MELUHA INTERNATIONAL SCHOOL

HYDERABAD

SR MPC JEE MAINS | **UNIT – IV** | **Date: 04-05-2020**
Time: | **ASSIGNMENT – 3** | **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 $\int \frac{\sin x}{\sin(x-\alpha)}dx = Ax + B\log\sin(x-\alpha)+c,$ then value of (A, B) is

(A) $(\sin\alpha, \cos\alpha)$ (B) $(\cos\alpha, \sin\alpha)$ (C) $(-\sin\alpha, \cos\alpha)$ (D) $(-\cos\alpha, \sin\alpha)$

2. $\int \frac{dx}{\cos x - \sin x}$ is equal to

(A) $\frac{1}{\sqrt{2}}\log\left|\tan\left(\frac{x}{2}-\frac{\pi}{8}\right)\right|+c$ (B) $\frac{1}{\sqrt{2}}\log\left|\cot\left(\frac{x}{2}\right)\right|+c$

(C) $\frac{1}{\sqrt{2}}\log\left|\tan\left(\frac{x}{2}-\frac{3\pi}{8}\right)\right|+c$ (D) $\frac{1}{\sqrt{2}}\log\left|\tan\left(\frac{x}{2}+\frac{3\pi}{8}\right)\right|+c$

3. $\int\left\{\frac{(\log x - 1)}{1+(\log x)^2}\right\}^2 dx$ is equal to

(A) $\frac{x}{(\log x)^2+1}+c$ (B) $\frac{xe^x}{1+x^2}+c$ (C) $\frac{x}{x^2+1}+c$ (D) $\frac{\log x}{(\log x)^2+1}$

4. If $\int \frac{dx}{\sqrt{\sin^3 x\cos^5 x}} = a\sqrt{\cot x}+b\sqrt{\tan^3 x}+c$, then

(A) a = –1, b = 1/3 (B) a = –3, b = 2/3 (C) a = –2, b = 4/3 (D) a = –2, b = 2/3

5. $\int \frac{\ln(\tan x)}{\sin x\cos x}dx$ is equal to

(A) $\frac{1}{2}\ln(\tan x)+c$ (B) $\frac{1}{2}\ln(\tan^2 x)+c$ (C) $\frac{1}{2}(\ln(\tan x))^2+c$ (D) None of these

6. The value of $\int_{-\pi/2}^{\pi/2}\left(x^3+x\cos x+\tan^5 x+1\right)dx$

(A) 0 (B) 2 (C) π (D) 1

7. The value of $\int_0^{\pi/2}\log\left(\frac{4+3\sin x}{4+3\cos x}\right)dx$ is

(A)2 (B) $\frac{3}{4}$ (C) 0 (D) -2

8. The value of $\int_0^1\tan^{-1}\left(\frac{2x-1}{1+x-x^2}\right)dx$ is

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

9. The value of $\int_0^1 \tan^{-1}\left(\frac{2x-1}{1+x-x^2}\right)dx$ is

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

10. If f and g are continuous functions in $[0,1]$ satisfying $f(x)=f(a-x)$ and $g(x)+g(a-x)=a$, then $\int_0^a f(x).g(x)dx$ is equal to

(A) $\frac{a}{2}$ (B) $\frac{a}{2}\int_0^a f(x)dx$ (C) $\int_0^a f(x)dx$ (D) $a\int_0^a f(x)dx$

11. If $x=\int_0^y \frac{dt}{\sqrt{1+9t^2}}$ and $\frac{d^2y}{dx^2}$=ay, then a is equal to

(A) 3 (B) 6 (C) 9 (D)1

12. If $\int_0^1 \frac{e^t}{1+t}dt=a,$ then $\int_0^1 \frac{e^t}{(1+t)^2}dt$ is equal to

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

13. Evaluate $\lim_{n\to\infty}\frac{1}{n}\sum_{r=n+1}^{2n}\log_e\left(1+\frac{r}{n}\right)$

(A) $\log\left(\frac{27}{4e}\right)$ (B) $\log\left(\frac{4}{e}\right)$ (C) $\log\left(\frac{25}{3e^2}\right)$ (D) $\log\left(\frac{27}{e^2}\right)$

14. Evaluate $\lim_{n\to\infty}\sum_{r=1}^{n}\frac{n}{(n+r)^2}$

(A) $\frac{3}{4}$ (B) $\frac{2}{3}$ (C) $\frac{2}{9}$ (D) $\frac{1}{2}$

15. $\int_{a+c}^{b+c} f(x)dx$ is equal to

(A) $\int_a^b f(x-c)dx$ (B) $\int_a^b f(x+c)dx$ (C) $\int_a^b f(x)dx$ (D) $\int_{a-c}^{b-c} f(x)dx$

16. The value of the integral $\int_3^6 \frac{\sqrt{x}}{\sqrt{9-x}+\sqrt{x}}dx$ is

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

17. $\int_0^\infty \frac{dx}{(x^2+a^2)(x^2+b^2)}=$

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

18. $\int_{-\pi}^{\pi}\frac{2x(1+\sin x)}{1+\cos^2 x}dx=$

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

19. If $\int_0^1 \frac{\sin x}{1+x}dx = K$ then the value of $\int\limits_{4\pi-2}^{4\pi} \frac{\sin\left(\frac{x}{2}\right)}{4\pi+2-x}dx$ equals

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

20. Let $u = \int_0^{\pi/4} \frac{\cos^2 x}{1+\sin 2x}dx$, $v = \int_0^{\pi/8} \frac{1}{(1+\tan 2x)^2}dx$ then the value of $\frac{u}{v}$ equals

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

21. Let $f(x)$ be a differentiable function on R such that $f(6+x) = f(6-x)$,

$f(4+x) = f(4-x)$ and $f(7)=1$ and $\int\limits_k^{k+4} f(x)dx = 5$ then the value of $\int\limits_3^7 x f'(x)dx$ equals

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

22 If $\underset{n\to\infty}{Lt}\int\limits_0^{\sqrt{a}}\left(1-\frac{x^2}{n}\right)^n x\,dx = 1/2\sqrt{2}$ $(n \in N)$ then the value of 'a' equals

(A) $2\ell n2$ (B) $2\ell n3$ (C) $2+\ell n3$ (D) $\ell n\left(2+\sqrt{2}\right)$

23. The value of $\int_0^1 \mathrm{x}(1-\mathrm{x})^{99}\,\mathrm{dx}$ is

(A) $\frac{1}{10100}$ (B) $\frac{11}{10100}$ (C) $\frac{1}{1010}$ (D) None of these

24. $I_1 = \int\limits_0^4\left[x+\frac{3}{2}\right]dx$ and $I_2 = \int\limits_0^{\pi}\sqrt{\frac{1+\cos 2x}{2}}dx$ then ([.] denotes the G.I.F.)

(A) $I_1 = 6I_2$ (B) $I_1 = 2I_2$ (C) $I_2 = 2I_1$ (D) $I_1 + I_2 = 0$

25. If $\int_0^{\pi}\frac{(2x+3)\sec x\tan x}{4+\tan^2 x}dx = \frac{(p\pi+q)\pi}{3\sqrt{3}}$ then p+q=

(A) 4 (B) 5 (C) 6 (D) 8

26. The value of $\underset{n\to\infty}{lt}\prod_{r=1}^{n}\left(\frac{n+r}{n}\right)^{1/n}$ equals

(A) $1/e$ (B) $2/e$ (C) $3/e$ (D) $4/e$

27. The value of $\int_0^{3\pi/2}\cos^4 3x.\sin^2 6x\,dx$ equals

(A) $\frac{15\pi}{64}$ (B) 0 (C) $\frac{5\pi}{64}$ (D) $\frac{5\pi}{32}$

28. Let $I_n = \int\limits_0^1 (1-x^a)^n dx$ and if $\frac{I_n}{I_{n+1}} = 1+\frac{\lambda}{a}$ then λ equals

(A) n (B) n+1 (C) $\frac{1}{n}$ (D) $\frac{1}{n+1}$

29. The value of $\sum_{k=2}^{\infty}\left\{\underset{n\to\infty}{Lt}\sum_{r=1}^{n}\left(\frac{\sqrt{n}}{\sqrt{r}\left(k\sqrt{n}-\sqrt{r}\right)^2}\right)\right\}$ equals

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

30. Let 'f' be a one-one continuous function such that $f(1)=4$, $f(2)=6$, given that $\int_1^2 f(x)\,dx=20$ then the value of $\int_4^6 f^{-1}(x)\,dx$ equals

(A) 6 (B) -8 (C) -10 (D) -12

31. The value of $\int_{\pi}^{3\pi}\frac{\sin^{-1}(\sin x)}{\sin^4 x+\cos^4 x}dx$ equals

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

32. The value of $I=\int_0^1 \ell n(\cos x)\,dx$ has the same value as that of the definite integral given below

(A) $\int_0^1\frac{\ell nx}{\sqrt{1-x^2}}dx$ (B) $\int_{\cos 1}^{1}\frac{\ell nx}{\sqrt{1-x^2}}dx$ (C) $\frac{1}{4}\int_{\cos^2 1}^{1}\frac{\ell nx}{\sqrt{x-x^2}}dx$ (D) $\int_{\cos 2}^{1}\frac{1}{\sqrt{1-x^2}}dx$

33. The value of $\underset{t\to 0}{Lt}\frac{1}{t}\int_0^{\pi}\tan(t\sin x)\,dx$ equals

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

34. Let $f(x)$ be a continuous function such that $\int_0^1 f(x)\left(2x-f(x)\right)dx=\frac{1}{3}$ then the value of $f(3)$ equals

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

35. The value of $\int_0^{102}\left[\cot^{-1}x\right]dx$ is K then the value of [k] equals (where [ ] is G.I.F.)

(A) 0 (B) 1 (C) 99 (D) 98

36. Let $f:(0,\infty)\to R$ and $F(x)=\int_0^x f(t)\,dt$ If $F\left(x^2\right)=x^2(1+x)$, then $f(4)$ equals:

(A) 5/4 (B) 7 (C) 4 (D) 2

37. The value of the integral $\int_{e^{-1}}^{e^2}\left|\frac{\log_e x}{x}\right|dx$ is

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

38. If $f(x)=\begin{cases} e^{\cos x}\sin x & for\ |x|\le 2 \\ 2 & otherwise\end{cases}$, then $\int_{-2}^{3} f(x)\,dx=$

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

39. Let $g(x)=\int_0^x f(t)\,dt$, where f is such that $\frac{1}{2}\le f(t)\le 1$ for $t\in[0,1]$ and $0\le f(t)\le\frac{1}{2}$ for $t\in[1,2]$. Then g(2) satisfies the inequality:

