MELUHA INTERNATIONAL SCHOOL

HYDERABAD

SR MPC JEE MAINS Time:	UNIT – IV ASSIGNMENT – 1	Date: 02-05-2020 Max. Marks:

MATHS

Syllabus: ***CALCULUS:– 1. LIMITS, 2. CONTINUITY & DIFFERENTIABILITY, 3. DERIVATIVES, 4. APPLICATIONS OF DERIVATIVES , 5.INDEFINITE INTEGRATION, 6. DEFINITE INTEGRATION , 7.AREAS, 8. DIFFERENTIAL EQUATIONS***

1. If α is a repeated root of $ax^2 + bx + c = 0$, then $\lim\limits_{x\to\alpha}\frac{\tan(ax^2+bx+c)}{(x-\alpha)^2}$ is

   (A) a (B) b (C) c (D) 0

2. $\lim\limits_{x\to\alpha}\left(\frac{\sin x}{\sin a}\right)^{\frac{1}{x-a}}$, $a \neq n\pi$, n is an integer, equals

   (A) $e^{\cot a}$ (B) $e^{\tan a}$ (C) $e^{\sin a}$ (D) $e^{\cos a}$

3. $\lim\limits_{x\to a}\left(2-\frac{x}{a}\right)^{\tan\frac{\pi x}{2a}}$ is equal to

   (A) $e^{\pi/2}$ (B) $e^{2/\pi}$ (C) $e^{-2/\pi}$ (D) $e^{-\pi/2}$

4. The value of $\lim\limits_{x\to\infty}\left[\sqrt{x+\sqrt{x+\sqrt{x}}}-\sqrt{x}\right]$ is

   (A) $\frac{1}{2}$ (B) 0 (C) 3 (D) does not exist

5. $\lim\limits_{x\to1}\frac{\sqrt{1-\cos 2(x-1)}}{x-1}$

   (A) exists and it equals $\sqrt{2}$ (B) exists and it equals - $\sqrt{2}$
   (C) does not exist because $(x - 1) \to 0$
   (D) does not exist because left hand limit is not equal to right hand limit

6. The value of constants a and b so that $\lim\limits_{x\to\infty}\left(\frac{x^2+1}{x+1}-ax-b\right)=0$ are

   (A) a = 1, b =-1 (B) a = -1, b = 1 (C) a = 0, b = 0 (D) a = 2, b = -1

7. $\lim\limits_{x\to\infty}\sqrt{\frac{x+\sin x}{x-\cos x}} =$

   (A) 0 (B) 1 (C) -1 (D) 2

8. $\lim\limits_{x\to\infty}\frac{1.2+2.3+3.4+......+n(n+1)}{n^3}$ is equal to

   (A) 1 (B) –1 (C) $\frac{1}{3}$ (D) none of these

9. $\lim\limits_{x\to0}(\cos x+\sin x)^{1/x}$ is equal to

   (A) e (B) e^2 (C) e^{-1} (D) 1

10. $\lim\limits_{x\to0}\frac{1-\cos^3 x}{x\sin x\cos x} =$

   (A) $\frac{3}{2}$ (B) $\frac{1}{2}$ (C) 1 (D) $\frac{5}{2}$

11. $\lim_{x\to 0}\frac{e^x+e^{-x}+2\cos x-4}{x^4}$ is equal to

(A) 0 (B) 1 (C) $\frac{1}{6}$ (D) $-\frac{1}{6}$

12. The value of $\lim_{x\to\infty}\left(\frac{2x^2+3}{2x^2+5}\right)^{8x^2+3}$ is

(A) e^8 (B) e^{-8} (C) e^4 (D) e^{-4}

13. $\lim_{x\to 2}\frac{7x^2-11x-6}{3x^2-x-10}=$

(A) $\frac{17}{11}$ (B) $\frac{11}{17}$ (C) $\frac{17}{14}$ (D) $-\frac{17}{14}$

14. $\lim_{x\to 0}\frac{e^{2x}-1}{3x}=$

(A) 2/3 (B) 6 (C) 3/2 (D) 1/6

15. $\lim_{x\to a}\frac{x^{\frac{5}{8}}-a^{\frac{5}{8}}}{x^{\frac{1}{3}}-a^{\frac{1}{3}}}=$

(A) $\frac{15}{8}a^{\frac{7}{24}}$ (B) $\frac{15}{4}a^{\frac{7}{24}}$ (C) $-\frac{15}{8}a^{\frac{7}{24}}$ (D) $\frac{15}{4}a^{-\frac{7}{24}}$

16. $\lim_{x\to\infty}\frac{\log_e[x]}{x}$, (where [.] denotes the greatest integer function) is equal to

A) 0 B) $\frac{x}{3}$ C) $\frac{x}{6}$ D) does not exist

17. $\lim_{x\to 1^-}\frac{e^{\{x\}}-\{x\}-1}{\{x\}^2}$ equals to (where {.} is fractional part function and I is an integer)

A) $\frac{I}{2}$ B) $e-2$ C) I D) does not exist

18. If $\lim_{x\to\infty}\left(\frac{x^2+x+1}{x+1}-ax-b\right)=4$ then

A) $a=1,b=4$ B) $a=-4,b=1$ C) $a=1,b=-4$ D) $a=4,b=-1$

19. The number of non-negative integral values of ***n*** for which $\lim_{x\to 0}\frac{(\cos x-1)(\cos x-e^x)}{x^n}=0$ is:

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

20. $\lim_{x\to 0}\left(1+\frac{a\sin bx}{\cos x}\right)^{\frac{1}{x}}$, where a, b are non-zero constants is equal to:

A) $e^{a/b}$ B) ab C) e^{ab} D) $e^{b/a}$

21. $\lim_{n\to\infty}\frac{n(2n+1)^2}{(n+2)(n^2+3n-1)}$ is equal to

A) 0 B) 2 C) 4 D) ∞

22. $\lim_{x\to 0}\frac{x^4(\cot^4 x-\cot^2 x+1)}{(\tan^4 x-\tan^2 x+1)}$ is equal to

A) 1 B) 0 C) 2 D) None of these

23. $\lim_{x\to\infty}\frac{(x+1)^{10}+(x+2)^{10}+.......+(x+100)^{10}}{x^{10}+10^{10}}$ is equal to

A) 0 B) 1 C) 10 D) 100

24. $\lim_{x\to 0}\left(\frac{2^x+3^x}{2}\right)^{2/x}$ is equal to:

(A) 6 (B) log 6 (C) log 3 D) none of these

25. $\lim_{x\to 0^-}\frac{\sin\{x\}}{\{x\}}$ is (where{•} is fractional part of x) :

(A) 1 (B) sin 1 (C) – sin 1 D) 0

26. $\lim_{x\to 0}\frac{\log(1+x+x^2)+\log(1-x+x^2)}{\log(1+x^2)}$ is equal to:

(A) 1 (B) 2 (C) 4 D) 0

27. $\lim_{x\to 0}\frac{\sqrt{1-\cos 2x}}{x}$ is equal to:

(A) $\sqrt{2}$ (B) $-\sqrt{2}$ (C) does not exists D) none of these

28. If $\lim_{x\to 0}(1+a\sin x)^{\operatorname{cosec} x}=3$ then a is :

(A) ln 2 (B) ln 3 (C) ln 4 (D) ln 5

29. The value of the $\lim_{x\to 0}\frac{\cos(\sin x)-\cos x}{x^4}$

(A) $\frac{1}{5}$ (B) $\frac{1}{6}$ (C) $\frac{1}{4}$ (D) $\frac{1}{2}$

30. $\lim_{x\to 0}\frac{1-\cos x}{x\log(1+x)}=$

(A) 1 (B) 0 (C) -1 (D) 1/2

31. $\lim_{x\to 0}\frac{a^x-1}{b^x-1}=$

(A) $\log_b a$ (B) $\log_a b$ (C) $\log_e ab$ (D) $\log_e \frac{a}{b}$

32. $\lim_{x\to 0}\frac{(1-\cos 2x)(3+\cos x)}{x\tan 4x}=$

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

33. $\lim_{x\to \pi}\frac{\sqrt{2+\cos x}-1}{(\pi-x)^2}=$

(A) 0 (B) $\frac{1}{4}$ (C) $\frac{1}{2}$ (D) 2

34. $\lim_{x\to 0}\frac{4^x-9^x}{x(4^x+9^x)}=$

(A) $\log\left(\frac{3}{2}\right)$ (B) $\log\left(\frac{2}{3}\right)$ (C) $\log\left(\frac{4}{3}\right)$ (D) $\log 2$

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

(A) $-\frac{1}{2}$ (B) $\frac{1}{2}$ (C) 2 (D) -2

36. $\lim_{x\to a} \frac{x^{\frac{5}{8}}-a^{\frac{5}{8}}}{x^{\frac{1}{3}}-a^{\frac{1}{3}}}=$

(A) $\frac{15}{8}a^{\frac{7}{24}}$ (B) $\frac{15}{4}a^{\frac{7}{24}}$ (C) $-\frac{15}{8}a^{\frac{7}{24}}$ (D) $\frac{15}{4}a^{-\frac{7}{24}}$

37. $\lim_{x\to 0}\left(\frac{\sec ax-\sec bx}{x^2}\right)=$

(A) $\frac{a^2-b^2}{2}$ (B) $\frac{b^2-a^2}{2}$ (C) 0 (D) 1

38. $\lim_{n\to\infty}\left(\frac{1}{1.3}+\frac{1}{3.5}+....+\frac{1}{(2n-1)(2n+1)}\right)=$

(A) 1 (B) ½ (C) 1/3 (D) 1/4

39. If [x] denotes the greatest integer less than or equal to x then $\lim_{n\to\infty}\frac{[x]+[2x]+........+[nx]}{n^2}=$

(A) x/2 (B) x/3 (C) x (D) 0

40. Let $f:R\to R$ be a positive increasing function with $\lim_{x\to\infty}\frac{f(3x)}{f(x)}=1,$ then $\lim_{x\to\infty}\frac{f(2x)}{f(x)}=$

(A) 2/3 (B) 3/2 (C) 3 (D) 1

41. $\lim_{x\to 0}\frac{x\sqrt{y^2-(y-x)^2}}{\left\{\sqrt{(8xy-4x^2)}+\sqrt{8xy}\right\}^3}=$

(A) $\frac{1}{4y}$ (B) $\frac{1}{2}$ (C) $\frac{1}{2\sqrt{2}}$ (D) $\frac{1}{128y}$

42. $\lim_{x\to 0}\frac{(4^x-1)^3}{\sin\left(\frac{x}{4}\right)\log_e\left(1+\frac{x^2}{3}\right)}=$

(A) $(\log_e 4)^3$ (B) $\log_e 4$ (C) $12(\log_e 4)^3$ (D) $5(\log_e 4)^3$

43. $\lim_{x\to 0}\left(\frac{1+\tan x}{1+\sin x}\right)^{\operatorname{cosec} x}=$

(A) $\frac{1}{e}$ (B) e (C) e^2 (D) 1

44. $\lim_{x\to\frac{\pi}{2}}\frac{1-(\sin x)^{\sin x}}{\cos^2 x}=$

(A) 2 (B) 1 (C) 1/2 (D)1/4

45. $\underset{x\to 0}{Lim}\frac{x\left(1-\sqrt{1-x^2}\right)}{\left(\sin^{-1}(x)^3\right)}=$

(A) 1 (B) $\frac{1}{2}$ (C) $-\frac{1}{2}$ (D) -1

46. If , $\underset{x\to 5}{Lim}\frac{x^k-5^k}{x-5}=500$ then the positive integral value of k is

A) 3 B) 4 C) 5 D) 6

47. If $\lim_{x\to 0}\left(\frac{\cos 4x+a\cos 2x+b}{x^4}\right)$ is finite then the value of a and b respectively

A) 5 B) -5,-4 C) -4,3 D) 4,5

48. $\lim_{x\to 0}\frac{e^x-e^{\sin x}}{2(x-\sin x)}=$

A) -1/2 B) 1/2 C) 1 D) 3/2

49. $\underset{x\to 0}{Lim}\frac{(1-\cos 2x)\sin 5x}{x^2\sin 3x}=$

A) 10/3 B) 3/10 C) 6/5 D) 56

50. $\lim_{x\to 0}\frac{1-\cos x}{x\log(1+x)}=$

A) 1 B) 0 C) -1 D) $\frac{1}{2}$

51. $\underset{n\to\infty}{Lim}\left(\frac{1}{1.3}+\frac{1}{3.5}+....+\frac{1}{(2n-1)(2n+1)}\right)=$

A) 1 B) $\frac{1}{2}$ C) $\frac{1}{3}$ D) $\frac{1}{4}$

52. $\underset{x\to\frac{\pi}{4}}{Lt}\frac{\sqrt{2}-cosx-sinx}{(4x-\pi)^2}=$

A) $\frac{1}{16\sqrt{2}}$ B) $\frac{1}{32\sqrt{2}}$ C) $\frac{1}{16}$ D) $\frac{1}{8}$

53. $\underset{x\to 0}{Lim}\frac{8}{x^8}\left(1-\cos\frac{x^2}{2}-\cos\frac{x^2}{4}+\cos\frac{x^2}{2}.\cos\frac{x^2}{4}\right)=$

A) $\frac{1}{16}$ B) $\frac{1}{15}$ C) $\frac{1}{32}$ D) 1

54. $\underset{x\to 0}{Lim}\frac{27^x-9^x-3^x+1}{\sqrt{2}-\sqrt{1+\cos x}}=$

A) 0 B) 8 $\sqrt{2}$ (log3)^2 C) 8 (log3)^2 D) 1

55. If f (x) = $\frac{\sin 3x+A\sin 2x+B\sin x}{x^5}$; x $\neq$ 0 is continuous at x = 0, then

(A) A + B = 2 (B) A + B = 1 (C)) A + B = 0 (D) A B = 1

56. If $a.\lim_{x\to 1}x^{\frac{1}{1-x}}+b=e^{-1}$ $(a\geq 1:b\geq 0)$ then

(A) $a=1:b=e^{-1}$ (B) $a=2:b=e^{-1}$ (C) $a=-1:b=e^{-1}$ (D) $a=1:b=0$

57. $\lim_{x\to 2}\frac{2^x+2^{3-x}-6}{\sqrt{2^{-x}}-2^{1-x}}$ is

(A) 2 (B) 4 (C) 8 (D)16

58. Let $f(x)=\lim_{n\to\infty}\left(\sin\frac{\pi x}{2}\right)^{2n}$ then set of all points of discontinuity is

(A) Z (B) N (C) {2n + 1:n ∈ Z} (D) {2n: n ∈ Z}

59. $\lim_{x\to\frac{\pi}{2}}\frac{1-\sin\theta}{\left(\frac{\pi}{2}-\theta\right)\cos\theta}=$

(A) 1 (B) –1 (C) $-\frac{1}{2}$ (D) $\frac{1}{2}$

60. $\lim_{x\to 0}\frac{\tan x-\sin x}{x^3}=....$

(A) 0 (B) $\frac{1}{2}$ (C) $\frac{1}{3}$ (D) 2

61. $\lim_{\alpha\to\beta}\frac{\sin^2\alpha-\sin^2\beta}{\alpha^2-\beta^2}=$

(A) 0 (B) 1 (C) $\frac{\sin\beta}{\beta}$ (D) $\frac{\sin 2\beta}{2\beta}$

62. The integer n for which the $\lim_{x\to 0}\frac{(\cos x-1)(\cos x-e^x)}{x^n}$ is a finite non-zero number, is

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

63. If $\begin{cases}\frac{(1-\cos 4x)}{x^2} & if \quad x<0\\ a & if \quad x=0\\ \frac{\sqrt{x}}{\sqrt{16+\sqrt{x}}-4} & if \quad x<0\end{cases}$ then f(x) is continuous at x = 0, for a =

(A) 4 (B) $\sqrt{32}$ (C) 8 (D) 16.

64. If the function f(x) $\begin{cases}\frac{x^2-(k+2)x+2k}{x-2}, & for\ x\neq 2\\ 2 & for\ x=2\end{cases}$ is continuous at x =2, then k is

(A) $-\frac{1}{2}$ (B) -1 (C) 0 (D) 1

65. The function f(x) = $\left(\frac{\log_e(1+ax)-\log_e(1-bx)}{x}\right)$ is undefined at x = 0. The value which should be assigned to f at x = 0, so that it is continuous at x = 0 is

(A) $\frac{a+b}{2}$ (B) $a+b$ (C) $\log_e(ab)$ (D) $a-b$

66. If $f(x)=\begin{cases}\frac{3\sin\pi x}{5x} & ,x\neq 0\\ 2K & ,x=0\end{cases}$ is continuous at x = 0, then the value of K is

(A) $\frac{3\pi}{10}$ (B) $\frac{3\pi}{5}$ (C) $\frac{\pi}{10}$ (D) $\frac{3\pi}{2}$

67. for a real number x, let [x] denote the greatest integer less than or equal to x then $f(x)=\dfrac{\tan(\pi[x-\pi])}{1+[x]^2}$ is

(A) continuous at some x

(B) continuous at all x but $f'(x)$ does not exist

(C) $f'(x)$ exists for all x but $f''(x)$ does not exist

(D) $f'(x)$ exists for all x.

