} = 1, if\ x > 0$

$\frac{|x|}{x} = -1, if\ x < 0$

19. $\sin^2 x + \cos^4 x$

$\Rightarrow \sin^2 x + \cos^2 x\left(1 - \sin^2 x\right)$

$\Rightarrow \sin^2 x + \cos^2 x - \cos^2 x \sin^2 x$

$\Rightarrow 1 - \frac{1}{4}\sin^2 2x$

$0 \le \sin^2 2x \le 0$

$\frac{-1}{4} \le \frac{-1}{4}\sin^2 2x \le 0$

$1 - \frac{1}{4} \le 1 - \frac{1}{4}\sin^2 2x \le 1$

$\frac{3}{4} \le 1 - \frac{1}{4}\sin^2 2x \le 1$

$\therefore Range = \left[\frac{3}{4}, 1\right]$

20. $-1 \le \cos 2x \le 1$

$-3 \le 3\cos 2x \le 3$

$-3 \le -3\cos 2x \le 3$

$5 - 3 \le 5 - 3\cos 2x \le 5 + 3$

$2 \le 5 - 3\cos 2x \le 8$

MATHS-B

21. Put $\frac{\pi}{2}-x=\theta$

$$\underset{\theta\to 0}{Lt}\frac{Tan\theta-\sin\theta}{\theta^3}=\underset{\theta\to 0}{Lt}\frac{Tan\theta}{\theta}.\frac{1-\cos\theta}{\theta^2}=\frac{1}{2}$$

22. Put $x=\cos\theta$

$$\underset{\theta\to\pi}{Lt}\frac{\sqrt{\pi}-\sqrt{\theta}}{\sqrt{1+\cos\theta}}=\underset{\theta\to\pi}{Lt}\frac{\sqrt{\pi}-\sqrt{\theta}}{\sqrt{2\cos^2\frac{\theta}{2}}}=\underset{\theta\to\pi}{Lt}\frac{1}{\sqrt{2\theta}\sin\frac{\theta}{2}}=\frac{1}{\sqrt{2\pi}}$$

23. $$\underset{x\to 0}{Lt}\frac{\left(9^x-1\right)\left(3^x-1\right)}{\sqrt{2}-\sqrt{2}\cos\frac{x}{2}}=\underset{x\to 0}{Lt}\frac{x.9^x\log 9.x.3^x\log 3}{\sqrt{2}.\frac{1}{2}.\frac{x^2}{4}}=8\sqrt{2}\left(\log 3\right)^2$$

24. By L.H rule $\underset{x\to 0}{Lt}\frac{\cos\left(\pi\cos^2 x\right)\left(\pi.2\cos x\left(-\sin x\right)\right)}{2x}=\pi$

25. $$\underset{n\to\infty}{Lt}\frac{\frac{a-1}{a-1}}{\frac{b^n-1}{b-1}}=0$$

26. $$\underset{e^{x\to 0}}{Lt}\left[\frac{a_1^x+a_2^x+...+a_n^x}{n}-1\right]\frac{1}{x}=\underset{e^{x\to 0}}{Lt}\frac{a_1^x+a_2^x+...+a_n^x-1}{nx}$$

By L.H rule $\underset{e^{x\to 0}}{Lt}\frac{a_1^x\log a_1+a_2^x\log a_2+...+a_n^x\log a_n}{n}=\sqrt[n]{a_1a_2....a_n}$

27. $$\underset{e^{x\to 0}}{Lt}\left(Tan^2\sqrt{x}\right)\frac{1}{2x}=e^{\frac{1}{2}}=\sqrt{e}$$

28. By L.H rule $\underset{x\to 0}{Lt}\frac{\sin^3 x\cos x(1)-0}{4x^3}=\frac{1}{4}=0.25$

29. $$\frac{1}{2}.\underset{n\to\infty}{Lt}\frac{5}{5^n}^n\left[\frac{6\left(\frac{2}{5}\right)^n-20}{5\left(\frac{2}{5}\right)^n+7}\right]$$

$$=\frac{-20}{7}$$

30. By L.H rule

$$1=\underset{x\to 0}{Lt}\frac{1+(a-b)\cos x-ax\sin x}{3x^2}$$

It is in $\frac{0}{0}$ form if $a-b=-1$

$$1=\underset{x\to 0}{Lt}\frac{1-\cos x-ax\sin x}{3x^2}$$

$$1=\underset{x\to 0}{Lt}\frac{1-\cos x}{3x^2}-\frac{a}{3}$$

$$a=\frac{-5}{3},b=\frac{-3}{2}$$

31. $n^3x-1<\left[x^3x\right]\le n^3x$

Putting $n=1,2...n$ and adding them

$$\frac{x\sum n^3}{n^4}-\frac{n^3}{n^4}<\frac{\sum\left[n^3x\right]}{n^4}\le x\frac{\sum n^3}{n^4}$$