(A) $-\frac{3}{2}\le g(2)<\frac{1}{2}$ (B) $0\le g(2)<2$ (C) $\frac{3}{2}<g(2)\le\frac{5}{2}$ (D) $2<g(2)<4$

40. $\lim_{x\to\infty}\frac{1}{n}\sum_{r=1}^{2n}\frac{r}{\sqrt{n^2+r^2}}$ equals:

(A) $1+\sqrt{5}$ (B) $-1+\sqrt{5}$ (C) $-1+\sqrt{2}$ (D) $1+\sqrt{2}$

41. If for a real number $y,[y]$ is the greatest integer less than or equal to *y*, then the value of the integral $\int_{\pi/2}^{3\pi/2}[2\sin x]dx$ is:

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

42. $\int_{\pi/4}^{3\pi/4}\frac{dx}{1+\cos x}$ is equal to:

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

43. $\int_0^x f(t)dx = x+\int_x^1 t\, f(t)dt,$ then the value of *f*(1) is:

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

44. Let $f(x)=x-[x],$ for every real number *x*, where [*x*] is the integral part of *x*.

Then $\int_{-1}^{1} f(x)dx$ is

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

45. If $g(x)=\int_0^x \cos^4 t\, dt,$ then $g(x+\pi)$ equals:

(A) $g(x)+g(\pi)$ (B) $g(x)-g(\pi)$ (C) $g(x)g(\pi)$ (D) $\frac{g(x)}{g(\pi)}$

46. The area inside the parabola $5x^2 - y = 0$ but outside the parabola $2x^2 - y + 9 = 0$ is

(A) $12\sqrt{3}$ sq. units (B) $6\sqrt{3}$ sq. units (C) $8\sqrt{3}$ sq. units (D) $4\sqrt{3}$ sq. units

47. The area of the region enclosed by the curves $y = x \log x$ and $y = 2x - 2x^2$ is

(A) $\frac{7}{12}$ sq. unit (B) $\frac{1}{2}$ sq. unit (C) $\frac{5}{12}$ sq. unit (D) none of these

48. Area bounded by $y=\frac{1}{x^2-2x+2}$ and the x-axis is

(A) 2π sq. units (B) $\frac{\pi}{2}$ sq. units (C) 2 sq. units (D) π sq. units

49. The area bounded by $y = \sec^{-1} x$, $y = \operatorname{cosec}^{-1} x$, and line $x - 1 = 0$ is

(A) $\log\left(3+2\sqrt{2}\right)-\frac{\pi}{2}$ sq. units (B) $\frac{\pi}{2}-\log\left(3+2\sqrt{2}\right)$ sq. units

(C) $\pi-\log_e 3$ sq. unit (D) none of these

50. The area of the closed figure bounded by x = - 1, x = 2 and $y=\begin{cases}-x^2+2 & x\le 1\\ 2x-1, & x>1\end{cases}$ and the abscissa axis is

(A) 16/3 sq. units (B) 10/3 sq. units (C) 13/3 sq. units (D) 7/3 sq. units

51. The area of the region bounded by x = 0, y = 0, x = 2, y = 2, $y \le e^x$ and $y \ge \ln x$, is

(A) 6 – 4 ln 2 sq. units (B) 4 ln 2 – 2 sq. units

(C) 2 ln 2 – 4 sq. units (D) 6 – 2 ln 2 sq. units

52. The area bounded by $y = 3 - |3 - x|$ and $y = \frac{6}{|x+1|}$ is

(A) $\frac{15}{2} - 6\ln 2$ sq. units (B) $\frac{13}{2} - 3\ln 2$ sq. units

(C) $\frac{13}{2} - 6\ln 2$ sq. units (D) none of these

53. Area bounded by the curves $y = \log_e x$ and $y = (\log_e x)^2$ is

(A) e – 2 sq. units (B) 3 – e sq. units (C) e sq. units (D) e – 1 sq. units

54. The area bounded by the curve $f(x) = x + \sin x$ and its inverse function between the ordinates x = 0 and x = 2π is

(A) 4π sq. units (B) 8π sq. units (C) 4 sq. units (D) 8 sq. units

55. Let $f(x)$ be a non-negative continuous function such that the area bounded by the curve $y = f(x)$, the x-axis, and the ordinates $x = \frac{\pi}{4}$ and $x = \beta > \frac{\pi}{4}$ is $\beta \sin\beta + \frac{\pi}{4}\cos\beta + \sqrt{2}\beta$. Then $f'\left(\frac{\pi}{2}\right)$ is

(A) $\left(\frac{\pi}{2} - \sqrt{2} - 1\right)$ (B) $\left(\frac{\pi}{4} + \sqrt{2} - 1\right)$ (C) $-\frac{\pi}{2}$ (D) $\left(1 - \frac{\pi}{4} - \sqrt{2}\right)$

56. The area bounded by $y = 2 - |2 - x|$ and $y = \frac{3}{|x|}$ is $\frac{k - 3\log_e 3}{2}$ then $k =$ _____

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

57. The area of the figure bounded by $y = x^2 - 2x + 3$ and the line tangent to it at $M(2,3)$ and $y -$ axis is

(A) $\frac{1}{3}$ (B) $8/3$ (C) 2 (D) 4

58. Area of the curve bounded by $|x - 2y| + |x + 2y| \le 8$. $xy \ge 2$ is

(A) $12 - 4\log_e 4$ (B) $6 - 4\log_e 2$ (C) $12\log_e 2$ (D) $3 - \log_e 2$

59. Area of the region bounded by the curve $(y - x)^2 = x^3$ and $x = 1$ is

(A) $\frac{1}{5}$ (B) $\frac{2}{5}$ (C) $\frac{3}{5}$ (D) $\frac{4}{5}$

60. Area of the region bounded by $x^2y^2 = a^2(y^2 - x^2)$ and $x = \pm a$. is λa^2 then $\lambda =$ _____

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

61. Area of the region bounded between $y^2 = 4x$ and $y = 2x - 4$ is

(A) 2 (B) 9 (C) 9/4 (D) 3

62. Area bounded between two successive points of intersections of $y = \sin x$, $y = \cos x$ is

(A) $\sqrt{2}$ (B) 2 (C) $2\sqrt{2}$ (D) 8

63. If $0 < a < c, 0 < b < c$ then $\int_0^\infty \frac{a^x - b^x}{c^x} dx =$

(A) $\log\frac{b}{c} - \log\frac{a}{c}$ (B) $\frac{\log a - \log b}{\log c}$

(C) $\frac{1}{\log b/c} - \frac{1}{\log a/c}$ (D) $\log\frac{a}{c} - \log\frac{b}{c}$

64. If $\int_0^k \frac{\cos x}{1+\sin^2 x}dx = \frac{\pi}{4}$ then k =

(A) 1 (B) $\pi/4$ (C) $\pi/2$ (D) $\pi/6$

65. $\int_2^e \left[\frac{1}{\log x} - \frac{1}{(\log x)^2}\right]dx =$

(A) $e-2$ (B) $e+2\log_2 e$ (C) $e-2\log_2 e$ (D) $\log_2 e$

66. Equation of the curve whose sub tangent is constant is

(A) $y^2 = ce^{\frac{x^2}{k}}$ (B) $y = cx^2$ (C) $y = ce^{\frac{x}{k}}$ (D) $y = ce^{x^2}$

67. Solution of the differential equation $\frac{\sqrt{x}\,dx+\sqrt{y}\,dy}{\sqrt{x}dx-\sqrt{y}dy} = \sqrt{\frac{y^3}{x^3}}$ is given by

(A) $\frac{3}{2}\log\left(\frac{y}{x}\right)+\log\left|\frac{x^{3/2}+y^{3/2}}{x^{3/2}}\right|+\tan^{-1}\left(\frac{y}{x}\right)^{3/2}+c=0$ (B) $\frac{2}{3}\log\left(\frac{y}{x}\right)+\log\left|\frac{x^{3/2}+y^{3/2}}{x^{3/2}}\right|+\tan^{-1}\frac{y}{x}+c=0$

(C) $\frac{2}{3}\log\left(\frac{y}{x}\right)+\log\left(\frac{x+y}{x}\right)+\tan^{-1}\left(\frac{y^{3/2}}{x^{3/2}}\right)+c=0$ (D) None of the above

68. The degree of the differential equation of all curves having normal of constant length c, is

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

69. The equation of the curve in which the portion of the tangent included between the coordinate axes is bisected at the point of contact, is

(A) a parabola (B) an ellipse (C) a circle (D) a hyperbola

70. Solution of $\sqrt{1+x^2+y^2+x^2y^2}+xy\frac{dy}{dx}=0$ is

(A) $\log\left(\frac{x}{1+\sqrt{1+x^2}}\right)+\sqrt{1+x^2}+\sqrt{1+y^2}=c$ (B) $\log\left(\frac{x}{\sqrt{1+x^2}}\right)+\sqrt{1-x^2}+\sqrt{1+y^2}=c$

(C) $\log\left(\frac{x}{\sqrt{1+x^2}}\right)=c$ (D) $\log\left(\sqrt{1+x^2}-\sqrt{1+y^2}\right)+\log\left(\frac{x}{\sqrt{1+x^2}}\right)=c$

71. The solution of $\frac{dy}{dx}=xy+2x-3y-6$

(A) $(y+2)^2=c.e^{(x-3)^2}$ (B) $\log(y+2)=x^2-3x+c$

(C) $y+2=2(x-3)+c$ (D) $(y+2)(x-3)=c$

72. The equation of the curve for which the tangent at P(x, y) cuts the y-axis at (0, y^3) is

(A) $xy^2=x+y$ (B) $x^2(y^2-1)=cy^2$

(C) $y(x^2-1)=cx^2$ (D) $yx+x^2=c$

73. If $x\frac{dy}{dx}=y(\log y-\log x+1)$, then the solution of the equation is

(A) $y\log\left(\frac{x}{y}\right)=cx$ (B) $x\log\left(\frac{y}{x}\right)=cy$ (C) $\log\left(\frac{y}{x}\right)=cx$ (D) $\log\left(\frac{x}{y}\right)=cy$