68. $f(x)=x\left[3-\log\left(\dfrac{\sin x}{x}\right)\right]-2$ to be continuous at $x=0$, then $f(0)=$

(A) 0 (B) 2 (C) –2 (D) 3

69. Let $f(x)=\begin{cases}\dfrac{(e^{kx}-1).\sin kx}{x^2} & if\ x\neq 0\\ 4 & if\ x=0\end{cases}$ is continuous at $x=0$ then $k=$

(A) ±1 (B) ±2 (C) 0 (D) ±3

70. If $f(x)=\begin{cases}\dfrac{1-\sqrt{2}\sin x}{\pi-4x}, & for\ x\neq\dfrac{\pi}{4}\\ a, & for\ x=\dfrac{\pi}{4}\end{cases}$, is continuous at $x=\dfrac{\pi}{4}$ then $a=$

(A) 4 (B) 2 (C) 1 (D) 1/4

71. Let $f(x)=\begin{cases}\dfrac{x(1+a\cos x)-b\sin x}{x^3} & if\ x\neq 0\\ 1 & if\ =0\end{cases}$. The values of a and b so that *f* is a continuous function at *x* = 0, are

(A) 5/2, 3/2 (B) 5/2, –3/2 (C) –5/2, –3/2 (D) –5/2, 3/2

72. If $f(x)=\begin{cases}\dfrac{72^x-9^x-8^x+1}{\sqrt{2}-\sqrt{1+\cos x}}, & if\ x\neq 0\\ K\log 2\log 3, & if\ x=0\end{cases}$ is a continuous function then K is equal to

(A) $\sqrt{2}$ (B) 24 (C) $18\sqrt{3}$ (D) $24\sqrt{2}$

73. The function $g(x)=\begin{cases}k\sqrt{x+1}; & 0\leq x\leq 3\\ mx+2; & 3<x\leq 5\end{cases}$ is

Differentiable, then the value of $k+m$ is

(A) $\dfrac{10}{3}$ (B) 4 (C) 2 (D) $\dfrac{16}{5}$

74. If $f(x)=\begin{cases}(1+|\sin x|)^{\frac{a}{|\sin x|}} & if\ -\dfrac{\pi}{6}<x<0\\ b & if\ x=0\\ e^{\frac{\tan 2x}{\tan 3x}} & if\ 0<x<\dfrac{\pi}{6}\end{cases}$ is continuous at *x* = 0 then

(A) $a=e^{2/3}, b=2/3$ (B) $a=2/3, b=e^{2/3}$ (C) $a=1/3, b=e^{1/3}$ (D) $a=e^{1/3}, b=e^{1/3}$

75. $f(x)=\begin{cases}\dfrac{(x+bx^2)^{1/2}-x^{1/2}}{bx^{3/2}}, & if\ x>0\\ c\quad, & if\ x=0\\ \dfrac{\sin(a+1)x+\sin x}{x}, & if\ x<0\end{cases}$ is continuous at $x = 0$ then

(A) $a=\dfrac{-3}{2}, b=0, c=\dfrac{1}{2}$ (B) $a=\dfrac{-3}{2}, b\neq 0, c=\dfrac{1}{2}$

(C) $a=\dfrac{3}{2}, b\neq 0, c=\dfrac{1}{2}$ (D) $a=\dfrac{3}{2}, b\neq 0, c=-\dfrac{1}{2}$

76. If $f(x)=\begin{cases}\dfrac{1}{e^{4x}+1}, & x\neq 0\\ 0\quad, & x=0\end{cases}$, then

(A) $\lim\limits_{x\to 0^+} f(x)=1$ (B) $\lim\limits_{x\to 0^-} f(x)=0$

(C) $f(x)$ is discontinuous at $x = 0$ (D) f(x) is continuous at x = 0

77. If $f(x)=\begin{cases}\dfrac{\log(1+2ax)-\log(1-bx)}{x}, & x\neq 0\\ k\quad, & x=0\end{cases}$ is continuous at x = 0, then k is equal to

(A) 2a + b (B) 2a – b (C) b – 2a (D) a + b

78. If $f(x)=\begin{cases}[x]+[-x], & x\neq 2\\ \lambda\quad, & x=2\end{cases}$ (where, [.] denotes greatest integer function), f is continuous then λ equal to

(A) –1 (B) 0 (C) 1 (D) 2

79. If $f(x)=\begin{cases}\dfrac{1-\cos 4x}{x^2}, & x<0\\ a, & x=0\\ \dfrac{\sqrt{x}}{\sqrt{16+\sqrt{x}}-4}, & x>0\end{cases}$, then the correct statement is

(A) f(x) is continuous at x = 0 and the value of a = 8
(B) f(x) is continuous at x = 0 and the value of a = 6
(C) f(x) is discontinuous at x = 0 and the value of a = 4
(D) f(x) is continuous at x = 0 and the value of a = 2

80. If $f(x)=\begin{cases}-4\sin x+\cos x, & \text{for } x\leq -\dfrac{\pi}{2}\\ a\sin x+b, & \text{for } -\dfrac{\pi}{2}<x<\dfrac{\pi}{2}\\ \cos x+2, & \text{for } \dfrac{\pi}{2}\leq x\end{cases}$ is continuous for all x, then the values of a and b are

(A) –1, 3 (B) 1, –3 (C) 1, 3 (D) –1, –3

81. The point of non-differentiability of the function $f(x)=\big|\,||x-1|-1|-1\,\big|$ are:

(A) $\{0, 1, 2, 3, 4\}$ (B) $\{-1, 0, 1, 2, 3\}$ (C) $\{-1, 0, 1\}$ (D) None of these

82. If $f(x)=\frac{1}{(x+1)(x-2)}$ and $g(x)=\frac{1}{x^2}$, then the points of discontinuity of $f(g(x))$ are

(A) $\left\{-1, 0, 1, \frac{1}{\sqrt{2}}\right\}$ (B) $\left\{-\frac{1}{2}, -1, 0, 1, \frac{1}{\sqrt{2}}\right\}$

(C) $\{0, 1\}$ (D) $\left\{0, 1, \frac{1}{\sqrt{2}}\right\}$

83. If $f(x)=\begin{cases}\left(\frac{e^{1/x}-e^{-1/x}}{e^{1/x}+e^{-1/x}}\right), & x\neq 0\\ 0, & x=0\end{cases}$, then at x = 0, f(x) is

(A) differentiable (B) not differentiable (C) $f'(0^+)=1$ (D) $f'(0^-)=1$

84. The function $f(x)=(x^2-1)|x^2-3x+2|+\cos(|x|)$ is not differentiable at x =

(A) –1 (B) 0 (C) 1 (D) 2

85. Which of the following function is differentiable at x = 0?

(A) $\cos(|x|)+|x|$ (B) $\cos(|x|)-|x|$ (C) $\sin(|x|)+|x|$ (D) $\sin(|x|)-|x|$

86. If the function f(x) is differentiable at x = a, then $\lim_{x\to a}\frac{x^2f(a)-a^2f(x)}{x-a}$ is

(A) $2af(a)+a^2f'(a)$ (B) $-a^2f'(a)$ (C) $af(a)-a^2f'(a)$ (D) $2af(a)-a^2f'(a)$

87. If for all values of x and y, f(x + y) = f(x) . f(y) and f(5) = 2, $f'(0)=3$, then $f'(5)$ is

(A) 3 (B) 4 (C) 5 (D) 6

88. Suppose f(x) is differentiable at x = 1, $\lim_{h\to 0}\frac{f(1+h)}{h}=5$, then $f'(1)$ equals

(A) 3 (B) 4 (C) 5 (D) 6

89. Let $f(x)=[n+p\sin x], x\in(0,\pi), n\in Z, p$ is a prime number and [.] denotes the greatest integer function. The number of points at which f(x) is not differentiable is

(A) p (B) p – 1 (C) 2p + 1 (D) 2p – 1

90. If g is the inverse of a function f and $f'(x)=\frac{1}{1+x^n}$, then $g'(x)$ is equal to

(A) $\frac{1}{1+\{g(x)\}^n}$ (B) $1+\{g(x)\}^n$ (D) $\{g(x)\}^n-1$ (D) none of these

91. A 13 ft ladder is leaning against a wall when its base starts to slide away. At the instant when the base is 12 ft away from the wall, the base is moving away from the wall at the rate of 5 ft/s. The rate at which the angle θ between the ladder and the ground is changing, is

(A) $-\frac{12}{13}$ rad / s (B) -1rad / s (C) $-\frac{13}{12}$ rad / s (D) $\frac{10}{13}$ rad / s

92. Water is poured into an inverted conical vessel of which the radius of the base is 2m and height 4m at the rate of 77 L/min. The rate at which the water level is rising at the instant when the depth is 70 cm, is

(A) 10 cm/min (B) 20 cm/min (C) 40 cm/min (D) none of these

93. If x and y are the sides of two square such that $y = x - x^2$. Then, the rate of change, if the area of second square with respect to the first square, when x = 2, is
(A) 1 (V) 4 (C) 3 (D) 6

94. The number of values of c such that the straight line 3x + 4y = c touches the curve $\frac{x^4}{2} = x + y$, is
(A) 0 (B) 1 (C) 2 (D) 4

95. The tangent to the curve $3xy^2 - 2x^2y = 1$ at (1, 1) meets the curve again the point
(A) (16/5, 1/20) (B) (–16/5, –11/20) (C) (1/20, 16/5) (D) None of these

96. The equation of tangent to the curve $y = x + \frac{4}{x^2}$, which is parallel to the X-axis, is
(A) y = 0 (B) y = 1 (C) y = 2 (D) y = 3

97. The normal to the curve, $y = f(x)$ at the point (3, 4) makes an angle $3\pi/4$ with the positive X-axis, then $f'(3)$ equal to
(A) –1 (B) –3/4 (C) 4/3 (D) 1

98. Angle between the tangents to the curve $y = x^2 - 5x + 6$ at the points (2, 0) and (3, 0), is
(A) $\pi/2$ (B) $\pi/6$ (C) $\pi/4$ (D) $\pi/3$

99. Let $f(x) = x^3 + ax + b$ with $a \neq b$ and suppose the tangent lines to the graph of f at x = a and x = b have the same gradient. Then, the value of f(1) is
(A) 0 (B) 1 (C) $\frac{-1}{3}$ (D) $\frac{2}{3}$

100. The curve $y - e^{xy} + x = 0$ has a vertical tangent at
(A) (1, 1) (C) (0, 1) (C) (1, 0) (D) no point

101. The coordinates of point(s) at each of which the tangents to the curve $y = x^3 - 3x^2 - 7x + 6$ cut off on the positive semi-axis OX a line segment half that on the negative semi-axis OY is given by
(A) (–1, 9) (B) (3, –15) (C) (1, –3) (D) None of these

102. At any point of a curve $\sqrt{\frac{\text{subnormal}}{\text{subtangent}}}$ is
(A) the abscissa of that point (B) the ordinate of that point
(C) slope of the tangent at that point (D) slope of the normal at the point

103. The length of subnormal of the curve $y^2 = 8ax\,(a > 0)$ is
(A) 2a (B) 4a (C) 6a (D) 8a

104. Find the approximate value of $\{(3.92)^2 + 3(2.1)^4\}^{1/6}$.
(A) 2.566 (B) 2.366 (C) 2.466 (D) None of these

105. The pressure p and the volume *v* of a gas are connected by the relation $pv^{1.4}$ = const. Find the percentage error in *p* corresponding to a decrease of 1.2% in *v*.
(A) 0.3 (B) 0.5 (C) 0.7 (D) None of these

106. The normal to the curve $x = a(1 + \cos\theta), y = a\sin\theta$ at 'θ' always passes through the fixed point:
(A) (a, 0) (B) (a, a) (C) (0, a) (D) (0, –a)

107. Slope of tangent to $x^2 = 4y$ at (–1, –1) is:
(A) $\frac{-1+\sqrt{5}}{2}$ (B) $\frac{1+\sqrt{5}}{2}$ (C) $-\frac{1}{2}$ (D) none of these

108. If the subnormal to the curve $x^2 . y^n = a^2$ is a constant then n =
(A) –4 (B) –3 (C) –2 (D) –1

109. The point(s) on the curve $y^3+3x^2=12y$ where the tangent is vertical, is (are):

(A) $\left(\pm\frac{4}{\sqrt{3}},-2\right)$ (B) $\left(\pm\frac{\sqrt{11}}{3},1\right)$ (C) (0, 0) (D) $\left(\pm\frac{4}{\sqrt{3}},2\right)$

110. If the normal to the curve y = f(x) at (3, 4) makes an angle $\frac{3\pi}{4}$ with the positive x-axis then f '(3) =

(A) 1 (B) –1 (C) $\frac{-3}{4}$ (D) $\frac{4}{3}$

111. The slope of the normal to the curve given by $x=a(\theta-\sin\theta),\ y=a(1-\cos\theta)$ at $\theta=\frac{\pi}{2}$

(A) $\frac{-1}{2}$ (B) $\frac{1}{2}$ (C) -1 (D) 2

112. The line $\frac{x}{a}+\frac{y}{b}=2$ is a tangent to the curve $\left(\frac{x}{a}\right)^n+\left(\frac{y}{b}\right)^n=2$ at (a, b) then $n\in$

(A) Z (B) R-Z (C) N (D) R – {0}

113. The points on the curve $y=x^2+\sqrt{1-x^2}$ at which the tangent is perpendicular to x-axis are

(A) (1, 1) only (B) $(\pm1,1)$ (C) $(1,\pm1)$ (D) $(-1,1)$ only

114. The point on the curve $y=be^{\frac{-x}{a}}$ at which the tangent drawn is $\frac{x}{a}+\frac{y}{b}=1$ is

(A) (0, b) (B) $\left(a,\frac{1}{e}\right)$ (C) (0, 1) (D) (1, 0)

115. The sum of the squares of the intercepts on the axes of the tangent at any point on the curve $x^{2/3}+y^{2/3}=a^{2/3}$ is

(A) $\frac{a^2}{2}$ (B) a^2 (C) $2a$ (D) $\frac{3a}{2}$

116. If the straight line $x\cos\alpha+y\sin\alpha=p$ touches the curve $\left(\frac{x}{a}\right)^n+\left(\frac{y}{b}\right)^n=2$ at the point (a, b) on it, then $\frac{1}{a^2}+\frac{1}{b^2}=$

(A) $\frac{1}{p^2}$ (B) $\frac{2}{p^2}$ (C) $\frac{3}{p^2}$ (D) $\frac{4}{p^2}$

117. If the curves x = y² and xy = k cut each other orthogonally then k² =

(A) $\frac{1}{2}$ (B) $\frac{1}{4}$ (C) $\frac{1}{8}$ (D) $\frac{1}{16}$

118. The angle between the curves y = x³ and $y=e^{3(x-1)}$ at (1, 1) is

(A) 0 (B) $\frac{\pi}{6}$ (C) $\frac{\pi}{4}$ (D) $\frac{\pi}{2}$

119. If the curves ay + x² = 7 and x³ = y cut orthogonally at (1, 1) then a =

(A) 1 (B) -6 (C) 6 (D) 1/6

120. A particle moves along a line is given by $S=\frac{t^3}{3}-3t^2+8t$ then the distance travelled by the particle before it first comes to rest is

(A) $\frac{40}{3}$ unit (B) $\frac{20}{3}$ unit (C) $\frac{3}{20}$ unit (D) $\frac{8}{3}$ unit

121. A particle is moving along a line such that $s = 3t^3 - 8t + 1$. Find the time 't' when the distance 'S' travelled by the particle increases.