$$\underset{n\to\infty}{Lt}\frac{\sum n^3}{n^4}-\frac{n^3}{n^4}<\underset{n\to\infty}{Lt}\frac{\sum\left[n^3x\right]}{n^4}\le\underset{n\to\infty}{Lt}\,x\frac{\sum n^3}{n^4}$$

$$\therefore\underset{n\to\infty}{Lt}\frac{1}{n^4}\left\{\sum\left[n^3x\right]\right\}=\frac{x}{4}$$

32. $\text{L.H.L}=\underset{x\to 0^-}{Lt}\dfrac{e^{\frac{1}{4}}\left(-1-e^{\frac{2}{x}}\right)}{e^{\frac{1}{x}}\left(1+e^{\frac{2}{x}}\right)}=\dfrac{-1+0}{1+0}=-1$

$$\text{R.H.L}=1=\underset{x\to 0^+}{Lt}\frac{e^{\frac{1}{4}}\left(-1-e^{\frac{-2}{x}}\right)}{e^{\frac{1}{x}}\left(1+e^{\frac{-2}{x}}\right)}=\frac{1-0}{1+0}=1$$

33. $\underset{n\to\infty}{Lt}\dfrac{\dfrac{1\left(1-\frac{1}{3^n}\right)}{1-\frac{1}{3}}}{\dfrac{1\left(1-\frac{1}{5^n}\right)}{1-\frac{1}{5}}}=\dfrac{\frac{1-0}{2}}{\frac{1-0}{4}}=\dfrac{\frac{3}{2}}{\frac{5}{4}}=\dfrac{6}{5}$

34. $\underset{x\to\alpha}{Lt}\dfrac{1-\cos a(x-\alpha)(x-\beta)}{(x-\alpha)^2}=\underset{x\to\alpha}{Lt}\dfrac{1-\cos a(x-\alpha)(x-\beta)}{(x-\alpha)^2(x-\beta)^2}=\dfrac{1}{2}a^2(\alpha-\beta)^2$

35. By L.H rule

$$\underset{y\to x}{Lt}\frac{2\sin y\cos y}{1}=\sin 2x$$

36. $l=\underset{\theta\to 0}{Lt}\dfrac{\sin 3\theta}{\theta}=3,m=\underset{\theta\to 0}{Lt}\dfrac{Tan2\theta}{\theta}=2$

Q.E is $x^2-x(3+2)+(3)(2)=0$

$x^2-5x+6=0$

37. As $f(x)$ is positive increasing function we have

$f(x)<f(2x)<f(3x)$

Dividing by $f(x)$

$1<\frac{f(2x)}{f(x)}<\frac{f(3x)}{f(x)}$

$\underset{x\to\infty}{Lt}\,1\le \underset{x\to\infty}{Lt}\frac{f(2x)}{f(x)}\le \underset{x\to\infty}{Lt}\frac{f(3x)}{f(x)}$

$\underset{x\to\infty}{Lt}\,1\le \underset{x\to\infty}{Lt}\frac{f(2x)}{f(x)}\le \underset{x\to\infty}{Lt}\,1$

$\therefore$ By sandwich theorem $\underset{x\to\infty}{Lt}\frac{f(2x)}{f(x)}=1$

38. $\underset{x\to\frac{\pi}{4}}{Lt}\frac{\sec x}{\cos(4x-\pi)}=\frac{\sqrt{2}}{1}=\sqrt{2}$

39. $\underset{x\to-\infty}{Lt}\frac{2x+3}{|x|\sqrt{1-\frac{4}{x^2}}}$

As $x\to-\infty|x|=-x$

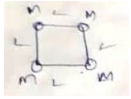
$\underset{x\to\infty}{Lt}\frac{2x+3}{-x\sqrt{1-\frac{4}{x^2}=-2}}$

40. $\underset{x\to\infty}{Lt}\frac{3\sin x^0-(3\sin x^0-4\sin^3 x^0)}{x^3}$

$=\underset{x\to0}{Lt}\frac{4\sin^3 x^0}{x^3}=4..\underset{x\to0}{Lt}\frac{\sin^3\frac{\pi x}{180}}{x^3}=4\left(\frac{\pi}{180}\right)^3$