74. Family $y=Ax+A^4$ of curves is represented by the differential equation of degree

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

750. The solution of $\frac{dy}{dx}-\frac{2xy}{1+x^2}=0$ is

(A) $y=c(1+x^2)$ (B) $y=c\sqrt{1+x^2}$ (C) $y=\frac{c}{1+x^2}$ (D) $y=\frac{c}{\sqrt{1+x^2}}$

76. The solution of $\frac{dy}{dx}=e^{x-y}$ is

(A) $e^x-e^y=c$ (B) $e^x+e^y=c$ (C) $e^{-x}-e^y=c$ (D) $e^{-x}-e^{-y}=c$

77. Equation of the curve passing through (1, 3) having slope $\frac{y}{x}$ at any point is

(A) $y=3x$ (B) $y=3x^2$ (C) $x^2=3y$ (D) $x=3y$

78. Solution of $\frac{dy}{dx}=\frac{x-y+2}{x+y-1}$

(A) $x^2+y^2+xy-4y-2x=c$ (B) $x^2-y^2-2xy+4x+2y=c$

(C) $x^2-y^2+xy+2x-4y=c$ (D) $x^2+y^2-xy+4x-2y=c$

79. Solution of $x+y=\cos^{-1}\left(\frac{dy}{dx}\right)$ is

(A) $x+c=\tan\left(\frac{x+y}{2}\right)$ (B) $x+c=\sin\left(\frac{x+y}{2}\right)$

(C) $x+c=\sec\left(\frac{x+y}{2}\right)$ (D) $x+c=cosec\left(\frac{x+y}{2}\right)$

80. The solution of $x\cos^2 y\, dx=y\cos^2 x dy$

(A) $\tan x\tan y=c$ (B) $y\tan y=x\tan x+c$

(C) $\tan x.\cos y=\tan y\cos x+c$ (D) $y\tan y-x\tan x+\log\left(\frac{\cos y}{\cos x}\right)=c$

81. A curve passes through the point (4, 2) and at any point (x, y) on it the product of its slope and the ordinate is equal to abscissa then the curve is

(A) parabola (B) Ellipse (C) Circle (D) Hyperbola

82. If $\frac{dy}{dx}=e^{-2y}$ and $y=0$ when $x=5,$ the value of x for $y=3$ is

(A) e^5 (B) e^6+1 (C) $\frac{e^6+9}{2}$ (D) $\log_e 6$

83. The solution of $xdx+ydy+\left(x^2+y^2\right)dy=0$ is

(A) $\left(x^2+y^2\right)e^{2y}=c$ (B) $\left(x^2+y^2\right)=cxy$ (C) $\left(x^2+y^2\right)=cx^2$ (D) $\left(x^2+y^2\right)e^{2x}=c$

84. Smaller area enclosed by the circle $x^2+y^2=4$ and the line $x+y=2$, is

(A) $2(\pi-2)$ (B) $\pi-2$ (C) $2\pi-1$ (D) $2(\pi+2)$

85. Area lying between the curve $y^2=4x$ and $y=2x$, is

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

86. Area bounded by the curve $y=x^3,$ the x-axis and the ordinates $x=-2$ and x=1, is

(A) -9 (B) $\frac{-15}{4}$ (C) $\frac{15}{4}$ (D) $\frac{17}{4}$

87. The area bounded by the curve $y=x|x|$, x-axis and the ordinates x = -1 and x =1 is given by

(A) 0 (B) $\frac{1}{3}$ (C) $\frac{2}{3}$ (D) $\frac{4}{3}$

88. The area of the circle $x^2+y^2=16$ exterior to the parabola $y^2=6x,$ is

(A) $\frac{4}{3}\left(4\pi-\sqrt{3}\right)$ (B) $\frac{4}{3}\left(4\pi+\sqrt{3}\right)$ (C) $\frac{4}{3}\left(8\pi-\sqrt{3}\right)$ (D) $\frac{4}{3}\left(8\pi+\sqrt{3}\right)$

89. The area bounded by the y-axis, y = cos x and y = sin x, when $0 \le x \le \frac{\pi}{4}$ is

(A) $2\left(\sqrt{2}-1\right)$ (B) $\sqrt{2}-1$ (C) $\sqrt{2}+1$ (D) $\sqrt{2}$

90. The area of the region bounded by the curve $x^2 = 4y$ and the straight line $x = 4y - 2$, is

(A) $\frac{3}{8} sq.units$ (B) $\frac{5}{8} sq.units$ (C) $\frac{7}{8} sq.units$ (D) $\frac{9}{8} sq.units$

91. Area of the region in the first quadrant enclosed by the x-axis, the line y=x and the circle $x^2 + y^2 = 32$, is

(A) $16\pi\ sq.units$ (B) $4\pi\ sq.units$ (C) $32\pi\ sq.units$ (D) $24\pi\ sq.units$

92. The area of the region bounded by parabola $y^2 = x$ and the straight line $2y = x$, is

(A) $\frac{4}{3} sq.units$ (B) $1 sq.units$ (C) $\frac{2}{3} sq.units$ (D) $\frac{1}{3} sq.units$

93. The area of the region bounded by the curve $y = \sin x$ between the coordinates $x = 0, x = \frac{\pi}{2}$ and the x-axis, is

(A) 2 sq. units (B) 4 sq. units (C) 3 sq. units (D) 1 sq. units

94. The area of the region bounded by the ellipse $\frac{x^2}{25} + \frac{y^2}{16} = 1$, is

(A) $20\pi\ sq.units$ (B) $20\pi^2\ sq.units$ (C) $3\pi\ sq.units$ (D) $4\pi\ sq.units$

95. The area of the region bounded by the curve $x = 2y + 3$ and the y lines. y=1 and y = -1 , is

(A) 4 sq. units (B) $\frac{3}{2} sq.units$ (C) $6 sq.units$ (D) $8 sq.units$

96. The equation of the curve whose tangent at any point (x, y) makes an angle $\tan^{-1}(2x + 3y)$ with x-axis and which passes through $(1, 2)$ is

(A) $6x + 9y + 2 = 26e^{3(x-1)}$ (B) $6x - 9y + 2 = 26e^{3(x-1)}$

(C) $6x + 9y - 2 = 26e^{3(x-1)}$ (D) None of these

97. Solution of the differential equation $\left(x + 2y^3\right)\frac{dy}{dx} = y$ is

(A) $x = y^2\left(c + y^2\right)$ (B) $x = y\left(c - y^2\right)$ (C) $x = 2y\left(c - y^2\right)$ (D) $x = y\left(c + y^2\right)$

98. The equation of a curve passing through $\left(1, \frac{\pi}{4}\right)$ and having slope $\frac{\sin 2y}{x + \tan y}$ at (x, y) is

(A) $x = \tan y$ (B) $y = \tan x$ (C) $x = 2\tan y$ (D) $y = 2\tan x$

99. The equation of the curve satisfying the equation $\left(1 + y^2\right)dx + \left(x - e^{-\tan^{-1} y}\right)dy = 0$ and passing through origin is

(A) $x.e^{\tan^{-1} y} = \cot^{-1} y$ (B) $x.e^{\cot^{-1} y} = \cot^{-1} y$

(C) $y.\tan^{-1} x = \tan^{-1} x$ (D) $x.e^{\tan^{-1} y} = \tan^{-1} y$

100. The general solution of the differential equation $\frac{dy}{dx} = y\tan x - y^2 \sec x$ is

(A) $\tan x = (c + \sec x)y$ (B) $\sec y = (c + \tan y)x$

(C) $\sec x = (c + \tan x)y$ (D) none of these

101. The differential equation of rectangular hyperbolas whose axes are asymptotes of the hyperbola $x^2 - y^2 = a^2$. is

(A) $y\dfrac{dy}{dx} = x$ (B) $x\dfrac{dy}{dx} = -y$ (C) $x\dfrac{dy}{dx} = y$ (D) $xdy + y\,dx = c$

102. If $\sin x$ is an integrating factor of the differential equation $\dfrac{dy}{dx} + Py = Q$, then P can be

(A) $\log\sin x$ (B) $\cot x$ (C) $\sin x$ (D) $\log\cos x$

103. The slope of the tangent at (x, y) to a curve passing through $\left(1, \dfrac{\pi}{4}\right)$ is given by $\dfrac{y}{x} - \cos^2\dfrac{y}{x}$, then the equation of the curve is

(A) $y = x\tan^{-1}\left[\log\left(\dfrac{e}{x}\right)\right]$ (B) $y = x\tan^{-1}\left[\log\left(\dfrac{x}{e}\right)\right]$

(C) $y = \tan^{-1}\left[\log\left(\dfrac{e}{x}\right)\right]$ (D) none of these

104. The equation of a curve passing through (0,1) and having gradient $\dfrac{-(y + y^3)}{1 + x + xy^2}$ at (x, y) is

(A) $xy + \tan^{-1} y = \dfrac{\pi}{2}$ (B) $xy + \tan^{-1} y = \dfrac{\pi}{4}$

(C) $xy - \tan^{-1} y = \dfrac{\pi}{2}$ (D) $xy - \tan^{-1} y = \dfrac{\pi}{4}$

105. The integrating factor of the differential equation $\dfrac{dy}{dx}(x\log x) + y = 2\log x$ is given by

(A) $\log(\log x)$ (B) e^x (C) $\log x$ (D) x

106. The differential equation of family of curves whose tangent are inclined at an angle of $\dfrac{\pi}{4}$ with the hyperbola $xy = 4$ is :

(A) $\dfrac{dy}{dx} = \dfrac{x^2+4}{x^2}$ (B) $\dfrac{dy}{dx} = \dfrac{x^2-4}{x^2+4}$ (C) $\dfrac{dy}{dx} = \dfrac{x^2-4}{x^2}$ (D) None of these