(A) $t > \frac{2\sqrt{2}}{3}$ (B) $t < \frac{2\sqrt{2}}{3}$ (C) $t < \frac{-2\sqrt{3}}{\sqrt{2}}$ (D) $t = 0$

122. A particle moves along a line by $S = t^3 - 9t^2 + 24t$ the time when its velocity decreases.

(A) $t > 3$ (B) $t = 5$ (C) $t < 3$ (D) $t > 5$

123. The value of 'a' for which $x^3 - 3x + a = 0$ has two distinct roots in [0, 1] is given by

(A) -1 (B) 1 (C) 3 (D) does not exists

124. The value of 'c' in Lagrange's mean value theorem for $f(x) = x(x-2)^2$ in [0, 2]

(A) 0 (B) 2 (C) 2/3 (D) 3/2

125. For the function $f(x) = x^3 - 6x^2 + ax + b$, if Roll's theorem holds in [1, 3] with $c = 2 + \frac{1}{\sqrt{3}}$ then (a, b) =

(A) (11, 12) (B) (11, 11) (C) (11, any value) (D) (any value, 0)

PHYSICS

Syllabus: ***MAGENETISM AND OPTICS:– 1. MAGNETISM AND MATTER, 2. RAY OPTICS, 3. WAVE OPTICS.***

1. The angle of dip at a place is δ. If the dip is measured in a plane making an angle θ with the magnetic meridian, the apparent angle of dip δ_1 will be

(A) $\tan^{-1}(\tan\delta)$ (B) $\tan^{-1}(\tan\delta\cos\theta)$ (C) $\tan^{-1}(\tan\delta\sec\theta)$ (D) 0

2. For magnets of magnetic moments M, 2M, 3M and 4M are arranged in the from of a square such that unlike poles are in contact. Then the resultant magnetic moment is

(A) $2\sqrt{2}M$ (B) $\sqrt{2}M$ (C) 10 M (D) 2 M

3. A long thin magnet of moment M is bent into a semi circle. The decrease in the Magnetic moment is

(A) $2M/\pi$ (B) $\pi M/2$ (C) $M(\pi-2)/\pi$ (D) $M(2-\pi)/2$

4. A magnet of magnetic moment $20\hat{k}$ Am² is placed along the z-axis in a magnetic field $\vec{B} = (0.4\hat{j} + 0.5\hat{k})$ T. The torque acting on the magnet is

(A) $8\hat{i}N-m$ (B) $6\hat{j}\,N-m$ (C) $-8\hat{i}\,N-m$ (D) $-6\hat{j}\,N-m$

5. A magnetised wire is bent into an arc of a circle subtending an angle 60° at its centre. Then its magnetic moment is X. If the same wire is bent into an arc of a circle subtending an angle 90° at its centre then its magnetic moment will be

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

6. Two magnets of magnetic moments M and $\sqrt{3}M$ are joined to form a cross +. The combination is suspended freely in a uniform magnetic field. In the equilibrium position, the angle between the magnetic moment $\sqrt{3}$ M and the field is

(A) 30° (B) 45° (C) 60° (D) 90°

7. A bar magnet of magnetic moment ‘M’ is bent in the form of an arc which makes angle 60°.The percentage change in the magnetic moment is
(A) 9% increase (B) 9 % decrease (C) 4.5 % decrease (D) 4.5 % increase

8. A circular coil of radius 10 cm and 100 turns carries a current 1A. What is the magnetic moment of the coil?
(A) 3.142 Am^2 (B) 3.142×10^4 Am^2 (C) 6.28×10^{-6} T (D) 6.28×10^{-1} T

9. The rate of change of torque $'\tau'$ with deflection θ is maximum for a magnet suspended freely in a uniform magnetic field of induction B when θ is equal to
(A) 0° (B) 45° (C) 60° (D) 90°

10. At a certain place, the horizontal component of earth’s magnetic field is √3 times the vertical component. The angle of dip at that place is
(A) 60^0 (B) 45^0 (C) 90^0 (D) 30^0

11. Two Magnets of same size and mass make respectively 10 and 15 oscillations per minute at certain place. The ratio of their magnetic moments is
(A) 4 : 9 (B) 9 : 4 (C) 2 : 3 (D) 3 : 2

12. Relative permittivity and permeability of a material are ε_r and μ_r, respectively. Which of the following values of these quantities are allowed for a diamagnetic material
(A) $\varepsilon_r = 1.5, \mu_r = 0.5$ (B) $\varepsilon_r = 0.5, \mu_r = 0.5$
(C) $\varepsilon_r = 1.5, \mu_r = 1.5$ (D) $\varepsilon_r = 0.5, \mu_r = 1.5$

13. Needles N_1, N_2 and N_3 are made of a ferromagnetic, a paramagnetic and diamagnetic substance respectively. A magnet when brought close to them will
(A) Attract N_1 strongly, N_2 weakly and repel N_3 weakly
(B) Attract N_1 strongly, but repel N_2 and N_3 weakly
(C) Attract all three of them
(D) Attract N_1 and N_2 strongly but repel N_3

14. When a ferromagnetic material is heated to temperature above its Curie temperature, the material
(A) Is permanently magnetized
(B) Remains ferromagnetic
(C) Behaves like a diamagnetic material
(D) Behaves like a paramagnetic material

15. Two identical short bar magnets, each having magnetic moment M, are placed a distance of 2d apart with axes perpendicular to each other in a horizontal plane. The magnetic induction at a point midway between them is
(A) $\frac{\mu_0}{4\pi}\left(\sqrt{2}\right)\frac{M}{d^3}$ (B) $\frac{\mu_0}{4\pi}\left(\sqrt{3}\right)\frac{M}{d^3}$ (C) $\left(\frac{2\mu_0}{\pi}\right)\frac{M}{d^3}$ (D) $\frac{\mu_0}{4\pi}\left(\sqrt{5}\right)\frac{M}{d^3}$

16. A current loop of area 0.01 m^2 and carrying a current of 10A is held perpendicular to a magnetic field of intensity 0.1 T. The torque (in Nm) acting on the loop is:
(A) 0 (B) 0.001 (B) 0.01 (D) 1.1

17. A magnet of dipole moment m is aligned in equilibrium position in a magnetic field of intensity B. The work done to rotate it through an angle θ with the magnetic field is:
(A) $mB\sin\theta$ (B) $mB\cos\theta$ (B) $mB(1-\cos\theta)$ (D) $mB(1-\sin\theta)$

18. When a current carrying coil is situated in a uniform magnetic field with its magnetic moment anti-parallel to the field
(i) Torque on it is maximum (ii) Torque on it is minimum
(iii) PE of loop is maximum (iv) PE of loop is minimum
(A) only i and ii are true (B) only ii and iii are true
(C) only iii and iv are true (D) only i, ii, and iii are true

19. A bar magnet is placed inside a non-uniform magnetic field. It experiences:
(A) a force and a torque (B) a force but not a torque
(C) a torque but not a force (D) neither a force nor a torque

20. A wire of length L m carrying a current of IA is bent in the form of a circle. Its magnitude of magnetic moment i
(A) $\frac{IL}{4\pi}$ (B) $\frac{IL^2}{4\pi}$ (C) $\frac{I^2L^2}{4\pi}$ (D) $\frac{I^2L}{4\pi}$

21. The mass of an iron rod is 80 gm and its magnetic moment is 10 Am^2. If the density of iron is 8gm/c.c. Then the value of intensity of magnetization will be
(A) 10^6 A/m (B) 10^4 A/m (C) 10^2 A/m (D) 10 A/m

22. Liquids and gases never exhibit
(A) diamagnetic properties (B) para magnetic properties
(C) ferro magnetic properties (D) electron magnetic properties

23. The magnetic susceptibility is negative for
(A) Paramagnetic material only
(B) Ferromagnetic material only
(C) Paramagnetic and ferromagnetic materials
(D) Diamagnetic material only.

24. χ_1 and χ_2 are susceptibilities of diamagnetic substance at temperatures T_1K and T_2K respectively, then
(A) $\chi_1 T_2 = \chi_2 T_2$ (B) $\chi_1 = \chi_2$ (C) $\chi_1\sqrt{T_1} = \chi_2\sqrt{T_2}$ (D) $\chi_1 T_2 = \chi_2 T_1$

25. A bar magnet of length 16cm has apole strength of 500 milliampa.m. The angle at which it should be placed to the direction of external magnetic field of induction 2.5 gauss so that it may experience a torque of $\sqrt{3}\times10^{-5}$ Nm is
(A) π (B) π/2 (C) π/3 (D) π/6

26. A rectangular coil of wire carrying a current is suspended in a uniform magnetic field. The plane of the coil is making an angle of 30^0 with the direction of the field and the torque experienced by it is τ_1 and when the plane of the coil is making an angle of 60^0 with the direction of the field the torque experienced by it is τ_2. Then the ratio $\tau_1 : \tau_2$ is
(A) 1 :√3 (B) √3 : 1 (C) 1 : 3 (D) 3 : 1

27. The permeability of a material is 0.9. The material is
(A) Diamagnetic (B) Para magnetic
(C) Electro-magnetic (D) Ferro magnetic

28. A thin bar magnet of length 2L is bent at the mid point so that the angle between them is 60°. The new length of the magnet is
(A) $\sqrt{2}$L (B) $\sqrt{3}$L (C) 2L (D) L

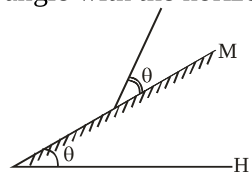
29. For an isotropic medium B, μ, H and M are related as:
(where B, μ_0, H and M have their usual meaning in the context of magnetic materials)
(A) $B - M = \mu_0 H$ (B) $M = \mu_0(H + M)$ (C) $H = \mu_0 (H + M)$ (D) $B = \mu_0(H + M)$

30. A bar magnet is placed with its North pole pointing North. Neutral point is at a distance 'd' from the centre of magnet. The net magnetic induction at the same distance on the axial line of the magnet is
(A) $2B_H$ (B) $3B_H$ (C) B_H (D) $7B_H$

31. The period of oscillation of a magnet at a place is 4 seconds. When it is remagnetised, so that the pole strength becomes $1/9^{th}$ of initial value, the period of oscillation in seconds is
(A) 3 (B) 12 (C) 5 (D) 4

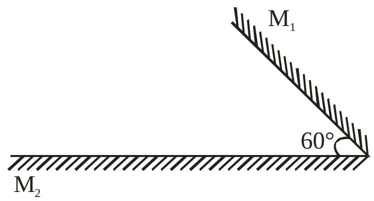
32. The angle of the dip at a place is 40.6° and the vertical component of the earths magnetic field $B_V = 6\times10^{-5}T$. The total intensity of the earth's magnetic field at this place is $(\sin 40.6° = 0.65)$
(A) $7\times10^{-5}T$ (B) $6\times10^{-5}T$ (C) $5\times10^{-5}T$ (D) $9.2\times10^{-5}T$

33. A mirror is inclined at an angle θ with the horizontal. If a ray of light is incident at an angle θ, then the reflected ray makes the following angle with the horizontal:



(A) θ (2) 2θ (C) θ/2 (D) none of these

34. Two plane mirrors are inclined at an angle of 60° as shown in figure. A ray of light incident on one mirror is parallel to the other. What will be the angle between the first incident ray and the last reflected ray?



(A) 120° (B) 60° (C) 30° (D) 0°

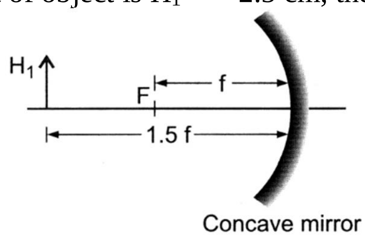
35. A man standing in front of a concave spherical mirror of radius of curvature 120 cm sees an erect image of this face four times its natural size. Then the distance of the man from the mirror is

(A) 180 cm (B) 300 cm (C) 240 cm (D) 45 cm

36. A concave mirror of focal length 15 cm forms an image having twice the linear dimensions of the object. The position of the object when the image is virtual will be

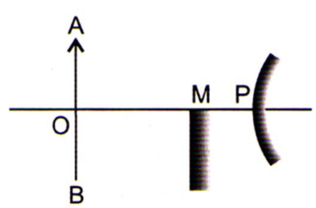
(A) 22.5 cm (B) 7.5 cm (C) 30 cm (D) 45 cm

37. If in the following figure, height of object is $H_1 = + 2.5$ cm, then height of image H_2 formed is:



(A) –5 cm (B) +5 cm (C) +7.5 cm (D) –7.5 cm

38. A convex mirror, a plane mirror and a needle object (AB) are placed on an optical bench as shown in the adjoining figure so that the images of the object needle due to the convex mirror and the plane mirror are formed one above the other without parallax.



Then in the convex mirror formula $\frac{1}{\upsilon}+\frac{1}{u}=\frac{1}{f}$, which of the following are correct?

1. u – OP 2. υ = OM – MP (C) f = MP

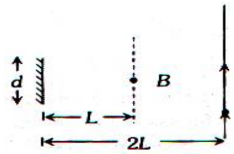
Select the correct answer using the code given below:

(A) 1 and 2 (B) 2 and 3 (C) 1 and 3 (D) 1, 2 and 3

39. A concave mirror having the focal length 15 cm, forms an image having twice of the linear dimensions of the object. If the image is virtual, then the position of the object will be:

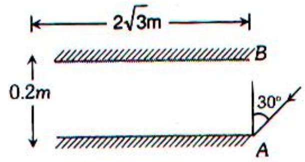
(A) 7.5 cm (B) 22.5 cm (C) 40 cm (D) 30 cm

40. A point source of light B is placed at a distance L in front of the centre of a mirror of width *d* hung vertically on a wall. A man walks in front of the mirror along a line parallel to the mirror at a distance 2L from it as shown. The greatest distance over which he can see the image of the light source in the mirror is



(A) d/2 (B) d (C) 2d (D) 3d

41. Two plane mirrors A and B are aligned parallel to each other, as shown in the fig. A light ray is incident at an angle of 30^0 at a point just inside on end of A. The plane of incidence coincides with the plane of the fig. The maximum number of times the ray undergoes reflections (including the first one) before it emerges out is

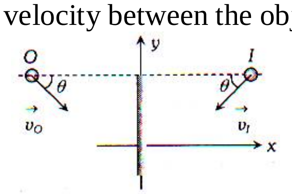


(A) 28 (B) 30 (C) 32 (D) 34

42. A thin rod of length *f*/3 lies along the axis of a concave mirror of focal length *f*. One end of its magnifies image touches an end of the rod. The length of the image is

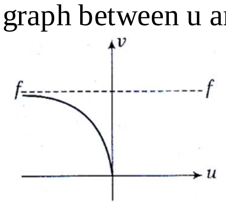
(A) f (B) $\frac{1}{2}f$ (C) $2f$ (D) $\frac{1}{4}f$

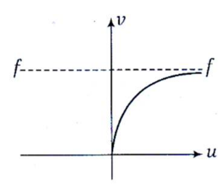
43. If an object moves towards a plane mirror with a speed *v* at an angle θ to the perpendicular to the plane of the mirror, find the relative velocity between the object and the image

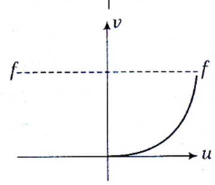


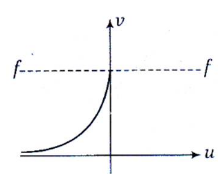
(A) v (B) $2v$ (C) $2v\cos\theta$ (D) $2v\sin\theta$

44. The graph between u and v for a convex mirror is

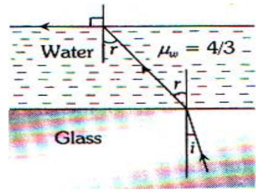
(A)


(B)


(C)


(D)


45. A ray of light is incident at the glass-water interface at an angle *i*, it emerges finally parallel to the surface of water then the value of μ_g would be



(A) $\left(\frac{4}{3}\right)\sin i$ (B) $\frac{1}{\sin i}$ (C) $\frac{4}{3}$ (D) 1

46. A point object is moving on the principal axis of a concave mirror of focal length 24cm towards the mirror. When it is at a distance of 60cm from the mirror, its velocity is 9cm/sec. What is the velocity of the image at that instant

(A) 5cm/sec towards the mirror (B) 4cm/sec towards the mirror

(C) 4cm/sec away from the mirror (D) 9cm/sec away from the mirror

47. For a concave mirror of focal length *f*, the image is 2 times larger than the object, then the object distance from the mirror is

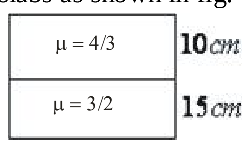
(A) $\frac{f}{2}$ (B) f (C) $\frac{f}{4}$ (D) $\frac{3f}{4}$

48. Which of the following (referred to a spherical mirror) depends upon whether the rays are paraxial or not?

(A) Pole (B) Focus

(C) Radius of curvature (D) Principal axis

49. Ray of light is incident normally on two slabs as shown in fig. The equivalent refractive index is



(A) 1.4 (B) 1.8 (C) 1.6 (D) 2.3

50. For a concave mirror

(A) virtual image is always larger in size compared to size of object

(B) real image is always smaller in size compared to size of object

(C) real image is always larger in size compared to size of object

(D) virtual image cannot be formed

51. A convex mirror is used to form an image of a real object. Then, the wrong statement is

(A) the image lies between the pole and the focus

(B) the image is diminished in size

(C) the image is erect

(D) the image is real

52. Total internal reflection takes place

(A) when a ray moves from denser to rarer and incident angle is greater than critical angle

(B) when a ray moves from rarer to denser and incident angle is less than critical angle

(C) when a ray moves from rarer to denser and incident angle is equal to critical angle

(D) none of the above

53. A vessel is half-filled with a liquid of refractive index μ. The other half of the vessel is filled with an immiscible liquid of refractive index 1.5μ. The apparent depth of the vessel is 50% of the actual dept. Then μ is

(A) 1.4 (B) 1.5 (C) 1.6 (D) 1.67

CHEMISTRY

Syllabus: ***SECOND YEAR PHYSICAL CHEMISTRY:– 1. SOLID STATE, 2. SOLUTIONS, 3. ELECTRO CHEMISTRY AND CHEMICAL KINETICS 4.SURFACE CHEMISTRY***

1. A binary solid (A^+B^-) has a zinc blende structure with B^- ions constituting the lattice and A^+ ions occupying in 25% tetrahedral holes. The formula of solid is

(A) AB (B) A_2B (C) AB_2 (D) AB_4

2. In a close packed array of N spheres, the number of tetrahedral holes are

(A) N/2 (B) 4N (C) 2N (D) N

3. An element occurs in the bcc structure with a cell edge length of 288 pm. The density of the element is 7.2 g cm-3. How many atoms of the elements does 208 g of the element contain?

