A.P EAMCET-2015 CODE-A

MATHEMATICS

1. If $f:R\to R, g;R\to R$ are defined by f(x) = 5x-3, g(x) = x^2 + 3, then $(gof^{-1})(3)$ =

1) $\frac{25}{9}$ 2) $\frac{111}{25}$ 3) $\frac{9}{25}$ 4) $\frac{25}{111}$

Sol: f(x) = 5x-3

$f^{-1}(x) = \frac{x+3}{5}$

$f^{-1}(3) = 6/5$

$g(f^{-1}(3) = g\left(6/5\right) = \frac{36}{25}+3 = \frac{36+75}{25}$

$= \frac{111}{25}$

2. If $A=\left\{x\in R \mid \frac{\pi}{4}\le x\le\frac{\pi}{3}\right\}$ and f(x) = sin x-x, then f(A)=

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

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

Sol: f(x) = sin x − x

$f^{1}(x)=\cos x-1<0$. f is↓ (decreasing function)

Range is $\left[f\left(\frac{\pi}{3}\right), f\left(\frac{\pi}{4}\right)\right]$

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

3. The value of the sum 1.2.3 + 2.3.4 + 3.4.5 + ….upto n terms =

1) $\frac{1}{6}n^2\left(2n^2+1\right)$ 2) $\frac{1}{6}\left(n^2-1\right)\left(2n-1\right)\left(2n+3\right)\backslash$

3) $\frac{1}{8}\left(n^2+1\right)\left(n^2+5\right)$ 4) $\frac{1}{4}n\left(n+1\right)\left(n+2\right)\left(n+3\right)$

4. **The value of the determinant** $\begin{vmatrix} b^2-ab & b-c & bc-ac \\ ab-a^2 & a-b & b^2-ab \\ bc-ac & c-a & ab-a^2 \end{vmatrix}$

1) abc 2) a+b+c 3) 0 4) ab+bc+ca

Sol: Give the values for a, b, c

5. **If A is a square matrix of order 3, then** $\left|Adj(AdjA^2)\right| =$

1) $|A|^2$ 2) $|A|^4$ 3) $|A|^8$ 4) $|A|^{16}$

Sol: Use the formula. $|A^2|^4$

$=|A|^8$

6. **The system** $2x+3y+z=5, 3x+y+5z=7, x+4y-2z=3$ **has**

1) Unique solution 2) Finite number of solutions

3) Infinite solutions 4) No solution

Sol:

2x+3y+z=5

3x+y+5z=7

x+4y-2z=3

2x+3y+z=5

9x+3y+15z=21

7x + 14z = 16 = x + 2z = 8

12x+4y+20z = 28

x + 4y - 2z = 3

11x+22z= 25

X+2z = 25/2

$\therefore$ Parallel lines .

No solution.

7. $\sum_{k=1}^{6}\left[\sin\frac{2k\pi}{7} - i\cos\frac{2k\pi}{7}\right] =$

1)-1 2) 0 3) -i 4) i

Sol: $\sum_{k=1}^{b}(-i)\left(\cos\frac{2k\pi}{7} + i\sin\frac{2k\pi}{7}\right)$

(-i) (-1) = i

8. **If ‘ω’ is a complex cube root of unity, then**

$\omega^{\left(\frac{1}{3}+\frac{2}{9}+\frac{4}{27}+...\infty\right)} + \omega^{\left(\frac{1}{2}+\frac{3}{8}+\frac{9}{32}+...\infty\right)} =$

1) 1 2) -1 3) ω 4) i

Sol: $\omega^{\frac{1}{3}\left(1+\frac{2}{(3)}+\frac{2}{(3)}^{2}+\ldots\infty\right)}+\omega^{\frac{1}{2}(1+\frac{3}{4}+\frac{3}{(4)}^{2}+\ldots.]}$

$\omega^{\frac{1}{3}\left[\frac{1}{1-2/3}\right]}+\omega^{\frac{1}{2}\left(\frac{1}{1-3/4}\right)}$

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

$\omega+\omega^{2}=-1$

9. The common roots of the equations $z^{3}+2z^{2}+2z+1=0, z^{2014}+z^{1015}+1=0$ are

1) ω, ω^{2} 2) $1, \omega, \omega^{2}$ 3) $-1, \omega, \omega^{2}$ 4) $-\omega, -\omega^{2}$

Sol: $z^{3}+2z^{2}+2z+1=0; \quad z^{2014}+z^{2015}+1=0$

Verification.