107. The tangent at any point P of a curve meets x-axis in T. The curve for which $OP = PT$ is a :

(A) parabola (B) ellipse (C) hyperbola (D) circle

108. Equation of the curve passing through the point $(1, 2)$ such that the intercept on the x-axis cut off between the tangent and origin is twice the abscissa is given by :

(A) $xy = 2$ (B) $xy = 1$ (C) $xy = 2y$ (D) $xy = 2x$

109. A normal at any point (x, y) to the curve $y = f(x)$ cuts a triangle of unit area with the axis, the differential equation of the curve is

(A) $y^2 - x^2\left(\dfrac{dy}{dx}\right)^2 = 4\dfrac{dy}{dx}$ (B) $x^2 - y^2\left(\dfrac{dy}{dx}\right)^2 = \dfrac{dy}{dx}$

(C) $y^2\left(\dfrac{dy}{dx}\right)^2 + 2(xy - 1)\dfrac{dy}{dx} + x^2 = 0$ (D) $x + y\left(\dfrac{dy}{dx}\right) = y$

110. The solution of $(x^3 - 3xy^2)dx = (y^3 - 3x^2y)dy$

(A) $y^2 - x^2 = c(x^2 + y^2)^2$ (B) $y^3 - x^3 = c(x^2 + y^2)$

(C) $y^2 + x^2 = c(x^2 - y^2)$ (D) $y^3 + x^3 = c(x^2 - y^2)$

111. The orthogonal trajectories of the family of curves $a^{n-1}y = x^n$ are give by

(A) $x^n + n^2 y$ = constant (B) $ny^2 + x^2$ = constant

(C) $n^2 x + y^n$ = constant (D) $n^2 x - y^n$ = constant

112. I.F of $x\frac{dy}{dx} + y(1+x) = 1$

(A) $x.e^x$ (B) $\frac{e^x}{x}$ (C) $x + \log x$ (D) $x \log x$

113. The general solution of the differential equation $ydx - (x + 2y^2)dy = 0$

(A) $y = 2x^2 + cx$ (B) $x = 2y^2 + cy$ (C) $x^2 = y^2 + cy$ (D) $y = x^2 + c$

114. The solution of $\frac{xdx + ydy}{ydx - xdy} = \frac{x\sin(x^2 + y^2)}{y^3}$ is

(A) $\log\left|\tan(x^2 + y^2)\right| = \frac{x^2}{y^2} + c$ (B) $\log\left|\tan\left(\frac{x^2 + y^2}{2}\right)\right| = \frac{x^2}{y^2} + c$

(C) $\log\left|\tan(x^2 + y^2)\right| = \frac{y^2}{x^2} + c$ (D) $\log\left|\tan\left(\frac{x^2 + y^2}{2}\right)\right| = \frac{y^2}{x^2} + c$

115. The solution of $\frac{dy}{dx} = 1 - x(y - x) - x^3(y - x)^3$ is

(A) $(y - x)^2(x^2 + 1 + cx^2) = 1$ (B) $(y - x)^2\left(x^2 + 1 + ce^{x^2}\right) = 1$

(C) $(y - x)^2(x^2 - 1 + cx^2) = 1$ (D) $(y - x)^2\left(-x^2 - 1 + ce^{x^2}\right) = 1$

116. A solution differential equation $\frac{dy}{dx} = \frac{1}{xy(x^2 \sin y^2 + 1)}$ (C is arbitrary constant)

(A) $x^2\left(\cos y^2 - \sin y^2 - 2ce^{-y^2}\right) = 2$ (B) $y^2\left(\cos x^2 - \sin y^2 - 2ce^{-y^2}\right) = 2$

(C) $y^2\left(\cos y^2 - \sin y^2 - e^{-y^2}\right) = 4$ (D) $y^2\left(\cos y^2 - \sin x^2 + e^{y^2}\right) = 2$

117. Solve $x\frac{dy}{dx} + y = x^3 y^6$

(A) $y^{-5}x^5 = \frac{5}{2}x^{-2} + c$ (B) $y^5 x^5 = \frac{5}{2}x^2 + c$ (C) $y^{-5}x^5 = \frac{5}{2}x^2 + c$ (D) $y^5 x^5 = \frac{5}{2}x + c$

118. Solution of the equation $x\,dy = \left(y + x\frac{f\left(\frac{y}{x}\right)}{f'\left(\frac{y}{x}\right)}\right)dx$ is

(A) $f\left(\frac{x}{y}\right) = cy$ (B) $f\left(\frac{y}{x}\right) = cx$ (C) $f\left(\frac{y}{x}\right) = cxy$ (D) None of these

119. The solution of $\frac{dy}{dx} = \frac{x^2 + y^2 + 1}{2xy}$, satisfying $y(1) = 0$ is given by

(A) a hyperbola (B) a circle (C) $y^2 = x(1 + x) - 10$ (D) $(x - 2)^2 + (y - 3)^2 = 5$

120. Solution of the equation $x\,dx + y\,dy + \dfrac{x\,dy - y\,dx}{x^2+y^2} = 0$ is

(A) $y = x\tan\left(\dfrac{c+x^2+y^2}{2}\right)$ (B) $x = y\tan\left(\dfrac{c+x^2+y^2}{2}\right)$

(C) $y = x\tan\left(\dfrac{c-x^2-y^2}{2}\right)$ (D) None of these

121. The solution of the differential equation, $2x^2y\dfrac{dy}{dx} = \tan\left(x^2y^2\right) - 2xy^2$ given $y(1) = \sqrt{\dfrac{\pi}{2}}$ is

(A) $\sin\left(x^2y^2\right) = e^{x-1}$ (B) $\sin\left(x^2y^2\right) = x$ (C) $\cos\left(x^2y^2\right) + x = 0$ (D) $\sin\left(x^2y^2\right) = e.e^{x}$

122. Solution of the differential equation $\left(e^{x^2} + e^{y^2}\right)y\dfrac{dy}{dx} + e^{x^2}\left(xy^2 - x\right) = 0$

(A) $e^{x^2}\left(y^2-1\right) + e^{y^2} = C$ (B) $e^{y^2}\left(x^2-1\right) + e^{x^2} = C$

(C) $e^{y^2}\left(y^2-1\right) + e^{x^2} = C$ (D) $e^{x^2}\left(y-1\right) + e^{y^2} = C$

123. A ray of light coming from origin after reflection at the point P(x, y) of any curve becomes parallel to x-axis, if the curve passes through (8, 6) then its equation is

(A) $y^2 = x$ (B) $y^2 = 4x+4$ (C) $y^2 = 4x$ (D) $y^2 = 4x+1$

124. Consider the differential equation $y^2dx + \left(x - \dfrac{1}{y}\right)dy = 0$. if $y(1) = 1$, Then x is given by:

(A) $4 - \dfrac{2}{y} - \dfrac{e^{\frac{1}{y}}}{e}$ (B) $3 - \dfrac{1}{y} - \dfrac{e^{\frac{1}{y}}}{e}$ (C) $1 + \dfrac{1}{y} - \dfrac{e^{\frac{1}{y}}}{e}$ (D) $1 - \dfrac{1}{y} + \dfrac{e^{\frac{1}{y}}}{e}$

125. If $x\dfrac{dy}{dx} = y\left(\log y - \log x + 1\right)$, then the solution of the equation is

(A) $y\log\left(\dfrac{x}{y}\right) = cx$ (B) $x\log\left(\dfrac{y}{x}\right) = cy$ (C) $\log\left(\dfrac{y}{x}\right) = cx$ (D) $\log\left(\dfrac{x}{y}\right) = cy$

PHYSICS

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

1. In a double slit experiment, 5^{th} dark fringe is formed opposite to one of the slits. The wavelength of light is

(A) $\dfrac{d^2}{6D}$ (B) $\dfrac{d^2}{5D}$ (C) $\dfrac{d^2}{15D}$ (D) $\dfrac{d^2}{9D}$

2. If the amplitude ratio of two sources producing interference is 3 : 5, the ratio of intensities at maxima and minima is

(A) 25 : 16 (B) 5 : 3 (C) 16 : 1 (D) 25 : 9

3. In Young's double slit interference experiment, the slit separation is made 3 fold. The fringe width becomes

(A) 1/3 times (B)1/9 times (C) 3 times (D) 9 times

4. In a certain double slit experiment arrangement interference fringes of width 1.0 mm each are observed when light of wavelength 5000 Å is used. Keeping the set up unaltered, if the source is replaced by another source of wavelength 6000Å, the fringe width will be

(A) 0.5 mm (B) 1.0 mm (C) 1.2 mm (D) 1.5 mm

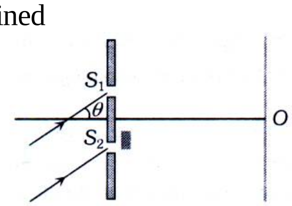
5. In Young's double slit experiment, if one of the slits is closed fully, then in the interference pattern
(A) The single diffraction pattern may be observed on screen
(B) The bright fringes will become more bright
(C) The bright fringes will become fainter
(D) The intensity on screen will keep changing with time

6. In two separate set-ups of the Young's double slit experiment, fringes of equal width are observed when lights of wavelengths in the ratio 1 : 2 are used. If the ratio of the slit separation in the two cases is 2 : 1, the ratio of the distance between the plane of the slits and the screen in the two set-ups is
(A) 4 : 1 (B) 1 : 1 (C) 1 : 4 (D) 2 : 1

7. In a Young's double slit experiment the intensity at a point where the path difference is $\frac{\lambda}{6}$ (λ being the wavelength of the light used) is I. If I_0 denotes the maximum intensity, $\frac{I}{I_0}$ is equal to
(A) $\frac{1}{\sqrt{2}}$ (B) $\frac{\sqrt{3}}{2}$ (C) 12 (D) ¾

8. In Young's double slit experiment, a mica slit of thickness t and refractive index μ is introduced in the ray from the first source S_1. By how much distance the fringes pattern will be displaced
(A) $\frac{d}{D}(\mu-1)t$ (B) $\frac{D}{d}(\mu-1)t$ (C) $\frac{d}{(\mu-1)D}$ (D) $\frac{D}{d}(\mu-1)$

9. A monochromatic beam of light on YDSE apparatus at some angle (say θ) as shown in fig. A thin sheet of glass is inserted in front of the lower slit S_2. The central bright fringe (path difference = 0) will be obtained