(A) 24.16×10^{25} (B) 24.16×10^{23} (C) 24.16×10^{24} (D) 24.16×10^{26}

4. In closest packing of A type of atoms (radius, r_A), the radius of atom B that can be fitted into octahedral void is

(A) 0.155 r_A (B) 0.125 r_A (C) 0.414 r_A (D) 0.732 r_A

5. In *fcc* arrangement of A and B atoms, where A atoms are at the corners of the unit cell, B atoms at the face centres, two atoms are missing from two corners in each unit cell, then the simplest formula of the compound is

(A) A_7B_6 (B) A_6B_7 (C) A_7B_{24} (D) AB_4

6. In fluorite structure (CaF_2)

(A) Ca^{++} ions are *ccp* and F^- ions are present in all the tetrahedral voids

(B) Ca^{++} ions are *ccp* and F^- ions are present in all the octahedral voids

(C) Ca^{++} ions are *ccp* and F^- ions are present in all the octahedral voids are half of ions are present in tetrahedral voids

(D) None of these

7. When NaCl crystal is doped with $MgCl_2$, the nature of defect produced is

(A) interstitial defect (B) Schottky defect (C) Frenkel defect (D) none of these

8. The ratio of Fe^{3+} and Fe^{2+} ions in $Fe_{0.9}S_{1.0}$ is

(A) 0.28 (B) 0.5 (C) 2 (D) 4

9. In a ferromagnetic material

(A) all the magnetic moment vectors are aligned in one direction

(B) half of the magnetic moment vectors point in one direction and rest in the opposite direction

(C) all the magnetic moment vectors are randomly oriented

(D) is characterized by small magnetic moment

10. In a cubic packed structure of mixed oxides, the lattice is made up of oxide ions, one fifth of tetrahedral voids are occupied by divalent (X^{2+})ions, while one-half of the octahedral voids are occupied by trivalent ions (Y^{3+})then the formula of the oxide is

(A) XY_2O_4 (B) X_2YO_4 (C) $X_4Y_5O_{10}$ (D) $X_5Y_4O_{10}$.

11. A compound XY crystallized in bcc lattice with unit cell edge length of 480 pm, if the radius of Y^- is 225 pm, then the radius of X^+ is

(A) 190.70 pm (B) 225 pm (C) 127.5 pm (D) none of these

12. The 8 : 8 type of packing is present in

(A) CsCl (B) KCl (C) NaCl (D) MgF_2.

13. An element having (atomic mass = 100 g/mol) bcc structure has unit cell edge 400 pm. The density of the element is

(A) $10.376 g/cm^3$ (B) $5.1888 g/cm^3$ (C) $7.289 g/cm^3$ (D) $2.144 g/cm^3$

14. What is the coordination number of sodium in Na_2O ?

(A) 6 (B) 4 (C) 8 (D) 2-

15. A metal 'M' is crystallized in F. C. C lattice. The number of unit cells in it having 2.4×10^{24} atoms.

(A) N (B) N/2 (C) 2N (D) 4N

16. The cubic unit cells of a metal (molar mass = 63.55 $gmol^{-1}$) has an edge length of 362 pm. Its density is 8.92 gcm^{-3}. The type of unit cells is

(A) primitive (B) face centred (C) body centred (D) end centred

17. Ferromagnetism is in

(A) ↑↑↑↑↑ (B ↑↓↑↓ (C) ↑↑↑↓↓ (D) ↑↑↓↓↑↑↑↓↓↓

18. A solid has a structure in which W atoms are located at the corners of the cubic lattice, O atoms at the centre of the edges and Na atom at the centre of the cube. The formula of the compound is

(A) $NaWO_2$ (B) Na_2WO_3 (C) $NaWO_3$ (D) $NaWO_4$

19. A metallic element has a cubic lattice. Each edge of the unit cell is 2A^o. The density of the metal is 2.5 gcm^{-3}. The unit cells in 200g of metal are

(A) 1×10^{24} (B) 1×10^{20} (C) 1×10^{22} (D) 1×10^{25}

20. A metallic element crystallizes into a lattice containing a sequence of laytersof ABABAB… Any packing of spheres leaves out voids in the lattice. Percentage of empty space (by volume) is:

(A) 52% (B) 26% (C) 50% (D) 74%

21. When molten Zn is cooled to solid state, it assumes hcp structure. Then the number of nearest neighbours of Zn atoms will be

(A) 4 (B) 6 (C) 8 (D) 12

22. Which of the following systems is not correctly characterized?

(A) cubic : $a=b=c;\alpha=\beta=\gamma=90^o$ (B) tetragonal : $a=b\neq c;\alpha=\beta=\gamma=90^o$

(C) orthorhombic : $a\neq b\neq c;\alpha=\beta=\gamma=90^0$ (D) rhombohedral : $a=b\neq c;\alpha=\beta=\gamma=90^o$

23. Which type of semiconductor is obtained on mixing the arsenic into the silicon?

(A) n-type (B) p-type (C) internal (D) both (1) and (2)

24. AB is an ionic solid. If the ratio of ionic radii of A^+ and B^- is 0. 52. What is the co-ordination number of B^-?

(A) 2 (B) 3 (C) 6 (D) 8

25. In a compound atoms of element Y from ccp lattice and those of element X occupy 2/3rd of tetrahedralvoids. The formula of the compound will be

(A) X_4Y_3 (B) X_2Y_3 (C) X_2Y (D) X_3Y_4

26. The edge length of a face centered cubic cell of an ionic substance is 508 pm. If the radius of the cation is 110 pm, the radius of the anion is

(A) 288 pm (B) 398 pm (C) 618 pm (D) 144 pm

27. In a face centred cubic lattice, atom A occupies the corner positions and atom B occupies the face centre positions. If one atom of B is missing from one of the face centred points, the formula of the compound is

(A) AB_2 (B) A_2B_3 (C) A_2B_5 (D) A_2B

28. Lithium forms body centred cubic structure. The length of the side of its unit cell is 351 pm. Atomic radius of the lithium will be

(A) 75 pm (B) 300 pm (C) 240 pm (D) 152 pm

29. CsCl crystallizes in body centred cubic lattice. If 'a' is its edge length then which of the following expressions is correct

(A) $r_{Cs^+}+r_{Cl^-}=\frac{\sqrt{3}}{2}a$ (B) $r_{Cs^+}+r_{Cl^-}=\sqrt{3}a$

(C) $r_{Cs^+}+r_{Cl^-}=3a\,b$ (D) $r_{Cs^+}+r_{Cl^-}=\frac{3a}{2}$

30. Which of the following is contributed towards the extra stability of lyophilic colloids

(A)Hydration (B)Charge (C) Colour (D) Tyndall effect

31. Which of the following methods is used for sol destruction

(A) Condensation (B) Dialysis

(C) Diffusion through animal membrane (D) Addition of an electrolyte

32. A catalyst is a substance which

(A) Increases the equilibrium concentration of the product

(B) Changes the equilibrium constant of the reaction

(C) Shortens the time to reach equilibrium

(D) Supplies energy to the reaction

33. The decomposition of hydrogen peroxide can be slowed by the addition of a small amount of acetamide. The latter acts as a

(A) Detainer (B) Stopper (C) Promoter (D) Inhibitor

34. The ability of an ion to bring about coagulation of a given colloid depends upon

(A) Its size (B) The magnitude of its charge only

(C) The sign of its charge

(D) Both the magnitude and the sign of its charge

35. Which one of the following is an incorrect statement for physisorption

(A) It is a reversible process (B) It requires less heat of adsorption

(C) It requires activation energy (D) It takes place at low temperature

36. Which is not colloidal

(A) Chlorophyll (B) Egg (C) Ruby glass (D) Milk

37. Which one of the following is **not** a surfactant

(A) $CH_3-(CH_2)_{15}-\overset{\overset{CH_3}{|}}{\underset{\underset{CH_3}{|}}{N^+}}-CH_3Br^-$ (B) $CH_3-(CH_2)_{14}-CH_2-NH_2$

(C) $CH_3-(CH_2)_{16}-CH_2OSO_2^-Na^+$ (D) $OHC-(CH_2)_{14}-CH_2-COO^-Na^+$

38. Size of colloidal particles is

(A) $0.1 m\mu$ to $0.001 m\mu$ (B) 10μ to 20μ

(C) $0.05 m\mu$ to $0.1 m\mu$ (D) 25μ to 30μ

39. Which of the following electrolytes is most effective in the coagulation of gold solution

(A) $NaNO_3$ (B) $K_4[Fe(CN)_6]$ (C) Na_3PO_4 (D) $MgCl_2$

40. A catalyst is used in a reaction to

(A) Change the nature of reaction products (B) Increase the reaction yield

(C) Decrease the need for reactants (D) Decrease the time required for the reaction

41. Which one of the following is not represented by sols

(A) Absorption (B) Tyndall effect (C) Flocculation (D) Paramagnetism

42. Example of intrinsic colloid is

(A) Glue (B) Sulphur (C) Fe (D) As_2S_3

43. Colloidal solution of arsenious sulphide can be prepared by

(A) Electrodispersion method (B) Peptization

(C) Double decomposition (D) Hydrolysis

44. The capacity to bring about coagulation increases with

(A) Ionic radii (B) Atomic radii

(C) Valency of an ion (D) Size of an ion

45. Gold number gives

(1) The amount of gold present in the colloid

(2) The amount of gold required to break the colloid

(3) The amount of gold required to protect the colloid

(4)None of these

46. Point out the *false* statement

(A)Brownian movement and Tyndall effect is shown by colloidal systems

(B) Gold number is a measure of the protective power of a lyophilic colloid

(C) The colloidal solution of a liquid in liquid is called is gel

(D)Hardy–Schulze rule is related with coagulation

47. Which of the following does not contain a hydrophobic structure

(A)Linseed oil (B) Lanolin (C) Glycogen (D) Rubber

48. The function of gum-arabic in the preparation of indian ink is

(A)Coagulation (B) Peptization (C) Protective action (D) Absorption

49. Identify the gas which is readily adsorbed by activated charcol

(A) N_2 (B) SO_2 (C) H_2 (D) O_2

50. The density of gold is $19\ g/cm^3$. If $1.9\times10^{-4}g$ of gold is dispersed in one litre of water to give a sol having spherical gold particles of radius 10 *nm*, then the number of gold particles per mm^3 of the sol will be

(A) 1.9×10^{12} (B) 6.3×10^{14} (C) 6.3×10^{10} (D) 2.4×10^{6}

51. Which of the following forms cationic miscelles above certain concentration

(A)Urea (B) Cetyltrimethylammonium bromide

(C) Sodium dodecyl sulphate (D) Sodium acetate

52. Gold number is related with

(A) Colloids (B) Radioactivity

(C) Gas equation (D) Kinetic energy

53. Small liquid droplets dispersed in another liquid is called

(A) Gel (B) Emulsion

(C) Suspension (D) True solution

54. Which of the following is used for the destruction of colloids

(A) Dialysis (B) Condensation

(C) By ultrafiltration (D) By adding electrolyte

55. An example of an associated colloid is

(A) Milk (B) Soap solution

(C) Rubber latex (D) Vegetable oil

56. The movement of colloidal particles towards the oppositely charged electrodes on passing electricity is known as

(A) Cataphoresis (B) Tyndall effect

(C) Brownian movement (D) None of these

57. Tyndall effect is shown by

(A) Sol (B) Solution (C) Plasma (D) Precipitation

58. Colloidal solutions of gold prepared by different methods have different colours owing to
(A) The difference in the size of the colloidal particles
(B) The fact that gold exhibits a variable valency of + 1 and + 3
(C) Different concentrations of gold
(D) Presence of different types of foreign particles depending upon the method of preparation of the colloid

59. Which of the following colloids are formed when hydrogen sulphide gas is passed through a cold solution of arsenious oxide
(A) As_2S_3 (B) As_2O_3 (C) As_2S (D) As_2H_2

60. The simplest way to check whether a system is colloidal, is
(A) Tyndall effect (B) Electro dialysis
(C) Brownian movement (D) Finding out particle size

61. Fog is an example of colloidal system
(A) Liquid dispersed in gas (B) Gas dispersed in gas
(C) Solid dispersed in gas (D) Gas dispersed in liquid

62. In the measurement of gold number, the useful electrolyte is
(A) $AuCl_3$ (B) NaC (C) $AlCl_3$ (D) $FeCl_3$

63. Blood may be purified by
(A) Dialysis (B) Electro-osmosis (C) Coagulation (D) Filtration

64. The stability of lyophilic colloidal sol is due to
(A) Both charge and solvation (B) Only solvation
(C) Only charge (D) None of these

65. The impurities present in rain water possess ..... charge
(A) Positive (B) Negative
(C) Zero (D) Positive and negative

66. Sodium lauryl sulphate is
(A) Cationic sol (B) Anionic sol (C) Neutral sol (D) None of these

67. Which of the following statement is false
(A) Every solid substance can be brought into colloidal state
(B) Colloidal particles carry electrical charges
(C) Every solid substance can be made to behave like a lyophilic colliod
(D) Addition of electrolytes causes flocculation of colloidal particles

68. Which is a colloid
(A) Sugar solution (B) Urea solution (C) Silicic acid (D) NaC solution

69. Alum helps in purifying water by
(A) Forming Si complex with clay particles
(B) Sulphate part which combines with the dirt and removes it
(C) Aluminium which coagulates the mud particles
(D) Making mud water soluble

70. Maximum coagulation power is in
(A) Na^+ (B) Ba^{++} (C) Al^{+++} (D) Sn^{++++}

71. Which of the following is not an emulsion
(A) Butter (B) Ice cream (C) Milk (D) Cloud

72. Colloidal solution of gold cannot be prepared by

(A) Bredig's arc method (B) Mechanical dispersion

(C) Reduction of gold chloride (D) Exchange of solvents

73. Which of the following ions can cause coagulation of proteins

(A) Ag^+ (B) Na^+ (C) Mg^{++} (D) Ca^{++}

74. Light scattering takes place in

(A) Solutions of electrolyte (B) Colloidal solutions

(C) Electrodialysis (D) Electroplating

75. Which of the following can stabilize gold sol from coagulation by NaC solution

(A) $Fe(OH)_3$ (B) Gelatin (C) As_2S_3 (D) None of these

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MELUHA INTERNATIONAL SCHOOL

HYDERABAD

SR MPC JEE MAINS | **UNIT – IV** | **Date: 02-05-2020**

Time: | **ASSIGNMENT – 1** | **Max. Marks:**

MATHS

1) **A**	2) **D**	3) **B**	4) **A**	5) **D**	6) **A**	7) **B**	8) **C**	9) **A**	10) **A**
11) **C**	12) **B**	13) **A**	14) **A**	15) **A**	16) **A**	17) **B**	18) **C**	19) **C**	20) **C**
21) **C**	22) **A**	23) **D**	24) **A**	25) **B**	26) **A**	27) **C**	28) **B**	29) **B**	30) **D**
31) **A**	32) **D**	33) **B**	34) **B**	35) **B**	36) **A**	37) **A**	38) **B**	39) **A**	40) **D**
41) **D**	42) **C**	43) **D**	44) **C**	45) **B**	46) **B**	47) **C**	48) **B**	49) **A**	50) **D**
51) **B**	52) **A**	53) **C**	54) **B**	55) **B**	56) **D**	57) **C**	58) **C**	59) **D**	60) **B**
61) **D**	62) **C**	63) **C**	64) **C**	65) **B**	66) **A**	67) **D**	68) **C**	69) **B**	70) **D**
71) **C**	72) **D**	73) **C**	74) **B**	75) **B**	76) **C**	77) **A**	78) **A**	79) **A**	80) **A**
81) **B**	82) **B**	83) **B**	84) **D**	85) **D**	86) **D**	87) **D**	88) **C**	89) **D**	90) **B**
91) **B**	92) **B**	93) **C**	94) **B**	95) **B**	96) **D**	97) **D**	98) **A**	99) **A**	100) **C**
101) **B**	102) **C**	103) **B**	104) **C**	105) **D**	106) **A**	107) **C**	108) **A**	109) **D**	110) **A**
111) **C**	112) **C**	113) **B**	114) **A**	115) **B**	116) **D**	117) **C**	118) **A**	119) **C**	120) **B**
121) **A**	122) **C**	123) **D**	124) **C**	125) **C**					