PHYSICS

41. 1) $I=mr^2$ 2) $I=\frac{mr^2}{2}$ 3) $I=\frac{3}{2}mr^2$ 4) $I=2mr^2$

42.  $I=\le\sum mr^2$

Hear $r=\frac{L}{\sqrt{2}}$

$$\therefore I = 4\left[m\left(\frac{L}{\sqrt{2}} \right)^2 \right] = 2mL^2$$

43. $L = Iw = \left(mr^2 \right) w$

$$\therefore \frac{w_1}{w_2} = \frac{r_2^2}{r_1^2} \Rightarrow r_1 : r_2 = \sqrt{w_2} : \sqrt{w_1}$$

44. $$\frac{I_{centre}}{I_{Tangent}} = = \frac{\frac{2}{5}mR^2}{\frac{7}{5}mR^2} = \frac{2}{7}$$

45. $I_1 w_1 = I_2 w_2$

46. $L = mvr$

47. $$\frac{L_1}{L_2} = \frac{m_1}{n_2} \times \frac{r_1^2}{r_2^2} \times \frac{T_2}{T_1}$$

48. $I_1 w_1 = I_2 w_2$

$$\frac{e_1}{e_2} \times \left(\frac{r_1}{r_2} \right)^{\frac{5}{3}} = \frac{T_1}{T_2}$$

$$T_2 = T_1 \left(\frac{e_1}{e_2} \right)^{\frac{2}{3}}$$

Time period becomes $\frac{1}{4}th \therefore T = 6hrs$

49. Work done by centrepetal force is zero

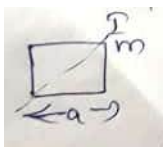
50. For circular disc $K.E_{translational} = \frac{1}{2}mv^2$

$$K.E_{rotational} = \frac{1}{2}Iw^2 = \frac{1}{2}\left[\frac{mr^2}{2} w^2 \right] = \frac{1}{4}mv^2$$

$$\frac{K.E_R}{K.E_T} = 1:2$$

51. Using perpendicular axis theorem

$$I = \frac{ma^2}{12}$$



52. $L = m\left(\vec{r} \times \vec{v} \right)$

53. From conservation of angular momentum about any fix point on the surface

$mr^2 w_0 = 2mr^2 w$

$\therefore w = \frac{w_0}{2}$

$\therefore V_{cm} = \frac{w_0 r}{2}$

54. If $F \alpha r^{-n}$

$mrw^2 \alpha r^{-n}$

$r\left(\frac{4\pi^2}{T^2}\right)\alpha r^{-n}$

$\therefore T^2 \alpha r^{1+n}$

$\therefore T \alpha r^{\frac{n+1}{2}}$

55. $T = fr\sin\theta$

$2.5 = 1\times 5\sin\theta \Rightarrow \sin\theta = \frac{25}{5} - \frac{1}{2}$

$\therefore \theta = \frac{\pi}{6}$

56. $I = I_0 + md^2 = \frac{mR^2}{2} + \frac{mR^2}{16}$

$\therefore I = \frac{9mR^2}{16}$

57. $I_1 = \frac{2}{5}mr^2 = 400 kgm^2$

$I_2 = \frac{1}{2}mr^2 = 20,000\, kg\, m^2$

$\Delta I = I_2 - I_1 = 16,000\, kg\, m^2$

$\therefore \frac{\Delta I}{\Delta t} = \frac{16000}{3600} = \frac{40}{9} kgm^2/s$

58. $a = \frac{g\sin\theta}{1+\frac{K^2}{R^2}} = \frac{10\times 0.42}{1+\frac{2}{5}} = 3m/s^2$

59. $K.E = \frac{1}{2}mv^2$

60. $K.E = Iw^2$

But $I = \frac{mR^2}{2} = \frac{12\times 2.5}{2} = 1.5 kg\, m^2$

$K.E = \frac{1}{2} \times 1.5 \times 100 \times 100$

$= 7.5$ J

CHEMISTRY

61. $CO_{2(g)} + H_{2(g)} \rightarrow CO_{(g)} + H_2O_{(l)}$

$\Delta H = H_P - H_R$

$\Delta H = \left(\Delta H_{co} + \Delta H_{H_2O}\right) - \Delta HCO_2$

$= -110.5 - 241.8 - (-393.5)$

$= +41.2$

62. $2C + H_2 \rightarrow C_2H_2$

$\Delta\ Hr = 2 \times \Delta H_{(C)} + \Delta H^C{}_{(H_2)} - \Delta H^C{}_{(C_2H_2)}$