(A) At O (B) Above O (C) Below O
(D) Anywhere depending on angle θ, thickness of plate t and refractive index of glass μ

10. In a Young's double slit experiment, the fringe pattern is observed on a screen placed at a distance D. The slits are separated by 'd' and are illuminated by light of wavelength λ. The distance from the central point where the intensity falls to half the maximum is
(A) $\frac{\lambda D}{3d}$ (B) $\frac{\lambda D}{2d}$ (C) $\frac{\lambda D}{d}$ (D) $\frac{\lambda D}{4d}$

11. In an interference pattern produced by two identical slits, the intensity at the site of the central maximum is 'I'. The intensity at the same spot when either of the two slits is closed is I_0. The correct relation between I and I_0 is
(A) $I = I_0$ (B) $I = 2I_0$ (C) $I = 4I_0$ (D) I & I_0 are not related

12. The wave front is a surface in which:
(A) all points are in the same phase
(B) there is a pair of points in opposite phase
(C) there is a pair of points with phase difference $(\pi/2)$
(D) there is no relation between the phases

13. When interference of light takes place:
(A) energy is created in the region of maximum intensity
(B) energy is destroyed in the region of maximum intensity
(C) conservation of energy holds good and energy is redistributed
(D) conservation of energy does not hold good

SECTION-II
(Numerical Value Answer Type)

14. In a biprism experiment, if the wavelength of red light used is $6.5\times10^{-7}m$ and that of green is $5.2\times10^{-7}m$, the value of n for which $(n+1)^{th}$ green bright band coincides with n^{th} red bright band for the same setting is given by:
(A) 2 (B) 3 (C) 4 (D) 1

15. A double slit is illuminated by two wavelengths 450 nm and 600 nm. What is the lowest order at which the maxima of one wavelength coincides with the minima of the other wavelength?
(A) 1 (B) 2 (C) 3 (D) 4

16. The maximum number of possible interference maxima for slit-separation equal to twice wavelength in Young's double-slit experiment is:
(A) ∞ (B) 5 (C) 3 (D) 0

17. A beam of light of wavelength 500 nm from a distant source falls on a single slit of width $\frac{1000}{\sqrt{3}}$ nm. Width of central maximum on a screen 1.5 m away from the slit will be:
(A) 2 m (B) 3.15 m (C) 2.6 m (D) 5.2 m

18. In Young's double slit experiment the angular width of a fringe formed on a distant screen is 1°. The wavelength of light used is 6000 $\overset{o}{A}$. The spacing between the slits is approximately
(A) 1 mm (B) 0.05 mm (C) 0.03 (D) 0.01 mm

19. The width of a single slit if the first minimum is observed at an angle 2° with a light of wavelength 6980Å is
(A) 0.2 mm (B) 2×10^{-5} mm (C) 2×10^{5} mm (D) 0.02 mm

20. What changes on polarization of light?
(A) intensity (B) phase (C) frequency (D) wavelength

21. The diffraction pattern of a single slit
(A) band are uniformly bright (B) bands are uniformly wide
(C) central band is narrower (D) central band is wider

22. When unpolarised light beam is incident from air onto glass (n = 1.5) at the polarizing angle
(A) reflected beam is polarized 100 percent
(B) reflected and refracted beams are partially polarised
(C) the reason for (1) is that almost all the light is reflected
(D) all of the above.

23. A single slit of width *a* is illuminated by violet light of wavelength 400 nm and the width of the diffraction pattern is measured as *y*. When half of the slit width is covered and illuminated by yellow light of wavelength 600 nm, the width of the diffraction pattern is
(A) the pattern vanishes and the width is zero (B) *y*/3
(C) 3*y* (D) none of these

24. Two polaroids are kept crossed to each other. Now one of them is rotated through an angle of 45^0. The percentage of unpolarised incident light now transmitted through the system is
(A) 15% (B) 25% (C) 50% (D) 60%

25. Polarization of light takes place due to many processes. Which of the following will not cause polarization?
(A) reflection (B) Polaroid sheet (C) scattering (D) diffraction

26. In diffraction from a single slit, the angular width of the central maximum does not depend on:
(A) wavelength of light used (B) width of slit
(C) distance of slit from screen (D) ratio of λ and slit width

27. The axes of a polarizer and an analyzer are oriented at right angles to each other. A third Polaroid sheet is placed between them with its axis at 45° to the axes of the polarizer and analyzer. If unpolarized light of intensity I_0 is incident on this system, what is the intensity of the transmitted light?
(A) 0.125 I_0 (B) 0.250I_0 (C) 0.500 I_0 (D) 0.375 I_0.

28. Polarized light of intensity I_0 is incident on a pair of Polaroid sheets. Let θ_1 and θ_2 be the angles between the incident amplitude and the axes of the first and second sheet, respectively. the intensity of the transmitted light is
(A) $I = I_0 \sin^2\theta_1 \cos^2(\theta_1 - \theta_2)$ (B) $I = I_0 \cos^2\theta_1 \cos^2(\theta_1 - \theta_2)$
(C) $I = I_0 \sin^2\theta_1 \sin^2(\theta_1 - \theta_2)$ (D) none of these

29. Which of the following cannot be polarized?
(A) Ultraviolet rays (B) Ultrasonic waves (C) X-rays (D) Radio waves

30. Two beams of light having intensities I and 4 I interfere to produce a fringe pattern on the screen. Phase difference between the beams is $\frac{\pi}{2}$ at point A and π at point B. The difference in intensities of resulting light at points A and B is
(A) 3 I (B) 4 I (C) 5 I (D) 6 I

31. In a single slit diffraction pattern the angular width of a central maxima is 30° when the slit is illuminated by light of wavelength $6000\overset{0}{A}$. Then width of the slit will be approximately given as:
(A) 12×10^{-6}m (B) 12×10^{-7}m (C) 12×10^{-8}m (D) 12×10^{-9}m

32. An unpolarized beam of light is incident on a group of three polarizing sheets are arranged in such a way that plane of rotation of one make an angle of 60° with the adjacent one. The percentage of incident light transmitted by first polarizer will be
(A) 6.25 % (B) 12.5 % (C) 50 % (D) None of these

33. First diffraction minima due to a single slit of width 1.0×10^{-5} cm is at 30°. Then wavelength of light used is:
(A) $400\overset{0}{A}$ (B) $500\overset{0}{A}$ (C) $600\overset{0}{A}$ (D) $700\overset{0}{A}$

34. A Polaroid examines two adjacent plane-polarised light beams A and B whose planes of polarization are mutually at right angles. In one position of the Polaroid, the beam B shows zero intensity. From this position a rotation of 30^0 shows the two beams of equal intensities. The ratio of intensity $\frac{I_A}{I_B}$ is
(A) 1 : 9 (B) 9 : 1 (C) 1 : 3 (D) 3 : 1

35. Two 'crossed' polaroids A and B are placed in the path of a light-beam. In between these, a third Polaroid C is places whose polarization axis makes an angles θ with the polarization axis of the Polaroid A. If the intensity of light emerging from the polaroid A is I_0, then the intensity of light emerging from Polaroid B is
(A) $\frac{1}{4}I_0\cos^2(2\theta)$ (B) $\frac{1}{4}I_0\sin^2(2\theta)$ (C) $\frac{1}{2}I_0\cos^2(2\theta)$ (D) $\frac{1}{2}I_0\sin^2(2\theta)$

36. A transparent thin plate of a polaroid is placed on another similar plate such that the angle between their axes is 30°. The intensities of the emergent and the unpolarized incident light will be in the ratio is
(A) 1 : 4 (B) 1 : 3 (C) 3 : 4 (D) 3 : 8

37. Light is incident on a glass surface at polarizing angle of 57.5°. Then the angle between the incident ray and the refracted ray is
(A) 57.5° (B) 115° (C) 205° (D) 145°

38. The velocity of light in air is $3 \times 10^8 ms^{-8}$ and that in water is $2.2 \times 10^8 ms^{-1}$. The polarizing angle of incidence approximately is
(A) 45° (B) 50° (C) 53.74° (D) 63°

SECTION-II
(Numerical Value Answer Type)

39. A beam of light of wavelength 600 nm from a distant source falls on a single slit 1mm wide and the resulting diffraction pattern is observed on a screen 2m away. The distance between the first dark fringes on either side of the central bright fringe is

(A) 1.2 mm (B) 1.8 mm (C) 2.4 mm (D) None of these

40. Light of wavelength $6000\,\overset{0}{A}$ is incident on a single slit. First minimum is obtained at a distance of 0.4 cm from the centre. If width of the slit is 0.3 mm, then distance between slit and screen will be:

(A) 1.0 m (B) 1.5m (C) 2.0 m (D) 2.3 m

41. Two linear polarizers are crossed at an angle of 60°. The fraction of intensity of light transmitted by the pair is

(A) 0.25 (B) 0.125 (C) 0.375 (D) 0.5

42. A beam of natural light falls on a system of 5 Polaroid's, which are arranged in succession such that the pass axis of each Polaroid is turned through 60° with respect to the preceding one. The fraction of the incident light intensity that passes through the system is

(A) 0.015625 (B) 0.03125 (C) 0.008 (D) 0.001953125

43. A polarizer and an analyzer are oriented so that the maximum light is transmitted. What is the fraction of maximum light transmitted when analyzer is rotated through 30^0?

(A) 0.75 (B)1.3333 (C) 0.6 (D) 1.667

44. The work functions of metal A and B are in the ratio 1 : 2. If light of frequencies f and $2f$ are incident on the surfaces of A and B respectively, the ratio of the maximum kinetic energies of photoelectrons emitted is (f is greater than threshold frequency of A, $2f$ is greater than threshold frequency of B)

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

45. A Polaroid is placed at 45^0 to an incoming Polarized light of intensity I_0. Find the intensity of light passing through Polaroid after polarization.