PHYSCIS

1) **C**	2) **A**	3) **C**	4) **C**	5) **C**	6) **A**	7) **C**	8) **A**	9) **A**	10) **D**
11) **A**	12) **A**	13) **A**	14) **D**	15) **D**	16) **A**	17) **C**	18) **B**	19) **A**	20) **B**
21) **A**	22) **C**	23) **D**	24) **D**	25) **C**	26) **B**	27) **A**	28) **D**	29) **D**	30) **B**
31) **B**	32) **D**	33) **D**	34) **A**	35) **D**	36) **B**	37) **A**	38) **A**	39) **A**	40) **D**
41) **B**	42) **B**	43) **C**	44) **A**	45) **B**	46) **C**	47) **A**	48) **B**	49) **A**	50) **A**
51) **D**	52) **A**	53) **D**							

CHEMISTRY

1) **C**	2) **C**	3) **B**	4) **C**	5) **D**	6) **A**	7) **D**	8) **A**	9) **A**	10) **C**
11) **A**	12) **A**	13) **B**	14) **B**	15) **A**	16) **B**	17) **A**	18) **C**	19) **D**	20) **B**
21) **D**	22) **D**	23) **A**	24) **C**	25) **A**	26) **D**	27) **C**	28) **D**	29) **A**	30) **A**
31) **D**	32) **C**	33) **D**	34) **D**	35) **C**	36) **A**	37) **B**	38) **A**	39) **B**	40) **D**
41) **D**	42) **A**	43) **C**	44) **C**	45) **D**	46) **C**	47) **D**	48) **C**	49) **B**	50) **D**
51) **D**	52) **A**	53) **B**	54) **D**	55) **B**	56) **A**	57) **A**	58) **A**	59) **A**	60) **A**
61) **A**	62) **B**	63) **A**	64) **A**	65) **B**	66) **A**	67) **C**	68) **C**	69) **C**	70) **D**
71) **D**	72) **D**	73) **A**	74) **B**	75) **B**					

HINTS & SOLUTIONS

MATHS

1. (A) $\lim\limits_{x\to\alpha}\dfrac{\tan a(x-\alpha)^2}{a(x-\alpha)^2}\times a = a$

2. (D) $e^{\lim\limits_{x\to\alpha}\left(\dfrac{\sin x-\sin a}{\sin a}\right).\dfrac{1}{x-a}}$

$= e^{\lim\limits_{x\to\alpha}} \cos x.\ (\text{LH rule}) = e^{\cos a}$

3. (B) $\lim\limits_{x\to a}\left(2-\dfrac{x}{a}\right)^{\tan\frac{\pi x}{2a}} = e^{\lim\limits_{x\to a}\left(\frac{\pi x}{2a}\right)\left[2-\frac{x}{a}-1\right]}$

[Using $\lim\limits_{x\to a}[f(x)]^{g(x)} = e^{\lim\limits_{x\to a} g(x)[f(x)-1]}$ as f(x) $\to 1$ and g(x) $\to \infty$ as $x \to a$]

$e^{\lim\limits_{x\to a}\left(1-\frac{x}{a}\right)\tan\left(\frac{\pi x}{2a}\right)} = e^{\lim\limits_{x\to a}\frac{(1-x/a)}{\cot(\pi x/2a)}}$

$= e^{\lim\limits_{x\to a}\frac{-1/a}{-\operatorname{cosec}^2\left(\frac{\pi x}{2a}\right)\frac{\pi}{2a}}} = e^{\lim\limits_{x\to a}\frac{2}{\pi}\left(\frac{\pi x}{2a}\right)} = e^{2/\pi}$

4. (A) $\lim\limits_{x\to\infty}\left[\sqrt{x+\sqrt{x+x}}-\sqrt{x}\right]$

$= \lim\limits_{x\to\infty}\dfrac{x+\sqrt{x+\sqrt{x}}-\sqrt{x}}{\sqrt{x+\sqrt{x+\sqrt{x}}}+\sqrt{x}}$

$= \lim\limits_{x\to\infty}\dfrac{\sqrt{x+\sqrt{x}}}{\sqrt{x+\sqrt{x+\sqrt{x}}}+\sqrt{x}}$

$= \lim\limits_{x\to\infty}\dfrac{\sqrt{x}\left(1+\dfrac{1}{\sqrt{x}}\right)^{1/2}}{\sqrt{x}\left[\left(1+\dfrac{1}{\sqrt{x}}\sqrt{1+\dfrac{1}{\sqrt{x}}}\right)^{1/2}+1\right]} = \dfrac{1}{1+1} = \dfrac{1}{2}$

5. (D) $\lim\limits_{x\to1}\dfrac{\sqrt{1-\cos 2(x-1)}}{x-1} = \lim\limits_{x\to1}\dfrac{\sqrt{2\sin^2(x-1)}}{x-1}$

$= \lim\limits_{x\to1}\dfrac{\sqrt{2}\,|\sin(x-1)|}{(x-1)}$

As LHL and RHL are unequal

$\therefore$ limit does not exists

6. (A) We have, $\lim\limits_{x\to\infty}\left(\dfrac{x^2+1}{x+1}-ax-b\right)=0$

$\Rightarrow \lim\limits_{x\to\infty}\dfrac{(x^2+1)-(ax+b)(x+1)}{x+1}=0$

$\Rightarrow \lim\limits_{x\to\infty}\dfrac{x^2(1-a)-(a+b)x-b+1}{x+1}=0$

$\Rightarrow$ 1 – a = 0 and a + b = 0

$\Rightarrow$ a = 1 and b = - 1

7. (B) $\lim\limits_{x\to\infty}\sqrt{\dfrac{x+\sin x}{x-\cos x}} = \lim\limits_{x\to\infty}\sqrt{\dfrac{1+\dfrac{\sin x}{x}}{1-\dfrac{\cos x}{x}}} = \sqrt{\dfrac{1+0}{1-0}} = 1$

8. (C) = $\lim_{n\to\infty}\frac{1.2+2.3+3.4+.......+n(n+1)}{n^3}$

$= \lim_{n\to\infty}\frac{\sum n(n+1)}{n^3} = \lim_{n\to\infty}\frac{\sum n^2+\sum n}{n^3}$

$= \lim_{n\to\infty}\frac{1}{n^3}\left[\frac{n(n+1)(2n+1)}{6}+\frac{n(n+1)}{2}\right]$

$= \lim_{n\to\infty}\left[\frac{1}{6}\left(1+\frac{1}{n}\right)\left(2+\frac{1}{n}\right)+\frac{1}{2}.\left(\frac{1}{n}+\frac{1}{n^2}\right)\right]$

$= \frac{1}{6}\times 1\times 2 = \frac{1}{3}$

9. (A) $\lim_{x\to 0}(\cos x+\sin x)^{1/x} = e^{\lim_{x\to 0}\frac{1}{x}(\cos x+\sin x-1)}$

$= e^{\lim_{x\to 0}\frac{(-\sin x+\cos x)}{1}}$

$= e^1 = e$

10. (A) $\lim_{x\to 0}\frac{1-\cos^3 x}{x\sin x\cos x}$

$= \lim_{x\to 0}\frac{(1-\cos x)(1+\cos^2 x+\cos x)}{x\sin x\cos x}$

$= \lim_{x\to 0}\frac{2\sin^2\frac{x}{2}(1+\cos^2 x+\cos x)}{2x\sin\frac{x}{2}\cos\frac{x}{2}\cos x}$

$= \lim_{x\to 0}\frac{1}{2}\frac{\sin\frac{x}{2}}{\frac{x}{2}}.\frac{1+\cos^2 x+\cos x}{\cos\frac{x}{2}.\cos x}$

$= \frac{1}{2}.1.\frac{3}{1} = \frac{3}{2}$

11. (C) $\lim_{x\to 0}\frac{2\left(1+\frac{x^2}{2!}+\frac{x^4}{4!}+......\right)+2\left(1-\frac{x^2}{2!}+\frac{x^4}{4!}+......\right)-4}{x^4}$

$= \frac{1}{6}$

13. (A) Using L-Hospital $= \lim_{x\to 2}\frac{14x-11}{6x-1} = \frac{17}{11}$

14. (D) Conceptual

15. (A) Using $\lim_{x\to a}\frac{x^p-a^p}{x^q-a^q} = \frac{p}{q}a^{p-q}$

16. Let $x=[x]+\{x\}, 0\le\{x\}<1$, $\Rightarrow \lim_{[x]\to\infty}\frac{\log_e[x]}{[x]+\{x\}} = \lim_{[x]\to\infty}\frac{\frac{1}{[x]}}{1} = 0$

17. $\lim_{x\to 1^-}\{x\}=1;\ \lim_{x\to 1^-}\frac{e^{\{x\}}-\{x\}-1}{\{x\}^2} = e-2$

18. $\underset{x\to\infty}{Lim}\ \frac{x^2+x+1-ax^2-bx-ax-b}{x+1} = 4$

$$\lim_{x\to\infty} \frac{(1-a)x^2+(1-b-a)x+1-b}{x+1}=4$$

$$\Rightarrow 1-a=0 \quad 1-b-a=4$$

$$\Rightarrow a=1, b=-4$$

19. $$\lim_{x\to 0}\frac{\cos x-1}{x^2}\left(\frac{\cos x-1}{x^{n-2}}-\frac{e^x-1}{x^{n-2}}\right)\Rightarrow n-2=1\Rightarrow n=3$$

20. $$e^{\lim_{x\to 0}\frac{1}{x}\left[1+\frac{a\sin bx}{\cos x}-1\right]}=e^{ab}$$

21. $$\lim_{n\to\infty}\frac{n(2n+1)^2}{(n+2)(n^2+3n-1)}$$

$$=\lim_{n\to\infty}\frac{\left(2+\frac{1}{n}\right)^2}{\left(1+\frac{2}{n}\right)\left(1+\frac{3}{n}-\frac{1}{n^2}\right)}$$

$$=\frac{(2+0)^2}{(1+0)(1+0+0)}=4$$

22. $$\frac{x^4(\cot^4 x-\cot^2 x+1)}{(\tan^4 x-\tan^2 x+1)}$$

$$=\frac{x^4(1-\tan^2 x+\tan^4 x)}{\tan^4 x(\tan^4 x-\tan^2 x+1)}=\frac{x^4}{\tan^4 x}, x\neq 0$$

$$\Rightarrow \lim_{x\to 0}\frac{x^4(\cot^4 x-\cot^2 x+1)}{(\tan^4 x-\tan^2 x+1)}=\lim_{x\to 0}\frac{x^4}{\tan^4 x}=1$$

23. $$\lim_{x\to\infty}\frac{(x+1)^{10}+(x+2)^{10}+.....+(x+100)^{10}}{x^{10}+10^{10}}$$

$$=\lim_{x\to\infty}\frac{x^{10}\left[\left(1+\frac{1}{x}\right)^{10}+\left(1+\frac{2}{x}\right)^{10}+....+\left(1+\frac{100}{x}\right)^{10}\right]}{x^{10}\left[1+\frac{10^{10}}{x^{10}}\right]}$$

24. $$\lim_{x\to 0}\left(\frac{2^x+3^x}{2}\right)^{2/x} \quad \left[1^\infty \text{ form}\right]$$

$$=e^{\lim_{x\to 0}\frac{2}{x}\left(\frac{2^x+3^x}{2}-1\right)}=e^{\lim_{x\to 0}\left(\frac{2^x-1}{x}+\frac{3^x-1}{x}\right)}=e^{(\log 2+\log 3)}=6$$

25. $$\lim_{x\to 0^-}\frac{\sin\{x\}}{\{x\}}=\lim_{x\to 0^-}\left(\frac{\sin(x+1)}{x+1}\right)=\sin 1$$

26. $$\lim_{x\to 0}\frac{\log(1+x+x^2)+\log(1-x+x^2)}{\log(1+x^2)}=\lim_{x\to 0}\frac{\log(1+x^2+x^4)}{\log(1+x^2)}$$

$$=\lim_{x\to 0}\frac{\log(1+x^2+x^4)}{(x^2+x^4)}\cdot\frac{(x^2+x^4)}{\log(1+x^2)}=\lim_{x\to 0}\frac{\log(1+x^2+x^4)}{(x^2+x^4)}\cdot\frac{x^2}{\log(1+x^2)}(1+x^2)$$

27. $\lim_{x\to 0}\frac{\sqrt{1-\cos 2x}}{x}=\lim_{x\to 0}\sqrt{2}\frac{|\sin x|}{x}=\lim_{x\to 0^+}\sqrt{2}\left[\frac{\sin(0+h)}{h}\right]=\sqrt{2}=\lim_{x\to 0^-}\sqrt{2}\left[\frac{|\sin(0-h)|}{(-h)}\right]=-\sqrt{2}$

Here R.H.L. is $\sqrt{2}$ and L.H.L. is $-\sqrt{2}$.

$\therefore$ Limit does not exist.

28. (B) $3=\lim_{x\to 0}(1+a\sin x)^{\operatorname{cosec}x}$

$=\lim_{x\to 0}e^{\operatorname{cosec}x(1+a\sin x-1)}=\lim_{x\to 0}e^{\operatorname{cosec}x.asnx}=e^a$

$\therefore e^a=3\Rightarrow a=\log_e 3=\text{In }3$

29. (B) $\lim_{x\to 0}\frac{\cos(\sin x)-\cos x}{x^4}$

$$=\lim_{x\to 0}\frac{2\sin\left(\frac{\sin x+x}{2}\right)\sin\left(\frac{x-\sin x}{2}\right)}{x^4}$$

$$=\lim_{x\to 0}\frac{2\sin\left(\frac{\sin x+x}{2}\right)}{\frac{\sin x+x}{2}},\frac{\sin x+x}{x}.\lim_{x\to 0}\frac{\sin\left(\frac{x-\sin x}{2}\right)}{\frac{x-\sin x}{2}}$$

$$\lim_{x\to 0}\frac{\frac{\frac{x}{2}\left[x-\left(x-\frac{x^3}{3!}+.......\right)\right]}{2}}{x^4}=2.\frac{1.}{2.3!}=\frac{1}{6}$$

30. (D) Given limit is $\frac{2\sin^2 x/2}{x\log(1+x)}=\frac{1}{2}\frac{\lim_{x\to 0}\left(\frac{\sin x/2}{x/2}\right)^2}{\lim_{x\to 0}\log(1+x)^{\frac{1}{x}}}=\frac{1}{2}$

31. (A) Use L- Hospital Rule

32. (D) $\lim_{x\to 0}\frac{1-\cos 2x}{x^2}\times\frac{3+\cos x}{1}\times\frac{x}{\tan 4x}=2$

33. (B) $\lim_{x\to\pi}\frac{\sqrt{2+\cos x}-1}{(\pi-x)^2}$

$$=\lim_{y\to 0}\frac{\sqrt{2+\cos(\pi-y)}-1}{y^2}=\lim_{y\to 0}\frac{\sqrt{2-\cos y}-1}{y^2}$$

$$=\lim_{y\to 0}\frac{2-\cos y-1}{y^2}\times\frac{1}{\sqrt{2-\cos y}+1}$$

$$=\lim_{y\to 0}\frac{2\sin^2\frac{y}{2}}{\left(\frac{y}{2}\right)^2}\times\frac{1}{4}\times\frac{1}{\sqrt{2-\cos y}+1}$$

$$=2\times 1\times\frac{1}{4}\times\frac{1}{1+1}=\frac{1}{4}$$

34. (B) $\lim_{x\to 0}\frac{(4^x-1)-(9^x-1)}{x}\times\frac{1}{(4^x+9^x)}$

$$\frac{\lim_{x\to 0}\left(\frac{4^x-1}{x}\right)-\lim_{x\to 0}\left(\frac{9^x-1}{x}\right)}{\lim_{x\to 0}\left(4^x+9^x\right)}$$

35. (B) $\lim_{\theta\to 0}\frac{\frac{\sin\theta}{\cos\theta}-\sin\theta}{\theta^3}=\lim_{\theta\to 0}\left(\frac{\frac{\sin\theta}{\cos\theta}}{\theta}\right)\left(\frac{1-\cos\theta}{\theta^2}\right)$

36. (A) Using $\lim_{x\to a}\frac{x^p-a^p}{x^q-a^q}=\frac{p}{q}a^{p-q}$

37. (A) Using L- Hospital Rule

38. (B) Given limit $=\frac{1}{2}\lim_{n\to\infty}\left(\frac{1}{1}-\frac{1}{3}+\frac{1}{3}-\frac{1}{5}+......+\frac{1}{(2n-1)}-\frac{1}{(2n+1)}\right)=\frac{1}{2}$