$= 2 \times (-394) + (-286) - (-1300)$

$= -788 - 286 + 1300 = -1074 + 1300 = +226$

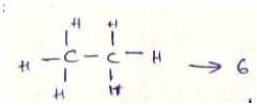
63. $S + O_2 \dashrightarrow SO_2$

$\Delta^H f_{(CO_2)} = \Delta^H SO_2 - \Delta^H S - \Delta HO_2$

$= y - 2x$

64. $4\{C-H\} \rightarrow$ bond dissociation energy given at 360

$C - H \rightarrow \frac{360}{4} = 90$

In C_2H_6  $(C-H)$ bonds are 'Present'

$1(C-C)$ bond is 'Present'

$6\{C-H\} = 90 \times 6 = 540$

Energy of $C - C = 620 - 540 = 80$

65. Glucose $(C_6H_{12}O_6)\ G.mwt = 180\,gms$

Heat of combustion of glucose $= 790\,kcal\,/\,mole$

$180\,gms \rightarrow 790\,Kcal\,/\,mole$

$? \quad \rightarrow 2370\,Kcal\,/\,mole$

Required amount of glucose $= 2370 \times \frac{180}{790} = 540 gms$

66. $\Delta u = q + w$

$\Delta u = q - p_e \times (v_f - v_i)$

$=100J-(0.5atm)(6.5L-1.5L)$

$=100J-2.5liatm$

$1Lit\,atm=101.35$

$=2.5\times101.3=253.3J$

$=100J-253.3$

$=-153.3J$

67. For ideal gas $\Delta E=0$

$\Delta H=\Delta E+P\Delta V$

$\Delta E=0$

$\Delta H=0$

68. $\Delta E=q-w$

$q=p\Delta V=200-100$

$\Delta E=100J$

69. $\Delta G=\Delta H-T\Delta S \quad \Delta G=-228.40KJmol^{-1}$

$\Rightarrow \Delta S=\dfrac{\Delta G-\Delta H}{T}\Delta H=-241.60\ KJmol^{-1}$

$\Delta S=\dfrac{-241.6-(-228.4)}{300}=-88J$

70. $q=dv+w$

71. $\Delta T=60-40=20^0c$

$wt\,of\,'Al'=56g\,(Given)$

$No\,of\,moles=\dfrac{54}{27}=2moles$

Molar heat capacity $=2\times20\times24=960J$

72. $2Fe_2O_3+6H_2\rightarrow4Fe+6H_2O$

$\Delta H=6H_2O-2Fe_2O_3$

$=6(-285.83)-2(-824.2)$

$=-66.58KJ$

73. wt of the graphite=6gm, Bomb calorimeter volume is constant so w=0 $\Delta H=\Delta U$

$12(gms)C\rightarrow248\,KJ$

$6(gms)C_{(grphite)}\rightarrow ?$

$=\dfrac{248\times16}{12}=124KJ$

$q=C_v\times\Delta T$

$124 = C_v$ x (31-25)

$C_v = 20.6$

74. $C + O_2 \rightarrow CO_2 \;\; \Delta H = 394 KJ / mol$

$44 gm \rightarrow -394 KJ / mol$

$17.6 gm \rightarrow ?$

$\Rightarrow \frac{17.6 \times -394}{44} = -157.6 KJ/mol$

75. $W = P\Delta V$

$= nRT$

$= 100 \times 8.3 \times 300 = 249000 J = 249 KJ$

76. $C + O_2 \rightarrow CO_2 \quad \Delta^H r = x$

$C + \frac{1}{2} O_2 \rightarrow CO \quad \Delta Hr = y$

$CO + \frac{1}{2} O_2 \rightarrow \qquad \Delta H_r = z$

$x = y + z$

77. $2NH_3$ -------> $N_2 + 3H_2$

$2NH_3 = 2$ X 3 (N-H) = 6a

$N_2 = 1$ (N ≡ N) = 1c

$3H_2 = 3$ (H-H) = 3b

ΔH_r = 6a - 3b - c

78. $H_2SO_4 \rightarrow 2H^+ + SO_4^{-2}$

$98 gm \rightarrow 27.2 Kcal$

$9.8 gm \rightarrow 2.72 Kcal$

79. $\Delta H = -ve$
$\Delta S = +ve$ when the process is spontaneous

80. $\Delta_r G^0 = -2.303 RT \log K \quad (R = 8.314 \times 10^{-3} KJmol^{-1}K^{-1}, T = 300K \text{ and } K = 10, \log 10 = 1)$

$= -2.303 \times 8.314 \times 10^{-3} \times 300 \log 10$

$\Delta_r G^0 = -57.44 KJmol^{-1}$