(A) I_0 (B) $\frac{I_0}{2}$ (C) $\frac{I_0}{3}$ (D) $\frac{I_0}{4}$

46. The critical angle of a certain medium is $\sin^{-1}\left(\frac{3}{5}\right)$. The polarizing angle of the medium is

(A) $\sin^{-1}\left(\frac{4}{5}\right)$ (B) $\tan^{-1}\left(\frac{5}{3}\right)$ (C) $\tan^{-1}\left(\frac{3}{4}\right)$ (D) $\tan^{-1}\left(\frac{4}{3}\right)$

47. A ray of light is incident on the surface of a glass plate at an angle of incidence equal to Brewster's angle ϕ. If μ represents the refractive index of glass with respect to air, then the angle between reflected and refracted rays is

(A) $90^0 + \phi$ (B) $\sin^{-1}(\mu\cos\phi)$ (C) 90^0 (D) $90^0 - \sin^{-1}\left(\frac{\sin\phi}{\mu}\right)$

48. Polarization of light takes place due to many processes. Which of the following will not cause polarization?

(A) reflection (B) Polaroid sheet (C) scattering (D) diffraction

(Numerical Value Answer Type)

49. Two linear polarizers are crossed at an angle of 60°. The fraction of intensity of light transmitted by the pair is

(A) 0.25 (B) 0.125 (C) 0.375 (D) 0.5

50. A beam of natural light falls on a system of 5 polaroids, which are arranged in succession such that the pass axis of each Polaroid is turned through 60° with respect to the preceding one. The nearest fraction of the incident light intensity that passes through the system is

(A) 0.015 (B) 0.031 (C) 0.004 (D) 0.002

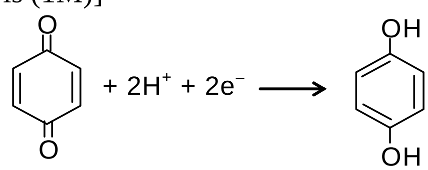
51. For what distance is ray optics a good approximation when the aperture is 4 mm wide and the wavelength is 400 nm?

(A) 20.0 m (B) 40.0 m (C) 30.0 m (D) 50.0 m

CHEMISTRY

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

1. Which of the following statement is correct?
If $E^{o}_{Cu^{2+}|Cu} = 0.337$ V and $E^{o}_{Sn^{2+}|Sn} = -0.136$ V.
(A) Cu^{2+} ions can be reduced by $H_2(g)$ (B) Cu can be oxidized by H^+
(C) Sn^{2+} ions can be reduced by H_2 (D) Cu can reduce Sn^{2+}
2. The reduction potential of hydrogen half–cell will be negative if
(A) $p(H_2) = 1$ atm and $[H^+] = 1$ M (B) $p(H_2) = 1$ atm and $[H^+] = 2$ M
(C) $p(H_2) = 2$ atm and $[H^+] = 1$ M (D) $p(H_2) = 2$ atm and $[H^+] = 2$ M
3. If $E^{\circ}_{Fe^{3+}|Fe}$ and $E^{\circ}_{Fe^{2+}|Fe}$ are –0.036 V and –0.44 V respectively, then the value of $E^{\circ}_{Fe^{3+}|Fe^{2+}}$ would be?
(A) – 0.77 V (B) + 0.77 V (C) – 0.916 V (D) + 0.916 V
4. Consider the cell potentials,
$E^{\circ}_{Mg^{2+}|Mg} = -2.37$ V and $E^{\circ}_{Fe^{3+}|Fe} = -0.036$ V.
The best reducing agent among them would be
(A) Mg^{2+} (B) Fe^{3+} (C) Mg (D) Fe
5. The standard reduction potential values of three metallic cations, X, Y and Z are 0.52, –3.03 and –1.18 V respectively. The order of reducing power of the corresponding metals is
(A) Y > Z > X (B) X > Y > Z (C) Z > Y > X (D) Z > X > Y
6. The standard reduction potentials of Cr^{3+} | Cr^{2+} and Cr^{3+} | Cr are –0.41 V and –0.74 V respectively. The standard electrode potentials of Cr^{2+} | Cr half–cell is
(A) +1.81 V (B) –1.81 V (C) + 0.9 V (D) – 0.9 V
7. The emf of the concentration cell is
Zn(s) | Zn^{2+} (0.10 M) | KCl (saturated) | Zn^{2+} (1.0 M) | Zn(s)
(A) zero (B) 0.0592 V (C) –0.0296 V (D) 0.0296 V
8. At pH = 2, $E^{\circ}_{Quinhydrone} = 1.30$ V, $E_{Quinhydrone}$ will be [Assume that the concentration of hydroquinone and quinone is (1M)]



(A) 1.36 V (B) 1.30 V (C) 1.418 V (D) 1.20 V
9. Zn | Zn^{2+} (c_1 M) || Zn^{2+} (c_2 M) | Zn
For this cell, ΔG would be negative, if
(A) $c_1 = c_2$ (B) $c_1 > c_2$ (C) $c_2 > c_1$ (D) None of these
10. The oxidation potential of a hydrogen electrode at pH = 10 and $P_{H_2} = 1$ atm, would be
(A) 0.51 V (B) 0.00 V (C) + 0.59 V (D) 0.059 V
11. A student made the following observations in the laboratory:
(i) Clean copper metal did not react with 1 molar $Pb(NO_3)_2$ solution
(ii) Clean lead metal dissolved in a 1 molar $AgNO_3$ solution and crystals of Ag metal appeared
(iii) Clean silver metal did not react with 1 molar $Cu(NO_3)_2$ solution.
The order of decreasing reducing character of the three metals is:
(A) Cu, Pb, Ag (B) Cu, Ag, Pb (C) Pb, Cu, Ag (D) Pb, Ag, Cu
12. The equivalent conductance of 1 M benzoic acid is 12.8 ohm^{-1} cm^2. If the equivalent conductance of benzoate ion and H^+ ion are 42 and 288.42 ohm^{-1} cm^2 respectively. Its degree of dissociation is:
(A) 39% (B) 3.9% (C) 0.35% (D) 0.039%

13. The time required to coat a metal surface of 80 cm^2 with 5×10^{-3} cm thick layer of silver (density 1.05 g cm^{-3}) with the passage of 3A current through a silver nitrate solution is:
(A) 115 sec (B) 125 sec (C) 135 sec (D) 145 sec

14. Aluminium oxide may be electrolysed at 1000^0C to furnish aluminium metal (atomic mass = 27 amu; 1 faraday = 96500 coulombs). The cathode reaction is $Al^{3+} + 3e^- \rightarrow Al$
To prepare 5.12 kg of aluminium metal by this method would require
(A) 5.49×10^7C of electricity (B) 1.83×10^7C of electricity
(C) 5.49×10^4 C of electricity (D) 5.49×10^{10}C of electricity

15. The $E^0\left(M^{3+}/M^{2+}\right)$ values for Cr, Mn, Fe and Co are –0.41, +1.57, +0.77 and +1.97 respectively. For which one of these metals the change in oxidation state form +2 to +3 is easiest?
(A) Cr (B) Mn (C) Fe (D) Co

16. The limiting molar conductivities Λ^0 for NaCl, KBr and KCl are 126, 152 and 150 S cm^2 mol^{-1} respectively. The Λ^0 for NaBr is
(A) 278 S cm^2 mol^{-1} (B) 178 S cm^2 mol^{-1} (C) 128 S cm^2 mol^{-1} (D) 306 S cm^2 mol^{-1}

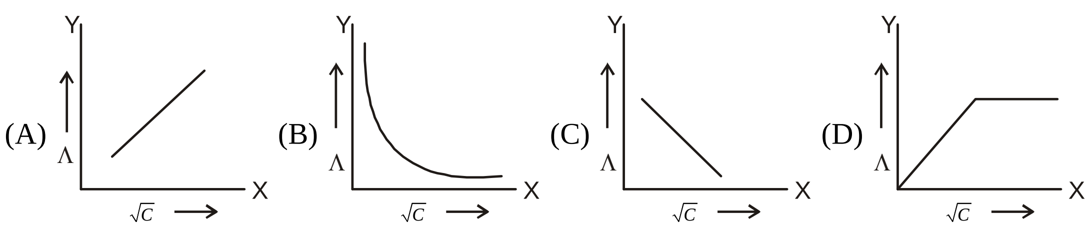
17. The electrical conductivity of the following aqueous solutions is highest for
(A) 0.1 M CH_3 COOH (B) 0.1 M CH_2 FCOOH
(C) 0.1 M CHF_2COOH (D) 0.1 M CH_2 ClCOOH

18. Resistance of a conductivity cell filled with a solution of an electrolyte of concentration 0.1 M is 100Ω. The conductivity of this solution is 1.29 S m^{-1}. Resistance of the same cell when filled with 0.2 M of the same solution is 520 Ω. The molar conductivity of 0.2 M solution of the electrolyte will be
(A) 124×10^{-4} S m^2 mol^{-1} (B) 1240×10^{-4} S m^2 mol^{-1}
(C) 1.24×10^{-4} S m^2 mol^{-1} (D) 12.4×10^{-4} S m^2 mol^{-1}

19. What is the effect of dilution on the equivalent conductance of strong electrolyte?
(A) Decrease on dilution (B) Remains unchanged
(C) Increase on dilution (D) None of these

20. For reducing 1 mol of $Cr_2O_7^{2-}$ to Cr^{3+}, charge required is
(A) 3×96500 coulomb (B) 6×96500 coulomb
(C) 0.3 F (D) 0.6 F

21. The variation of equivalent conductance of weak electrolyte with $\sqrt{concentration}$ is correctly shown in fig



22. The specific conductance of 0.1 N KCl solution at 23^0C is 0.012 ohm^{-1} cm^{-1}. The resistance of cell containing the solution at the same temperature was found to be 55 ohm. The cell constant will be
(A) 0.142 cm^{-1} (B) 0.616 cm^{-1} (C) 6.16 cm^{-1} (D) 616 cm^{-1}

23. Specific conductance of 0.01 N solution of an electrolyte is 0.00419 ohm cm^{-1}. The equivalent conductance of this solution will be
(A) 4.18 mho cm^2 (B) 419 mho cm^2 (C) 0.0419 mho cm^2 (D) 0.209 mho cm^2

24. One ampere of current is passed for 9650 second through molten $AlCl_3$. What is the weight in grams of Al deposited at cathode? (Atomic weight of Al = 27)
(A) 0.9 (B) 9.0 (C) 0.18 (D) 18.0

25. Which of the following is a reversible cell?
(A) Dry cell (B) Mercury cell (C) Daniell cell (D) All of these

26. The two half -cell reactions of an electrochemical cell is given as:

$Ag^{+} + e^{-} \rightarrow Ag;$ $E^{0}_{Ag^{+}/Ag} = -0.3995V$

$Fe^{++} \rightarrow Fe^{+++} + e^{-}$ $E^{0}_{Fe^{+++}/Fe^{++}} = -0.7120V$

The value of cell EMF will be

(A) –0.3125 V (B) 0.3125V (C) 1.114 V (D) –1.114 V

27. The standard reduction potentials for $Zn^{2+}/Zn, Ni^{2+}/Ni$, and Fe^{2+}/Fe are – 0.76, – 0.23 and – 0.44 V respectively. The reaction $X + Y^{2+} \rightarrow X^{2+} + Y$ will be spontaneous when

(A) X = Ni, Y = Zn (B) X = Fe, Y = Zn (C) X = Zn, Y = Ni (D) X = Ni, Y = Fe

28. Standard electrode potential of half cell reactions are given below:

$Cu^{2+} + 2e^{-} \rightarrow Cu; E^{0} = 0.34V$

$Zn^{2+} + 2e^{-} \rightarrow Zn; E^{0} = -0.76V$

What is the EMF of the cell ?