39. (A) By using Sandwitch theorem

40. (D) By using Sandwich theorem

41. (D) Take common higher power of x in both numerator and denominator

42. (C) Using standard formulae

43. (D) 1^∞ form

44. (C) Use L- Hospital rule

45. (B) On rationalizing given limit $=\lim_{x\to 0}\frac{x^3}{[\sin^{-1}(x^3)]}\cdot\frac{1}{1+\sqrt{1-x^2}}$

46. (B) Using $\lim_{x\to a}\frac{x^p-a^p}{x^q-a^q}=\frac{p}{q}a^{p-q}$

47. (C) By L-Hospital rule

48. (B) $\lim_{x\to 0}\frac{e^{\sin x}\left(e^{x-\sin x}-1\right)}{2\left(x-\sin x\right)}=\frac{1}{2}$

49. (A) Given limit is $\frac{2\sin^2 x\sin 5x}{x^2\sin 3x}=\frac{10}{3}$

50. (D) Given limit is

$$\frac{2\sin^2 x/2}{x\log(1+x)}=\frac{1}{2}\frac{\lim_{x\to 0}\left(\frac{\sin x/2}{x/2}\right)^2}{\lim_{x\to 0}\log(1+x)^{\frac{1}{x}}}=\frac{1}{2}$$

52. (A) Use L-Hospital

53. (C) Given limit is

$$\lim_{x\to 0}\frac{8}{x^8}\left(1-\cos\frac{x^2}{2}\right)\left(1-\cos\frac{x^2}{4}\right)=32\frac{1}{16}\frac{1}{64}=\frac{1}{32}$$

54. (B) $\underset{x\to 0}{lt}\ \frac{(9.3)^x-9^x-3^x+1}{\sqrt{2}-\sqrt{1+\cos x}}\times\frac{\sqrt{2}+\sqrt{1+\cos x}}{\sqrt{2}+\sqrt{1+\cos x}}$ and

$=\underset{x\to 0}{lt}\ \frac{\left(9^x-1\right)\left(3^x-1\right)}{x^2}\frac{x^2}{1-\cos x}\left(\sqrt{2}+\sqrt{1+\cos x}\right)$

55. use L Hospitals rule

56. $a.\lim_{x\to 1}\left(1+(x-1)\right)^{\frac{1}{1-x}}+b=e^{-1}$

$\Rightarrow a.e^{\lim_{x\to 1}\frac{x-1}{1-x}}+b=e^{-1}\Rightarrow a=1;b=0$

57. $\lim\limits_{x\to 2}\dfrac{2^x+2^{3-x}-6}{\sqrt{2^{-x}}-2^{1-x}}=\lim\limits_{x\to 2}\dfrac{(2^x)^2-6.2^x+2^3}{\sqrt{2^x}-2}$

(Multiplying Num. And Den. by 2^x)

$$=\lim_{x\to 2}\frac{(2^x-4)(2^x-2)(\sqrt{2^x}+2)}{(\sqrt{2^x}-2)(\sqrt{2^x}+2)}=\lim_{x\to 2}\frac{(2^x-4)(2^x-2)(\sqrt{2^x}+2)}{2^x-4}$$

$$=\lim_{x\to 2}(2^x-2)(\sqrt{2^x}+2)=\lim_{x\to 2}(2^x-2)(\sqrt{2^x}+2)=(2^2-2)(\sqrt{2^2}+2)=8$$

58.

$$f(x)=\left(\sin\frac{\pi x}{2}\right)^{2n}=\begin{cases}0: \left|\sin\frac{\pi x}{2}\right|<1\\ 1: \left|\sin\frac{\pi x}{2}\right|=1\end{cases}$$

59. (D)

$$\underset{\theta\to\frac{\pi}{2}}{\text{Lt}}\ \frac{1-\sin\theta}{\cos\theta.\left(\frac{\pi}{2}-\theta\right)}$$

$$=\underset{\theta\to\frac{\pi}{2}}{\text{Lt}}\ \frac{\left(\cos\frac{\theta}{2}-\sin\frac{\theta}{2}\right)^2}{\left(\cos\frac{\theta}{2}-\sin\frac{\theta}{2}\right)\left(\cos\frac{\theta}{2}+\sin\frac{\theta}{2}\right).\left(\frac{\pi}{2}-\theta\right)}$$

$$=\underset{\theta\to\frac{\pi}{2}}{\text{Lt}}\ \frac{\cos\frac{\theta}{2}-\sin\frac{\theta}{2}}{\left(\cos\frac{\theta}{2}+\sin\frac{\theta}{2}\right)\left(\frac{\pi}{2}-\theta\right)}$$

$$=\underset{\theta\to\frac{\pi}{2}}{\text{Lt}}\ \frac{-\sin\frac{\theta}{2}.\frac{1}{2}-\cos\frac{\theta}{2}.\frac{1}{2}}{\left(\cos\frac{\theta}{2}+\sin\frac{\theta}{2}\right)(-1)+\left(\frac{\pi}{2}-\theta\right)\left(-\sin\frac{\theta}{2}.\frac{1}{2}-\cos\frac{\theta}{2}.\frac{1}{2}\right)}$$

$$=\underset{\theta\to\frac{\pi}{2}}{\text{Lt}}\ \frac{-\frac{1}{2}\left(\sin\frac{\theta}{2}+\cos\frac{\theta}{2}\right)}{-1\left(\sin\frac{\theta}{2}+\cos\frac{\theta}{2}\right)}=\frac{1}{2}$$

60. (D)

$$\underset{x\to 0}{\text{Lt}}\ \frac{\tan x-\sin x}{x^3}=\underset{x\to 0}{\text{Lt}}\ \frac{\sin x}{x}\,\frac{\left(\frac{1}{\cos x}-1\right)}{x^2}$$

$$=\underset{x\to 0}{\text{Lt}}\ \frac{1-\cos x}{x^2\cos x}\qquad\left(\frac{0}{0}\text{ form}\right)$$

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

$$=\underset{x\to 0}{\text{Lt}}\ \frac{\sin x/x}{2\cos x-x\sin x}=\frac{1}{2-0}=\frac{1}{2}$$

61. (D)

$$\underset{\alpha\to\beta}{\text{Lt}}\ \frac{\sin^2\alpha-\sin^2\beta}{\alpha^2-\beta^2}=\underset{\alpha\to\beta}{\text{Lt}}\ \frac{\sin(\alpha+\beta)\sin(\alpha-\beta)}{(\alpha+\beta)(\alpha-\beta)}$$

$$=\underset{\alpha\to\beta}{\text{Lt}}\ \frac{\sin(\alpha+\beta)}{\alpha+\beta}=\frac{\sin 2\beta}{2\beta}$$

$$\left[\because\ \underset{\alpha\to\beta}{\text{Lt}}\ \frac{\sin(\alpha-\beta)}{\alpha-\beta}=1\right.$$

62. (C)

Let $l = \underset{x\to 0}{\text{Lt}} \dfrac{(\cos x - 1)(\cos x - e^x)}{x^n}$

$= \underset{x\to 0}{\text{Lt}} \dfrac{-2\sin^2\frac{x}{2}.(\cos x - e^x)}{x^n}$

For $n = 1, n = 2, l = 0$

For $n = 3$, $l = \underset{x\to 0}{\text{Lt}} -2.\left(\dfrac{\sin\frac{x}{2}}{\frac{x}{2}}\right)^2 \dfrac{\cos x - e^x}{2^2.x}$

$= -\dfrac{1}{2}\underset{x\to 0}{\text{Lt}} \dfrac{\cos x - e^x}{x} = -\dfrac{1}{2}\underset{x\to 0}{\text{Lt}} \dfrac{-\sin x - e^x}{1} = \dfrac{1}{2}$

(By L Hospital's Rule)

$\therefore l$ is finite and non-zero Hence $n = 3$.

63. (C)

$\lim\limits_{x\to 0-} f(x) = \lim\limits_{x\to 0} \dfrac{1-\cos 4x}{x^2}$

$= \lim\limits_{x\to 0} \dfrac{2\sin^2 2x}{x^2} = \lim\limits_{x\to 0} 2\left(\dfrac{\sin 2x}{2x}\right)^2 \cdot 4$

$= 8(1)^2 = 8$ $a = 8$ $[\because f(x)$ is continuous$]$

Also $\lim\limits_{x\to 0_+} f(x) = 8 \therefore (c)$ **holds.**

65. (B)

$\lim\limits_{x\to 0} f(x)$

$= \lim\limits_{x\to 0}\left[\dfrac{\log(1+ax)-\log(1-bx)}{x}\right]\left[\dfrac{0}{0}\right]$

$= \lim\limits_{x\to 0}\left[\dfrac{\frac{a}{1+ax}+\frac{b}{1-bx}}{1}\right]$

$= \dfrac{a}{1+0}+\dfrac{b}{1-b} = a+b = f(0)$

$[\because f(x)$ is continuous

$\therefore f(0) = a+b \therefore (b)$ **holds.**

66. (A)

Since $f(x)$ is cont. at $x = 0$

$\therefore \underset{x\to 0}{\text{Lt}} f(x) = f(0) \Rightarrow \underset{x\to 0}{\text{Lt}} \dfrac{3\sin\pi x}{5x} = 2k$

$\Rightarrow \dfrac{3\pi}{5}\underset{x\to 0}{\text{Lt}} \dfrac{\sin\pi x}{\pi x} = 2k$

$\therefore \dfrac{3\pi}{5}\cdot 1 = 2k \Rightarrow k = \dfrac{3\pi}{10} \therefore (a)$ **holds.**

67. Since f(x) = 0 for all $x \therefore f'(x) = 0$ for all x ($\because \tan(\pi[x-\pi]) = \tan x\pi = 0$ where x is an integer.

68. $f(0) = -2$

69. $f(0) = \lim\limits_{x\to 0}\left(\dfrac{e^{kx}-1}{x}\right).\dfrac{\sin kx}{x} \Rightarrow 4 = k^2$

70. Use L-Hospital Rule

71. Note that f is continuous everywhere except possibly at $x = 0$. For f to be continuous at $x = 0$,

$$1 = f(0) = \lim_{x\to 0}\frac{x(1+a\cos x)-b\sin x}{x^3}\left(\frac{0}{0}\text{ from}\right)$$

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

This limit will exist only if $1+(a-b)=0$.

$$=\lim_{x\to 0}\frac{-(a-b)\sin x-ax\cos x-a\sin x}{6x} \quad =\frac{1}{6}\lim_{x\to 0}\left[(b-2a)\frac{\sin x}{x}-a\cos x\right] \quad =\frac{1}{6}[b-3a]$$

$\Rightarrow \quad b-3a=6$

Solving $a-b=-1$ and $b-3a=6$, we get $b=-3/2$ and $a=-5/2$.

72. $K\log 2\log 3=f(0)$

$$=\lim_{x\to 0}f(x)=\lim_{x\to 0}\frac{72^x-9^x-8^x+1}{\sqrt{2}-\sqrt{1+\cos x}}$$

$$=\lim_{x\to 0}\frac{9^x-1}{x}.\frac{8^x-1}{x}\frac{16(x/4)^4}{\sqrt{2}.2\sin^2 x/4}$$

$$=\frac{16}{2\sqrt{2}}\log 9\log 8$$

$$=\frac{8}{\sqrt{2}}6\log 3\log 2=24\sqrt{2}\log 3\log 2$$

Thus $K=24\sqrt{2}$.

73. $\lim_{x\to 3^+}g(x)=g(3)$

$\Rightarrow 3m+2=2k$ ……(i)

Also differentiable

$g'(x)_{at\ x=3} \quad \Rightarrow \quad m=\frac{k}{4}$ …….(ii)

From (i) and (ii) $k+m=2$

74. $\lim_{x\to 0^-}f(x)=\lim_{x\to 0^+}f(x)=f(0)$

76. We have, $f(x)=\begin{cases}\frac{1}{e^{4x}+1}, & x\neq 0\\ 0 \quad , & x=0\end{cases}$

$$\lim_{x\to 0^-}f(x)=\lim_{x\to 0^-}\frac{1}{e^{4x}+1}$$

$$=\lim_{x\to(0-h)}\frac{1}{e^{-4h}+1}$$

$$\lim_{x\to 0^+}f(x)=\lim_{x\to 0^+}\frac{1}{e^{4x}+1}$$

$$=\lim_{x\to(0+h)}\frac{1}{e^{4x}+1}$$

$$=\frac{1}{e^0+1}=\frac{1}{2}$$

$\therefore \quad \lim_{x\to 0^-}f(x)=\lim_{x\to 0^+}f(x)\neq f(0)=0$

Hence, $f(x)$ is discontinuous.

77. We have, $\mathrm{f}(\mathrm{x})=\begin{cases}\frac{\log(1+2ax)-\log(1-bx)}{x}, & \text{if } x\neq 0\\ k \quad , & \text{if } x=0\end{cases}$

$\mathrm{f}(\mathrm{x})$ is continuous at x = 2.

$\therefore \quad \lim_{x\to 0}f(x)=f(0)$

$$\Rightarrow \lim_{x\to 0}\frac{\log(1+2ax)-\log(1-bx)}{x}=k \qquad [\because f(0)=k]$$

$$\Rightarrow \lim_{x\to 0}\frac{\log(1+2ax).2a}{2ax}-\lim_{x\to 0}\frac{\log(1-bx).(-b)}{-bx}=k$$

$$\Rightarrow 2a+b=k \qquad \left[\because \lim_{x\to 0}\frac{\log(1+x)}{x}=1\right]$$

78. We have, $f(x)=\begin{cases}[x]+[-x], & x\neq 2\\ \lambda, & x=2\end{cases}$

f(x) is continuous at x = 2.

$\therefore \lim_{x\to 0} f(x)=f(2)$

$\Rightarrow \lim_{x\to 0}[x]+[-x]=\lambda \qquad [\because f(2)=\lambda]$

$\Rightarrow -1=\lambda$ [∵ [x] + [–x] = 0, x∈ integer and [x] + [–x] = –1, x∉ integer]

$\therefore\ \lambda=-1$

79. We have, $f(x)=\begin{cases}\dfrac{1-\cos 4x}{x^2}, & x<0\\ a, & x=0\\ \dfrac{\sqrt{x}}{\sqrt{16+\sqrt{x}}-4}, & x>0\end{cases}$

For f(x) is continuous at x = 0,

$$\lim_{x\to 0^-} f(x)=\lim_{x\to 0^-} f(x)=f(0)$$

Now, $\lim_{x\to 0^-} f(x)=\lim_{x\to 0^-}\frac{1-\cos 4x}{x^2}=\lim_{x\to 0}\frac{1-\cos 4h}{h^2}=\lim_{x\to 0}\frac{4\times 2\sin^2 2h}{(2h)^2}=8$

and $\lim_{x\to 0^+} f(x)=\lim_{x\to 0^+}\frac{\sqrt{x}}{\sqrt{16+\sqrt{x}}-4}=\lim_{x\to 0}\frac{\sqrt{h}}{\sqrt{16+\sqrt{h}}-4}$

$$=\lim_{h\to 0}\frac{\sqrt{h}\left(\sqrt{16+\sqrt{h}}+4\right)}{16+\sqrt{h}-16}$$

$$=\lim_{h\to 0}\sqrt{16+\sqrt{h}}+4=8 \qquad \therefore\ \lim_{x\to 0^-} f(x)=\lim_{x\to 0^+} f(x)=f(0)$$

$\therefore \qquad 8=8=a \qquad [\because f(0)=a]$

80. Given, $f(x)=\begin{cases}-4\sin x+\cos x, & \text{for } x\leq -\dfrac{\pi}{2}\\ a\sin x+b, & \text{for } -\dfrac{\pi}{2}<x<\dfrac{\pi}{2}\\ \cos x+2, & \text{for } \dfrac{\pi}{2}\leq x\end{cases}$

LHL at $x=\frac{-\pi}{2}$,

$$\lim_{x\to \frac{\pi^-}{2}} f(x)=\lim_{h\to 0}-4\sin\left(\frac{-\pi}{2}-h\right)+\cos\left(\frac{-\pi}{2}-h\right)$$

$$= \lim_{h\to 0} 4\cosh - \sinh = 4$$

RHL at $x = \frac{-\pi}{2}$

$$\lim_{x\to \frac{\pi^-}{2}} f(x) = \lim_{h\to 0} a\sin\left(\frac{-\pi}{2} - h\right) + b$$

$$= \lim_{h\to 0}(-a\cosh + b) - a + b$$

$\because$ f(x) is continuous at $x = \frac{-\pi}{2}$.