(A) +1.10 V (B) – 1.10 V (C) – 0.42 V (D) + 042 V

29. Given the following in equation (i) and (ii) calculate the EMF of the cell given in equation (iii)

$CuI_{(s)} + e^{-} \rightarrow Cu_{(s)} + I^{-}; E^{0} = -0.16$ (i)

$Zn^{2+}_{(aq)} + 2e^{-} \rightarrow Zn_{(s)}; E^{0} = -0.76$ (ii)

$Zn \mid Zn^{2+}(1.0M) \parallel I^{-}(1.0M) \mid CuI \mid Cu$ (iii)

(A) 1.08 V (B) 0.44 V (C) 0.92 V (D) 0.60 V

30. The standard reduction potential E° for half reactions are

$Zn \rightarrow Zn^{2+} + 2e^{-}; E^{0} = +0.76V$

$Fe \rightarrow Fe^{2+} + 2e^{-}; E^{0} = +0.41V$

The EMF of the cell reaction

$Fe^{2+} + Zn \rightarrow Zn^{2+} + Fe$ is

(A) – 0.35 V (B) + 0.35 V (C) +1.17 V (D) – 1.17 V

31. What is the standard reduction potential (E°) for $Fe^{3+} \rightarrow Fe$?

Given that :

$Fe^{2+} + 2e^{-} \rightarrow Fe; E^{0}_{Fe^{2+}/Fe} = -0.47V$

$Fe^{3+} + e^{-} \rightarrow Fe^{2+}; E^{0}_{Fe^{3+}/Fe^{2+}} = +0.77V$

(A) + 0.057V (B) + 0.30 V (C) – 0.30 V (D) – 0.057V

32. For the following electrochemical cell at 298 K,

$Pt_{(s)}H_{2(g)}, (1bar) \mid H^{+}_{(aq)}, (1M) \parallel M^{4+}_{(aq)}, M^{2+}_{(aq)} \mid Pt_{(s)}$

$E_{cell} = 0.092V$ When $\frac{\left[M^{2+}_{(aq)}\right]}{\left[M^{4+}_{aq}\right]} = 10^{x}$

Given : $E^{0}_{M^{4+}/M^{2+}}$ $0.151V; 2.303\frac{RT}{F} = 0.059V$ the value of x is

(A) – 2 (B) – 1 (C) 1 (D) 2

33. What pressure of H_2 would be required to make emf fo the hydrogen electrode zero in pure water at 25°C?

(A) 10^{-7} atm (B) 10^{-14} atm (C) 1 atm (D) 0.5atm

34. Consider the following electrolytic cells:

(i) $M_{(s)} \mid M^{2+}_{(aq)}, 0.1M \parallel X^{2+}_{(aq)}, 0.01M \mid X_{(s)}$.

(ii) $M_{(s)} \mid M^{2+}_{(aq)}, 0.1M \parallel X^{2+}_{(aq)}, 0.1M \mid X_{(s)}$ and

(iii) $M_{(s)} \mid M^{2+}_{(aq)}, 0.01M \parallel X^{2+}_{(aq)}, 0.1M \mid X_{(s)}$

(A) $E_1 > E_2 > E_3$ (B) $E_2 > E_3 > E_1$ (C) $E_3 > E_1 > E_2$ (D) $E_3 > E_2 > E_1$

35. The standard reduction potential data at 25°C is given below:

$E^0(Fe^{3+}, Fe^{2+}) = +0.77V; E^0(Fe^{2+}, Fe) = -0.44V$

$E^0(Cu^{2+}, Cu) = +0.34V; E^0(Cu^{+}, Cu) = +0.52V$

$E^0[O_{2(g)} + 4H^+ + 4e^- \rightarrow 2H_2O] = +1.23V;$

$E^0[O_{2(g)} + 2H_2O + 4e^- \rightarrow 4OH^-] = +0.40V$

$E^0(Cr^{3+}, Cr) = -0.74V; E^0(Cr^{2+}, Cr) = -0.91V$

Match E° of the redox pair in List I with the values given in List II and select the correct answer using the code given below the lists:

	List I		List II
P.	$E^0(Fe^{3+}, Fe)$	1.	– 0.18V
Q.	$E^0(4H_2O \rightleftharpoons 4H^+ + 4OH^-)$	2.	– 0.4 V
R.	$E^0(Cu^{2+} + Cu \rightarrow 2Cu^+)$	3.	– 0.04 V
S.	$E^0(Cr^{3+}, Cr^{2+})$	4.	–0.83 V

(A) P-4, Q-1,R-2, S-3
(B) P-2, Q-3, R-4, S-1
(C) P-1, Q-2, R-3,S-4
(D) P-3, Q-4, R-1, S-2

36. From the following data at 25°, $Cr^{3+}_{(aq)} + e^- \rightarrow Ce^{2+}_{(aq)} E^0 = -0.424V$

$Cr^{2+}_{(aq)} + 2e^- \rightarrow Cr_{(s)}, E^0 = -0.900V$

Find E^0 at 25°C for the reaction, $Cr^{3+} + 3e^- \rightarrow Cr_{(s)}$

(A) – 0.741 V
(B) – 1.324 V
(C) – 0.476V
(D) + 0.741 V

37. The reduction potential of hydrogen half-cell will be negative if

(A) $p(H_2) = 1$ atm and $[H^+] = 2.0M$
(B) $p(H_2) = 1$ atm and $[H^+] = 1.0M$
(C) $p(H_2) = 2$ atm and $[H^+] = 1.0M$
(D) $p(H_2) = 2$ atm and $[H^+] = 2.0M$

38. E_1, E_2 and E_3 are the emfs of the following three galvanic cells respectively.

(i) $Zn_{(s)} | Zn^{2+}(0.1M) || Cu^{2+}(1M) | Cu_{(s)}$
(ii) $Zn_{(s)} | Zn^{2+}(1M) || Cu^{2+}(1M) | Cu_{(s)}$
(iii) $Zn_{(s)} | Zn^{2+}(1M) || Cu^{2+}(0.1M) | Cu_{(s)}$

Which one of the following is true?

(A) $E_2 > E_1 > E_3$
(B) $E_1 > E_2 > E_3$
(C) $E_3 > E_1 > E_2$
(D) $E_3 > E_2 > E_1$

39. The standard emf fo galvanic cell involving 3 moles of electrons in its redox reaction is 0.59 V. The equilibrium constant for the reaction of the cell is

(A) 10^{25}
(B) 10^{20}
(C) 10^{15}
(D) 10^{30}

40. The potential of a hydrogen electrode at pH = 10 is

(A) 0.59 V
(B) 0.00 V
(C) 0 –0.59 V
(D) –0.059 V

41. What weight of copper will be deposited by passing 2 faradays of electricity through a cupric salt?

(At. Wt. of Cu = 63.5)

(A) 2.0 g
(B) 3.175 g
(C) 63.5 g
(D) 127.0 g

42. The mass of copper that will be deposited at cathode in electrolysis of 0.2 M solution of copper sulphate when a quantity of electricity equal to that required to liberate 2.24 L of hydrogen from 0.1 M aqueous H_2SO_4 is (At. Mass of Cu = 63.5)

(A) 1.59 g
(B) 3.18 g
(C) 6.35 g
(D) 12.70 g

43. The resistance of 1 N solution of acetic acid is 250 oh, when measured in a cell of cell constant 1.15 cm^{-1}. The equivalent conductance (in ohm^{-1} cm^2 $equiv^{-1}$) of 1 N acetic acid is

(A) 4.6 (B) 9.2 (C) 18.4 (D) 0.023

44. The specific conductance of 0.1 M NaCl solution is 1.06×10^{-2} ohm^{-1}. Its molar conductance in ohm^{-1} cm^2 mol^{-1} is

(A) 1.06×10^2 (B) 1.06×10^3 (C) 1.06×10^4 (D) 53

45. The specific conductance of a 0.1 N KCl solution at 23°C is 0.012 ohm^{-1} cm^{-1}. The resistance of cell containing the solution at the same temperature was found to be 55 ohm. The cell constant will be

(A) 0.142 cm^{-1} (B) 0.66 cm^{-1} (C) 0.918 cm^{-1} (D) 1.12 cm^{-1}

46. At infinite dilution in the aqueous solution of $BaCl_2$, molar conductivity of Ba^{2+} and Cl^- ions are = 127.32 S cm^2/mol and 76.64 S cm^2/mol respectively. What is Λ_m^o for $BaCl_2$ at same dilution?

(A) 280 S cm^2 mol^{-1} (B) 330.98 S cm^{-2} mol^{-1}

(C) 90.98 S cm^2 mol^- (D) 203.6 S cm^2 mol^{-1}

47. MnO_2 is prepared by electrolysis of aqueous solution of $MaSO_4$, as per reaction

$$Mn^{2+}_{(aq)} + 2H_2O \rightarrow MnO_{2(s)} + 2H^+_{(aq)} + H_{2(g)}$$

Passing a current of 25 A for 30 hours gives on kg of MnO_2. What is the current efficiency? (Mol. Wt. of MnO_2 = 87)

(A) 20.54% (B) 25% (C) 49.2% (D) 82.16%

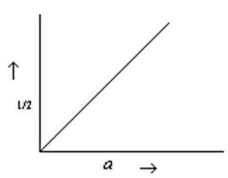
48. Calculate the weight of metal deposited when a current of 15 ampere with 75% current efficiency is passed through the cell for 2 hours.
(Electrochemical equivalent of metal = 4×10^{-4})

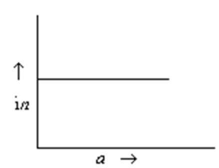
(A) 32.4 g (B) 43.2 g (C) 57.6 g (D) 16.2 g

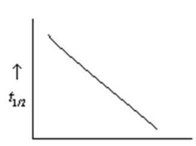
49. K represents the rate constant of a reaction when log K is plotted against 1/T (T= temperature) the graph obtained is a

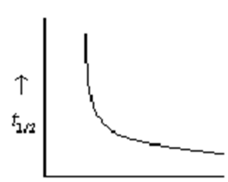
(A) Curve
(B) A straight line with a constant positive slope
(C) A straight line with constant negative slope
(D) A straight line with no slope

50. Which of the following curves represents a 1st order reaction ?

(A) 

(B) 

(C) 

(D) 

51. A chemical reaction was carried out of 300K and 280 K. The rate constants were found to be K_1 and K_2 respectively, then

(1) $K_2 = 4K_1$ (2) $K_2 = 2K_1$ (3) $K_2 = 0.25K_1$ (4) $K_2 = 0.5K_1$

52. For the reaction

$$N_2O_5 \rightarrow 2NO_2 + \frac{1}{2}O_2$$

$$\frac{-d[N_2O_5]}{dt} = k_1[N_2O_5]$$

$$\frac{d[NO_2]}{dt} = k_2[N_2O_5]$$

$$\frac{d[O_2]}{dt} = k_3[N_2O_5]$$

The relation in between k_1, k_2 and k_3 is

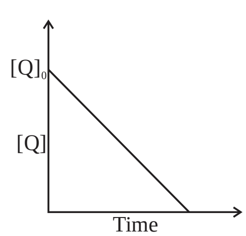
(A) $2k_1 = k_2 = 4k_3$ (B) $k_1 = k_2 = k_3$ (C) $2k_1 = 4k_2 = k_3$ (D) none of these

53. For the following reaction:
$NO_{2(g)} + CO_{(g)} \rightarrow NO_{(g)} + CO_{2(g)}$, the rate law is: Rate = k$[NO_2]^2$. If 0.1 mole of gaseous CO is added at constant temperature to the reaction mixture which of the following statements is true?
(A) Both *k* and the reaction rate remain the same.
(B) Both *k* and the reaction rate increase
(C) Both *k* and the reaction rate decrease.
(D) Only *k* increases, the reaction rate remain the same.

54. Consider the reaction:
$Cl_{2(aq)} + H_2S_{(aq)} \rightarrow S_{(S)} + 2H^+_{(aq)} + 2Cl^-_{(aq)}$
The rate of reaction for the reaction is
rate $= k[Cl_2][H_2S]$
Which of these mechanism is/are consistent with this rate equation?
(I) $Cl_2 + H_2S \rightarrow H^+ + Cl^- + Cl^+ + HS^-$ (slow)
$Cl^+ + HS^- \rightarrow H^+ + Cl^- + S$ (fast)
(II) $H_2S \rightleftharpoons H^+ + HS^-$ (fast equilibrium)
$Cl_2 + HS^- \rightarrow 2Cl^- + H^+ + S$ (slow)
(A) I only (B) II only (C) Both I and II (D) Neither I nor II

55. For the reaction $C + D \rightarrow$ product
If the initial concentration of C and D is doubled, the reaction rate is increased by a factor of 32.
If the concentration of D is doubled keeping that of C fixed, the reaction rate becomes 4 times.
The rate law will be
(A) $k[C]^3[D]^3$ (B) $k[C]^2[D]^3$ (C) $k[C]^3[D]^2$ (D) $k[C]^2[D]^2$

56. In the reaction, $P + Q \rightarrow R + S$ the time taken for 75% reaction of P is twice the time taken for 50% reaction of P. The concentration of Q varies with reaction time as shown in the fig. The overall order of the reaction is



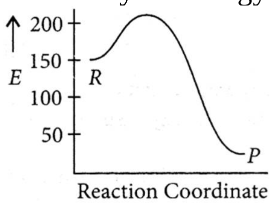
(A) 2 (B) 3 (C) 0 (D) 1

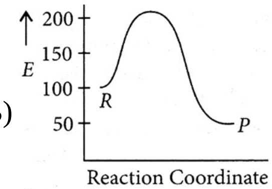
57. The time for half life period of a certain reaction A $\rightarrow$ Products is 1 hour. When the initial concentration of the reaction A is 2.0 mol L^{-1}, how much time does it take for its concentration to come 0.50 to 0.25 mol L^{-1} if it is a zero order reaction?
(A) 1h (B) 4h (C) 0.5 h (D) 0.25 h

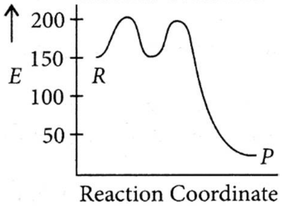
58. AN exothermic chemical reaction proceeds in two stages:

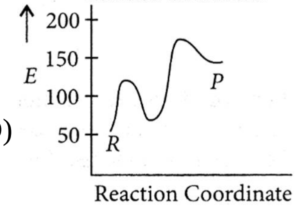
$$R \xrightarrow{\text{Stage I}} \text{Intermediate} \xrightarrow{\text{Stage II}} P$$

The activation energy of stage I is 50 kJ mol^{-1}. The enthalpy change of the reaction is –100 kJ mol^{-1}. Identify the energy level diagram for the reaction.

(A)


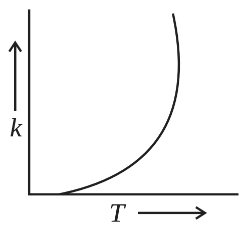
(B)


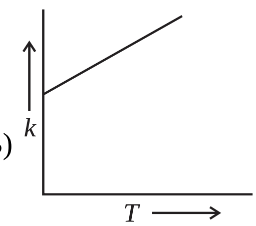
(C)


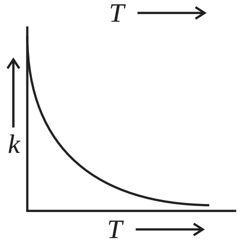
(D)


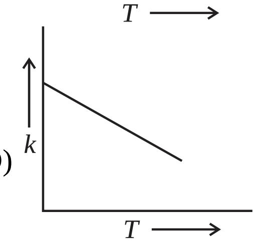
59. An endothermic reaction, $A \rightarrow B$ has an activation energy as x kJ/mol. If the energy change of the reaction is y kJ, the activation energy of the reverse reaction is
(A) $-x$ (B) $x - y$ (C) $x + y$ (D) $y - x$

60. Plots showing the variation of the rate constant (k) with temperature (T) are given below. The plot that follows Arrhenius equation is

(A)


(B)


(C)


(D)


61. For a first order reaction A $\rightarrow$ P, the temperature (T) dependent rate constant (k) was found to follow the equation $\log k = -(2000)\frac{1}{T} + 6.0$. The pre-exponential factor A and the activation energy E_a, respectively, are
(A) 1.0×10^6 s^{-1} and 9.2 kJ mol^{-1} (B) 6.0 s^{-1} and 16.6 kJ mol^{-1}
(C) 1.0×10^6 s^{-1} and 16.6 kJ mol^{-1} (D) 1.0×10^6 s^{-1} and 38.3 kJ mol^{-1}

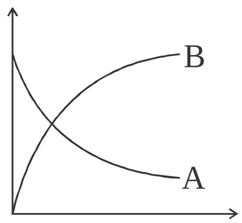
62. Which of the following bonds determines the secondary structure of proteins ?
(A) Electrovalent bond (B) Covalent bond
(C) Hydrogen bond (D) Coordinate bond

63. For a zero-order reaction.
(A) the reaction rate is doubled when the initial concentration is doubled.
(B) the time for half change is half the tome taken for completion of the reaction
(C) the time for half change is independent of the initial concentration
(D) the time for completion of the reaction is independent of the initial concemntration

64. Which of the following represent the expression for 3/4th the life of a first-order reaction?

(A) $\frac{k}{2.303}\log\frac{4}{3}$ (B) $\frac{2.303}{k}\log\frac{4}{3}$ (C) $\frac{2.303}{k}\log 4$ (A) $\frac{2.303}{k}\log 3$

65. At the point of intersection of the two curves shown, the concentration of B is given as ($A \rightarrow nB$)



(A) $\frac{A_0}{n}$ (B) $\frac{A_0}{n-1}$ (C) $\frac{nA_0}{n+1}$ (D) $\frac{n-1}{n+1}A_0$

66. The chemical reaction: $2O_3 \rightarrow 3O_2$ proceeds as

$O_3 \underset{K_2}{\overset{K_1}{\rightleftharpoons}} O_2 + O$ (fast),

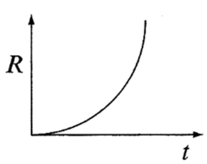
$O + O_3 \xrightarrow{K_3} 2O_2\,(\text{slow})$

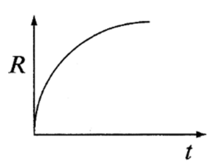
The rate law expression will be

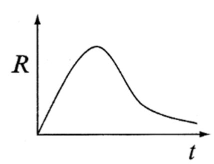
(A) Rate $= K_1[O][O_3]$ (B) rate $= K_1[O_3]$

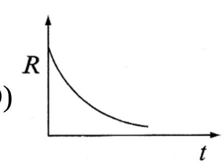
(C) Rate $= \frac{K_1.K_3}{K_2}\frac{[O_3]^2}{[O_2]}$ (D) rate $= K_3\frac{[O_3]^2}{[O_2]}$

67. The reaction: $X(g) \rightarrow Y(g)$ follows first order kinetics. The correct graph representing the rate of formation (R) of Y(g) with time (t) is

(A) 

(B) 

(C) 

(D) 

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