$\therefore$ $-a + b = 4$ …….(i)

$\therefore$ Now LHL at $x = \frac{\pi}{2}$,

$$\lim_{x\to \frac{\pi^-}{2}} f(x) = \lim_{h\to 0} a\sin\left(\frac{\pi}{2} - h\right) + b = a + b$$

RHL at $x = \frac{\pi}{2}$,

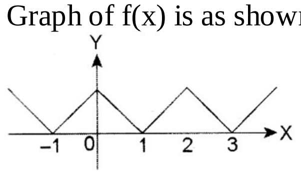
$$\lim_{x\to \frac{\pi^+}{2}} f(x) = \lim_{x\to 0}\cos\left(\frac{\pi}{2} + h\right) + 2 = 2 \Rightarrow a + b = 2$$ ……….(ii)

On solving Eqns. (i) and (ii), we get

$a = -1,\ b = 3$

81. $f(x) = \left|\left||x-1|-1\right|-1\right|$

Graph of f(x) is as shown below.



$\Rightarrow f(x)$ has points of non-differentiable in set {–1, 0, 1, 2, 3}

82. Given, $f(x) = \frac{1}{(x+1)(x-2)}$ and $g(x) = \frac{1}{x^2}$

Now, $f[g(x)] = \frac{1}{[g(x)-1][g(x)-2]}$

Clearly, g(x) is not defined at x = 0.

$\therefore$ g(x) is discontinuous at x = 0

Also f9x) is not defined at x = 1, 2

F[g(x)] is also not defined at x = 1, 2

When g(x) = 2, then $x = \frac{\pm 1}{\sqrt{2}}$

Hence, the point of discontinuity of $f[g(x)]$ are $\frac{-1}{\sqrt{2}}, -1, 0, 1\frac{1}{\sqrt{2}}$

83. We have, $f(x) = \begin{cases} \left(\frac{e^{1/x} - e^{-1/x}}{e^{1/x} + e^{-1/x}}\right), & \text{if } x \neq 0 \\ 0, & \text{if } x = 0 \end{cases}$

Now, $Lf'(0^-) = \lim_{h\to 0}\frac{f(0-h) - f(0)}{-h}$

$$= \lim_{h\to 0} \frac{-h\left(\frac{e^{1/h} - e^{-1/h}}{e^{1/h} + e^{-1/h}}\right)}{-h} = \lim_{h\to 0}\left(\frac{e^{-2/h} - 1}{e^{-2/h} + 1}\right) = -1$$

$$Rf'(0^+) = \lim_{h\to 0} \frac{f(0+h) - f(0)}{h}$$

$$= \lim_{h\to 0} \frac{h\left(\frac{e^{1/h} - e^{1/h}}{e^{1/h} + e^{-1/h}}\right)}{h} = \lim_{h\to 0} \frac{1 - e^{-2/h}}{1 + e^{-2/h}} = 1$$

$\because Lf'(0^-) \neq Rf'(0^+)$

$\therefore$ f(x) is not differentiable at x = 0.

84. $f(x) = (x^2 - 1)\left|x^2 - 3x + 2\right| + \cos(|x|)$

$$= (x-1)(x+1); \left|(x-1)(x-2)\right| + \cos x$$

(x – 1) |x – 1| and cos x are differentiable for all x, but |x – 2| is not differentiable at x = 2
Hence, f(x) is non-differentiable at x = 2.

86. $\lim_{x\to a} \frac{x^2 f(a) - a^2 f(x)}{x - a}$ $\left[\frac{0}{0}\text{ form}\right]$

$= \lim_{x\to a} \frac{2xf(a) - a^2 f'(x)}{1 - 0}$ [using L` Hospital rule]

$= 2af(a) - a^2 f'(0)$

87. $f'(5) = \lim_{h\to 0} \frac{f(5+h) - f(5)}{h} = \lim_{h\to 0} \frac{f(5).f(h) - f(5)}{h} = f(5).\lim_{h\to 0} \frac{f(h) - 1}{h}$

88. We have, f(x) is differentiable and $\lim_{h\to 0} \frac{f(1+h)}{h}$ is 5, when f(1) = 0.

$\therefore \lim_{h\to 0} \frac{f'(1+h)}{1} = f'(1) = 5$

89. f(x) = [n + p sin x]
= n + [p sin x]
F(x) is not differentiable at those points, where p sin x is an integer.

p sin x is an integer of sin x = 1, –1 and $\frac{x}{p}$

i.e. $x = \frac{\pi}{2}, \frac{-\pi}{2}, \sin^{-1}\frac{r}{p}, \pi - \sin^{-1}\frac{r}{p}$

where, $0 \le r \le p - 1$

but $x = \frac{-\pi}{2}, 0$

$\therefore$ Function is not differentiable at $x = \frac{\pi}{2}, \sin^{-1}\frac{r}{p}, \pi - \sin^{-1}\frac{r}{p},$ where $0 < r < p - 1$

So, the required number of points are 1+ 2(p – 1) = 2p – 1

92. Let α be the semi-vertical angle of the cone C/AB whose height CO is 4m and radius OB = 2m, then
Let V be the volume of water in the cone i.e. the volume of the cone CA'B'.
After time t min, h be the height of the water, then

$$V=\frac{1}{3}\pi(O'B')^2(CO')$$

$$\Rightarrow V=\frac{1}{3}\pi h^3\tan^2\alpha \qquad \left[\because \tan\alpha=\frac{O'B'}{CO'}=\frac{O'B'}{h}\Rightarrow O'B'=h\tan\alpha\right]$$

$$\Rightarrow V=\frac{\pi}{12}h^3$$

Now, $\frac{dV}{dt}=\frac{\pi}{12}3h^2\frac{dh}{dt}=\frac{\pi}{4}h^4\frac{dh}{dt}$

$$\Rightarrow 77\times10^3=\frac{\pi h^2}{4}.\frac{dh}{dt} \qquad \left[\begin{array}{l}\because 1L=10^3cm^3\\ \therefore 77L=77\times10^3cm^3\\ \text{i.e.}\frac{dV}{dt}=77L=77\times10^3cm^3\end{array}\right]$$

$$\Rightarrow \frac{dh}{dt}=\frac{77\times4\times10^3}{\pi h^2}$$

$$\therefore \left(\frac{dh}{dt}\right)_h=\frac{77\times4\times10^3}{\pi\times(70)^2}=\frac{77\times4\times7\times10^3}{22\times70\times70}=20\text{ cm / min}$$

93. Given, x and y are the sides of squares. Then, the area of the squares are x^2 and y^2.

We have to obtain, $\frac{d(y^2)}{d(x^2)}=\frac{2y\frac{dy}{dx}}{2x}=\frac{y}{x}\times\frac{dy}{dx}$ ……(i)

Given curve is $y = x - x^2$

$$\Rightarrow \frac{dy}{dx}=1-2x \qquad ……(ii)$$

Thus, $\frac{d(y^2)}{d(x^2)}=\frac{y}{x}(1-2x)$ [from Eqs. (i) and (ii)]

$$\Rightarrow \frac{d(y^2)}{d(x^2)}=\frac{(x-x^2)(1-2x)}{x}$$

$$\Rightarrow \frac{d(y^2)}{d(x^2)}=2x^2-3x+1$$

$$\therefore \left[\frac{d(y^2)}{d(x^2)}\right]_{x=2}=2\times2^2-3\times2+1=3$$

94. Given, $\frac{x^4}{2}=x+y$ …….(i)

Let (x_1, y_1) be the point on the curve (i), then

$$\frac{x_1^4}{2}=x_1+y_1 \qquad ……..(ii)$$

Also, point (x_1, y_2) lies on the line 3x + 4y = c.

$$\therefore \quad 3x_1+4y_1=c \qquad …….(iii)$$

From Eq. (i), we have

$$\frac{dy}{dx} = 2x^3 - 1$$

$\therefore$ $$\left(\frac{dy}{dx}\right)_{(x_1, y_1)} = 2x_1^3 - 1$$

Now, slope of tangent at (x_1, y_3) = Slope of the line

$\Rightarrow 2x_1^3 - 1 = \frac{-3}{4}$

$\Rightarrow 2x_1^3 = \frac{1}{4}$

$\Rightarrow x_1^3 = \frac{1}{8} \Rightarrow x_1 = \frac{1}{2}$

$\therefore y_1 = \frac{1}{4}\left(c - \frac{3}{2}\right)$

From Eq. (ii), we have

$$\frac{\left(\frac{1}{2}\right)^4}{2} = \frac{1}{2} + \frac{1}{4}\left(-\frac{3}{2} + c\right)$$

$\frac{1}{32} = \frac{1}{2} - \frac{3}{8} + \frac{c}{4} \Rightarrow \frac{1}{32} = \frac{1}{8} + \frac{c}{4}$

$\Rightarrow \frac{c}{4} = \frac{1}{32} - \frac{1}{8} \Rightarrow \frac{c}{4} = \frac{-3}{32}$

$\therefore c = \frac{-3}{8}$

95. Given $3xy^2 - 2x^2y = 1$ ……..(i)

$\Rightarrow 3x2y\frac{dy}{dx} + 3y^2 - 4xy - 2x^2\frac{dy}{dx} = 0$

$\Rightarrow \left(6xy - 2x^2\right)\frac{dx}{dy} + 3y^2 - 4xy = 0$

$\Rightarrow \frac{dy}{dx} = \frac{4xy - 3y^2}{6xy - 2x^2}$

$$\left(\frac{dy}{dx}\right)_{(1,1)} = \frac{4-3}{6-2} = \frac{1}{4}$$

Equation of the tangent is

$$y - 1 = \frac{1}{4}(x - 1)$$

$\Rightarrow 4y - 4 = x - 1$

$\Rightarrow x - 4y + 3 = 0$ …….(ii)

From Eqns. (i) and (ii), we have

$$3x\left(\frac{x+3}{4}\right)^2 - 2x^2\left(\frac{x+3}{4}\right) = 1$$

$\Rightarrow 3x\frac{(x+3)^2}{16} - 2x^2\frac{(x+3)}{4} = 1$

$\Rightarrow (x+3)\left[\frac{3x^2 + 9x - 8x^2}{16}\right] = 1$

$\Rightarrow (x+3)\left(9x - 5x^2\right) = 16$

$\Rightarrow \quad 9x^2 - 5x^3 + 27x - 15x^2 = 16$

$\Rightarrow \quad x = 1, \frac{-16}{5}$

When $x = \frac{-16}{5}$, then $y = -\frac{1}{20}$

$\therefore$ Other point on the curve where tangent meet again is $\left(\frac{-16}{5}, \frac{-1}{20}\right)$

96. We have $y = x + \frac{4}{x^2}$

On differentiating w.r.t. x, we get

$\frac{dy}{dx} = 1 - \frac{8}{x^3}$

Since, the tangent is parallel to x-axis, therefore

$\frac{dy}{dx} = 0$

$\Rightarrow x^3 = 8 \;\therefore\quad x = 2$ and $y = 3$

97. We have, $y = f(x)$

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

$\Rightarrow \left(\frac{dy}{dx}\right)_{(3,4)} = f'(3)$

$\Rightarrow -\frac{1}{\left(\frac{dy}{dx}\right)_{(3,4)}} = -\frac{1}{f'(3)}$

It is given that, slope of normal $= \tan\frac{3\pi}{4}$

$\therefore \tan\frac{3\pi}{4} = -\frac{1}{f'(3)}$

$\therefore \quad f'(3) = 1$

98. The equation of the curve is

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

$\therefore \quad \frac{dy}{dx} = 2x - 5$

Let m_1 and m_2 be the slopes of tangents at (2, 0) and (3, 0) to that given curve.

Then, $m_1 = \left(\frac{dy}{dx}\right)_{(2,0)} = 2 \times 2 - 5 = -1$

and $\quad m_2 = \left(\frac{dy}{dx}\right)_{(3,0)} = 2 \times 3 - 5 = 1$

Clearly, $m_1.m_2 = (-1)(1) = 1$

So the required angle is $\frac{\pi}{2}$.

99. Given, $f(x) = x^3 + ax + b,\ a \neq b$ ……(i)

From Eq. (i), we have

$f'(x) = 3x^2 + a$

$f'(a) = 3a^2 + a$

$f'(b) = 3b^2 + a$

According to the question,

$f'(a) = f'(b)$

$3a^2 + a = 3b^2 + a$

$\Rightarrow \quad 3a^2 = 3b^2 \quad \Rightarrow a = \pm b$

$\Rightarrow \quad a = -b \quad [\because\ a \neq b]$

Now, $f(1) = 1 + a + b = 1 - b + b \quad [\because a = -b]$

$\therefore \quad f(1) = 1$

100. Equation of the curve is

$y - e^{xy} + x = 0$

$\Rightarrow \dfrac{dy}{dx} - e^{xy}\left(y + x\dfrac{dy}{dx}\right) + 1 = 0$

$\Rightarrow \dfrac{dy}{dx}\left(1 - xe^{xy}\right) = y.e^{xy} - 1$

$\Rightarrow \dfrac{dy}{dx} = \dfrac{1}{y}$

Clearly, $\dfrac{dx}{dy} = 0$

So, the required point is (1, 0).

102. We have, subnormal, $y = \dfrac{dy}{dx}$

and subtangent $= \dfrac{y}{\frac{dy}{dx}}$

$\Rightarrow \sqrt{\dfrac{\text{sunnormal}}{\text{Subtangent}}} = \sqrt{\dfrac{y\frac{dy}{dx}}{y/\frac{dy}{dx}}} = \dfrac{dy}{dx} =$ Slope of the tangents

103. Given, $y^2 = 8ax\,(a > 0)$

$\Rightarrow 2y\dfrac{dy}{dx} = 8a \Rightarrow \dfrac{dy}{dx} = \dfrac{8a}{2y} = \dfrac{4a}{y}$

$\therefore$ Length of subnormal $y.\dfrac{dy}{dx} = y.\dfrac{4a}{y} = 4a$

104. Let $f(x, y) = (x^2 + 3y^4)^{1/6}$

Taking $x = 4$, $\Delta x = -0.08$ and $y = 2$, $\Delta y = 0.1$ Differentiating (1) w.r.t. x, treating as constant.

$\therefore \dfrac{\Delta f}{\Delta x} = \dfrac{1}{6}\left(x^2 + 3y^4\right)^{-5/6}(2x)$

$= \dfrac{8}{9}(16 + 48)^{-5/6} = \dfrac{4}{3} \times 2^{-5} = \dfrac{1}{24}$ and differentiating (1) w.r.t. y treating *x* as constant

$\therefore \dfrac{\Delta f}{\Delta y} = \dfrac{1}{6}\left(x^2 + 3y^4\right)^{-5/6}\left(12y^3\right) = \dfrac{12(8)}{6}(64)^{-5/6} = 16(2)^{-5} = \dfrac{1}{2}$

$$\therefore\ df = \frac{\Delta f}{\Delta x}.dx + \frac{\Delta f}{\Delta y}dy = \frac{1}{24}\times -0.08 + \frac{1}{2}\times 0.1 = -\frac{0.01}{3} + \frac{0.1}{2} = 0.466$$

$$\therefore\ \left\{(3.92)^2 + 3(2.1)^4\right\}^{1/6} = f(4, 2) + fd = 2 + 0.466 = 2.466$$

105. We have, $pv^{1.4} = k$(constant)

$\Rightarrow \log p + 1.4 \log v = \log k$

$$\Rightarrow \frac{1}{p}\frac{dp}{dv} + \frac{1.4}{v} = 0 \Rightarrow \frac{dp}{dv} = -\frac{1.4p}{v}$$

Now, $\Delta p = \frac{dp}{dv}\Delta v$

$$\Rightarrow \Delta p = \frac{1.4p}{v}\Delta v \Rightarrow \frac{\Delta p}{p} = -1.4\frac{\Delta v}{v}$$

$$\Rightarrow \frac{\Delta p}{p}\times 100 = -1.4\left(\frac{\Delta v}{v}\times 100\right)$$

$$\Rightarrow \frac{\Delta p}{p}\times 100 = -1.4(-1.2) = 1.68 \qquad \left[\because \frac{\Delta v}{v}\times 100 = 1.2 \text{ given}\right]$$

106. $\frac{dx}{d\theta} = a(0 - \sin\theta)$, $\frac{dy}{d\theta} = a\cos\theta$

$$\left(-\frac{dx}{dy}\right) = \tan\theta$$

Equation of normal at $'\theta'$

$$y - a\sin\theta = \frac{\sin\theta}{\cos\theta}(x - a - a\cos\theta)$$

$y\cos\theta - a\sin\cos\theta = x\sin\theta - a\sin\theta - a\sin\theta\cos\theta$

$y\cos\theta - \sin\theta(x - a) = 0$

$y + \lambda(x - a) = 0$

So. It passes through fixed point (a, 0).

107. $x^2 = 4y \Rightarrow 2x = 4.\frac{dy}{dx} \Rightarrow \frac{dy}{dx} = \frac{x}{2}$

108. $x^2y^n = a^2, m = 2, n = n, 2m + n = 0$

$4 + n = 0, n = -4$

109. $\frac{dy}{dx} = \frac{6x}{(12 - 3y^2)}$

For vertical tangent dy/dx does not exist or $y = \pm 2$, whatever be the value of x satisfying curve.

110. The normal makes an angle $\frac{3\pi}{4}$ with $\overline{OX}$ the tangent makes an angle $\frac{\pi}{4}$ with $\overline{OX}$

$\theta = \frac{\pi}{4} \Rightarrow m = \tan\theta = \tan\frac{\pi}{4} = 1 \quad \therefore f^1(3) = 1$

111. (C)

$$\left(\frac{dy}{dx}\right)_{at\theta} = \left(\frac{\frac{dy}{d\theta}}{\frac{dx}{d\theta}}\right)_{\theta = \frac{\pi}{2}}$$

112. (D) Calculate slope

113. (B) $\frac{dy}{dx}$ is not defined.

114. (A)

115. (B) Equation of the tangent at $p(\theta)$ to $x^{\frac{2}{3}}+y^{\frac{2}{3}}=a^{\frac{2}{3}}$ is $\frac{x}{a\cos\theta}+\frac{y}{a\sin\theta}=1$

116. (D) Find $\frac{dy}{dx}$ and the equation of the tangent

117. (C) $m_1.m_2=-1$

118. (A) Find $\frac{dy}{dx}$ to the two curves at (1, 1) they are $m_1$and m_2. Then $\tan\theta=\left|\frac{m_1-m_2}{1+m_1m_2}\right|$

119. (C) Slope of the first curve at (1, 1) is $m_1=\frac{-2}{a}$ Slope of the second curve at (1, 1) is m_2=3

$m_1m_2=-1\Rightarrow\frac{-2}{3}.3=-1\Rightarrow a=6$

120. (B) Given, $S=\frac{t^2}{3}-3t^2+8t$ for rest, $\frac{ds}{dt}=0,$ i.e.,

$t^2-6t+8=0\Rightarrow(t-2)(t-4)=0,$

$\Rightarrow t=2$ or $t=4.$ required distance =

$s_{t=2}=\frac{8}{3}-12+16=\frac{8}{3}+4=\frac{20}{3}$ units

121. (A) Given $s=3t^3-8t+1\Rightarrow\frac{ds}{dt}=9t^2-8$

For distance increasing, $\frac{ds}{dt}>0$ i.e., $9t^2-8>0$

$\Rightarrow t^2>\frac{8}{9}\Rightarrow t<\frac{-2\sqrt{2}}{3}$ or $t>\frac{2\sqrt{2}}{3}$

$t=-\frac{2\sqrt{3}}{2}$ is rejected $\Rightarrow t>\frac{2\sqrt{2}}{3}$

122. (C) $S=t^3-9t^2+24t\Rightarrow\frac{ds}{dt}=3t^2-18t+24,$

Velocity decreases, $\frac{d^2s}{dt^2}<0$ i.e., $6t-18<0,\ \therefore t<3$

123. (D) Let $\alpha,\beta\in[0,1]. f(x)$ is continuous on $[\alpha,\beta]$ & differentiable on (α,β) and

$f(\alpha)=f(\beta)=0\ \therefore c\in(\alpha,\beta)$ such that $f'(c)=0\Rightarrow c=\pm1\notin(0,1)$

124. (C) $f'(c)=0\quad 2c(c-2)+(c-2)^2=0$

$c=2,2/3\quad\therefore c=2/3(c\neq2)$

125. (C) $f(1)=f(3)\Rightarrow a=11$

PHYSCIS

1. $\tan\delta=\frac{V}{H}$ and $\tan\delta_1=\frac{V}{H\cos\theta}$

2. $M_R=\sqrt{M_1^2+M_2^2+2M_1M_2\cos\theta}$

3. For semi circle $M^1=\frac{2M}{\pi}$ decrease = $M-M'$

4. $\tau=\bar{M}\times\bar{B}$

5. $M^1 = \frac{2M\sin\left(\frac{\theta}{2}\right)}{\theta}$

6. $\sqrt{3}MB\sin\theta = MB\sin(90-\theta) = \tan\theta = \frac{1}{\sqrt{3}} \Rightarrow \theta = 30°$

7. $M' = \frac{2M\sin\left(\frac{\theta}{2}\right)}{\theta}$

Percentage change in the magnetic moment

$\frac{M'-M}{M}\times 100$

8.

Here,

Radius, r = 10 cm = 10 × 10^{-2}m

Number of turns, N = 100

Current, I = 1A

Area of the coil, $A = \pi r^2$

Magnetic moment of the coil,

$$M = NIA = NI\pi r^2$$
$$= 100\times 1\times 3.142\times\left(10\times 10^{-2}\right)^2 \text{ A m}^2$$
$$= 3.142 \text{ A m}^2$$

9. $\frac{d\tau}{d\theta} = MB\cos\theta$

10. $B_H = \sqrt{3}B_v$, also $\tan\phi = \frac{B_v}{B_H} = \frac{1}{\sqrt{3}} \Rightarrow \phi = 30^0$

11. $T = 2\pi\sqrt{\frac{1}{MB_H}} \Rightarrow \frac{T_1}{T_2} = \sqrt{\frac{M_2}{M_1}} \Rightarrow \frac{M_1}{M_2} = \frac{T_2^2}{T_1^2} = \frac{(60/15)^2}{(60/10)^2} = \frac{4}{9}$

12. $\mu_r < 1$ and $\varepsilon_r > 1$

13. Ferromagnetic substance, magnetized strongly in the direction of magnetic field, paramagnetic substance magnetized weakly in the direction of magnetic field while diamagnetic substance is magnetized weakly in opposite direction of magnetic field.

14. Behaves like a paramagnetic material.

15. At point P net magnet field $B_{net} = \sqrt{B_1^2 + B_2^2}$

Where $B_1 = \frac{\mu_0}{4\pi}.\frac{2M}{d^3}$ and $B_2 = \frac{\mu_0}{4\pi}.\frac{M}{d^3}$

$\Rightarrow B_{net} = \frac{\mu_0}{4\pi}.\frac{\sqrt{5}M}{d^3}$

16. $\vec{\tau} = I\vec{A}\times\vec{B} = IAB\sin\theta = 0$

(As $\vec{A}$ is perpendicular to the plane of the loop, angle between $\vec{A}$ and $\vec{B}$ is zero).

17. $W = \int_0^\theta mB\sin\theta\, d\theta = mB(1-\cos\theta)$

(as dW = τ dθ = mB sin θ dθ)

21. (A) $I = \frac{M}{V}, V = \frac{mass}{density}$

22. Ferro magnetic substance never be in liquid or gases

25. C = MBsinθ

26. $\tau = BAIN\cos\theta$, θ = angle made by plane of coil with magnetic field

28. When the magnet is bent, the length of the magnet is,

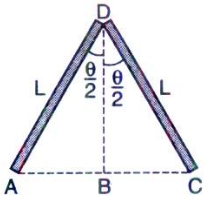
AC = AB + BC

$$= L\sin\frac{\theta}{2} + L\sin\frac{\theta}{2}$$

$$= 2L\sin(\theta/2)$$

$$= 2L\sin(60^0/2)$$

$$= 2L\sin 30^0 = L.$$



30. $B_e = B_H$ and $B = B_a + B_H = 2B_e + B_H = 2B_H + B_H = 3B_H$

31. $T \propto \frac{1}{\sqrt{M}}$ and M=m×2l

32. $B_V = B\sin\theta \Rightarrow B = \frac{B_V}{\sin\theta}$

38. Since, image formed by mirror will be at distance OM on right side, so image will be formed for convex mirror at OM –MP. So, υ = OM – MP and object is at OP.

$\therefore u$ = OP

39. Since, image is virtual, v is +ve.

f = – 15, u = ?

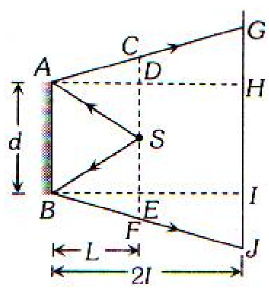
$$m = 2 = \frac{\upsilon}{u} \quad \text{or,} \quad \upsilon = 2u$$

Applying mirror formula, we get;

$$\frac{1}{\upsilon} + \frac{1}{u} = \frac{1}{f}$$

$$\frac{1}{2u} - \frac{1}{u} = -\frac{1}{15} \quad \text{or} \quad \frac{1-2}{2u} = -\frac{1}{15}$$

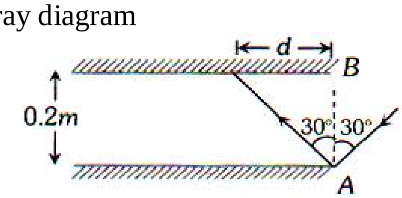
40. According to the following ray diagram $HI = AB = d$ and $DS = CD = \frac{d}{2}$



$\because AH = 2AD \Rightarrow GH = 2CD = \frac{2d}{2} = d$

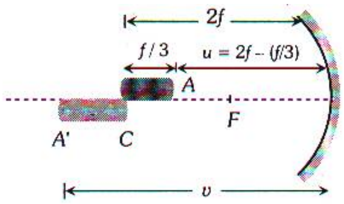
Similarly $IJ = d$ so $GJ = GH + HI + IJ = d + d + d = 3d$

41. From the following ray diagram



$$d = 0.2\tan 30^0 = \frac{0.2}{\sqrt{3}} \Rightarrow \frac{l}{d} = \frac{2\sqrt{3}}{0.2/\sqrt{3}} = 30$$

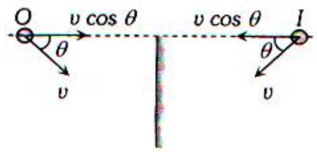
42. If end A of rod acts an object for mirror then it's image will be A' and if $u = 2f - \frac{f}{3} = \frac{5f}{3}$ so by using $\frac{1}{f} = \frac{1}{v} + \frac{1}{u}$



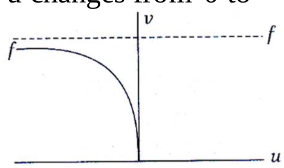
$$\Rightarrow \frac{1}{-f} = \frac{1}{v} + \frac{1}{\frac{-5f}{3}} \Rightarrow v = -\frac{5}{2}f$$

$\therefore$ Length of image $= \frac{5}{2}f - 2f = \frac{f}{2}$

43. From fig. it is clear that relative velocity between object and it's image = $2v\cos\theta$



44.
u changes from 0 to $-\infty$ then, v change from 0 to + f.



45. For glass-water interface ${}_g\mu_w = \frac{\sin i}{\sin r}$ ……..(i)

For water-air interface ${}_g\mu_w = \frac{\sin r}{\sin 90^0}$ ……..(ii)

$$\Rightarrow {}_g\mu_w \times {}_w\mu_q = \frac{\sin i}{\sin r} \times \frac{\sin r}{\sin 90^0} = \sin i$$

$$\Rightarrow \frac{\mu_w}{\mu_g} \times \frac{\mu_a}{\mu_w} = \sin i \Rightarrow \mu_g = \frac{1}{\sin i}$$

46. $v_i = -\left(\frac{f}{f-u}\right)^2 .v_0 = -\left(\frac{-24}{-24-(-60)}\right) \times 9 = -4\,cm/s$

47. $m = \pm 2$

Now $-\frac{v}{u} = 2$ $\qquad -v = 2u$

$$\frac{1}{v} + \frac{1}{u} = \frac{1}{f}$$

$$-\frac{1}{2u} + \frac{1}{u} = \frac{1}{f} \Rightarrow \frac{1}{2u} = \frac{1}{f}$$

$$\Rightarrow u = \frac{f}{2}$$

50. Virtual image is always larger in size compared to size of object.

CHEMISTRY

15. One unit cell contains 4 atoms 1 atom is present in $\frac{1}{4}$ unit cells

2.4×10^{24} atoms are present in $2.4\times10^{24}\times\frac{1}{4}=6\times10^{23}=N$

16. $\rho=\frac{zm}{N_0a^3}$

18. $W=8\times\frac{1}{8}=1 \quad O=12\times\frac{1}{4}=3$

$Na=1\times1=1 \quad \therefore$ formula $= NaWO_3$

19. $v=a^3=8\times10^{-24}cc$

20. AB, AB, AB…… arrangement represents hcp packing

21. In hcp coordination

25. No. of atoms of Y = 4 No. of atoms of $X=\frac{2}{3}\times8$

Formula of compound will be X4Y3

26. For an ionic substance in FCC arrangement,

$2(r^++r^-)=$ edge length $2(110+r^-)=508;\ r^-=144pm$

27. Effective no. of A atoms $=\frac{1}{8}\times8=1$ Effective no. of B atoms $=\frac{1}{2}\times5$

(One is missing) $=\frac{5}{2}$ Therefore formula is $A_1B_{\frac{5}{2}}=A_2B_5$

28. For BCC, $\sqrt{3}a=4r \quad r=\frac{\sqrt{3}\times351}{4}=152pm$

29. In CsCl structure, Cs^+ ion is in contact with Cl^- ion at the nearest distance which is equal to $\sqrt{3}\frac{a}{2}$

30. Lyophillic means liquid loving hence hydration is contributed toward the extra stability of lyophillic colloids.

31. Traces of electrolytes are essential for stabilising the sales hence for sales destruction addition of electrolytes are required

32. A catalyst is a substance which alters the rate of reaction and shortens the time to reach equilibrium.

33. Inhibitors are also catalysts but they slow down the rate of reaction.

34. The ability of an ion to bring about coagulation of a given calloid depend upon both the magnitude and sign of its charge.

35. Physiorption is a process in which the particles of adsorbate are held to the surface of adsorbent by physical forces hence does not requires activation energy.

36. Egg is a calloid of solid and liquid; Ruby glass is a colloid of solid and solid. Milk is a colloid of liquid and liquid but chlorophyll is a complex of magnesium.

37. Surfactant are those which have charge on their tail e.g., cetyltrimethyl ammonium bromide.

$$CH_3-(CH_2)_{15}-\overset{\overset{CH_3}{|}}{\underset{\underset{CH_3}{|}}{N^+}}-CH_3-Br^-$$

Surfactants are those, which dissociate in water to yield positively charged ion.

38. The size of colloidal particles is of the order $0.1m\mu$ to $0.001m\mu$.

39. $K_4[Fe(CN)_6]$ is most effective in the coagulation of gold-solution.

40. A catalyst is used to decrease the time required for the reaction hence it can decease or increase the rate of reaction.
41. Absorption, Tyndall effect and flocculation all are related to sol but paramagnetism is not represented by sol.
42. On shaking with the dispersion medium, colloids directly from the colloidal sol. Hence they are called intrinsic colloids. *i.e.*, glue.
43. Arsenious sulphide can be prepared by double decomposition
$As_2O_3 + 3H_2S \rightarrow As_2S_3 + 3H_2O$
44. The amount of electrolyte required to coagulate a fixed amount of a sol depends upon the valency of flocculating ion.
45. Gold no. is a measure of protective power of a lyophillic colloid.
46. The colloidal solution of liquid in liquid is called emulsion not gel.
47. Linseed oil, lanolin and Glycogen attract water hence contain a hydrophobic structure but rubber does not attract water and does not contain a hydrophobic structure.
48. Gum-arabic has protective power hence the function of it ion in preparation of indian ink is protective action.
49. Easily liquefiable gases like SO_2, NH_3, CO_2 are adsorbed to a greater extent than the elemental gases like N_2, O_2, H_2.
50. Volume of the gold dispersed in one litre water $= \frac{\text{Mass}}{\text{Density}} = \frac{1.9 \times 10^{-4}\ gm}{19\ gm\ cm^{-3}} = 1 \times 10^{-5}\ cm^{-3}$

Radius of gold sol particle $= 10\ nm = 10 \times 10^{-9}\ m = 10 \times 10^{-7}\ cm = 10^{-6}\ cm$

Volume of the gold sol particle $= \frac{4}{3}\pi r^3 = \frac{4}{3} \times \frac{22}{7} \times (10^{-6})^3 = 4.19 \times 10^{-18}\ cm^3$

No. of gold sol particle in $1 \times 10^{-5}\ cm^3 = \frac{1 \times 10^{-5}}{4.19 \times 10^{-18}}$

$= 2.38 \times 10^{12}$

No. of gold sol particle in one $mm^3 = \frac{2.38 \times 10^{12}}{10^6} = 2.38 \times 10^6$

51. Sodium acetate forms cationic micelles in the molecule of soap and detergent the negative ions aggregate to form a micelle of colloidal size. The negative ion has a long hydrocarbon chain and a polar group $(-COO^-)$ at one end.
52. The protective action of different colloids is expressed in terms of Gold number.
57. Tyndall effect may be defined as the scattering of light by the colloidal particles present in a colloidal sol.
59. It is due to adsorption of S^{2-} ions on the surface of the colloidal particles and H^+ ions in the diffused layer.
69. Alum helps in purifying water by Al^{3+} ions which coagulate the negative mud particles.
70. Sn^{+4} contain maximum coagulation power (coagulation power $\propto$ number of charge on ion)
71. It is liquid in gas colloidal solution.

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