10. $\left(\dfrac{1+\cos\frac{\pi}{8}-i\sin\frac{\pi}{8}}{1+\cos\frac{\pi}{8}+i\sin\frac{\pi}{8}}\right)^{8}=$

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

Sol: $\theta=\pi/8$ (say)

$\left(\dfrac{1+\cos\theta-i\sin\theta}{1+\cos\theta+i\sin\theta}\right)^{8}$

$=\left(\dfrac{2\cos^{2}\frac{\theta}{2}-2i\sin\frac{\theta}{2}\cos\frac{\theta}{2}}{2\cos^{2}\frac{\theta}{2}+2i\sin\frac{\theta}{2}\cos\frac{\theta}{2}}\right)^{8}=\left[\dfrac{\text{cis}\left(-\frac{\theta}{2}\right)}{\text{cis}(\theta/2)}\right]^{8}$

$=[\text{cis}(-\theta)]^{8}=\cos 8\theta-i\sin 8\theta$

$\cos 8\times\frac{\pi}{8}-i\sin 8\times\frac{\pi}{8}$ = -1 -0 = -1

11. If a,b,c are distinct and the roots of (b-c) x^{2}+(c-a)x+(a-b) = 0 are equal, then a,b,c are in

1) Arithmetic progression 2) Geometric Progression

3) Harmonic progression 4) Arithmetico-Geometric progression

Sol: It is clear that, x = 1 is a root of the equation and $\therefore$ roots are equal

$1=\dfrac{a-b}{b-c}$

b – c = a – b

2b = a+c $\Rightarrow$ a, b, c are in AP

12. If the roots of $x^3 - kx^2 + 14x - 8 = 0$ are in geometric progression, then k =

1) -3 2) 7 3) 4 4) 0

Sol: $x^3 - kx^2 + 14x - 8 = 0$

$\frac{a}{r}, a, ar$

Product of roots $= +8$

$a^3 = +8$

$a = +2$

sub in the above

$+8 - 4k + 28 - 8 = 0$

$4k = 28$

$k = 7$

13. If the harmonic mean of the roots of $\sqrt{2}x^2 - bx + \left(8 - 2\sqrt{5}\right) = 0$ is 4, then the value of b=

1) 2 2) 3 3) $4 - \sqrt{5}$ 4) $4 + \sqrt{5}$

Sol: $\alpha + \beta = \frac{b}{\sqrt{2}}; \alpha\beta = \frac{8 - 2\sqrt{5}}{\sqrt{2}}$

$\frac{2\alpha\beta}{\alpha + \beta} = 4$

$\frac{\sqrt{2}(8 - 2\sqrt{5})\sqrt{2}}{b} = 4$

$2b = 8 - 2\sqrt{5} \Rightarrow b = 4 - \sqrt{5}$

14. For real values of x, the range of $\frac{x^2 + 2x + 1}{x^2 + 2x - 1}$ is

1) $(-\infty, o) \cup (1, \infty)$ 2) $\left[\frac{1}{2}, 2\right]$ 3) $\left(-\infty, \frac{-2}{9}\right] \cup (1, \infty)$ 4) $(-\infty, -6] \cup (-2, \infty)$

Sol: $\frac{x^2 + 2x + 1}{x^2 + 2x - 1} = y$

Simplify, and disc ≥ 0

15. The number of four digit numbers formed by using the digits 0,2,4,5 and which are not divisible by 5, is

1) 10 2) 8 3) 6 4) 4

Sol: _ _ _ $\underline{0} = 3! = 6$

_ _ _ $\underline{5} = 2 \times 2 \times 1 = 4$

Total 10 ways

16. **T_m denotes the number of Triangles that can be formed with the vertices of a regular polygon of m sides. If $T_{m+1} - T_m = 15$, then m =**

1)3 2) 6 3) 9 4) 12

Sol: $m+1_{C_3} - m_{C_3} = 15$

Verification m = b; $7c_3 - bc_3$

35 – 20 = 15

17. **If |x| <1 then the coefficient of x^5 in the expansion of $\frac{3x}{(x-2)(x+1)}$ is**

1) $\frac{33}{32}$ 2) $-\frac{33}{32}$ 3) $\frac{31}{32}$ 4) $-\frac{31}{32}$

Sol: $\frac{3x}{(x-2)(x+1)} = \frac{A}{x-2} + \frac{B}{x+1} =$

x= 2; A = $\frac{6}{3} = 2$

x = -1 B = $\frac{-3}{-3} = 1$

$$\frac{2}{(-2)\left[1-\frac{x}{2}\right]} + \frac{1}{1+x}$$

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

$$\left[1+\frac{x}{2}+\frac{x^2}{4}+\frac{x^3}{8}+\frac{x^4}{16}+\frac{x^5}{32}\right] + \left[1-x+x^2-x^3+x^4-x^5\right]$$

$-\frac{1}{32} - 1$ = -33/32

18. **If the coefficients of x^9, x^{10}, x^{11} in the expansion of $(1+x)^n$ are in arithmetic progression then $n^2 - 41n$ =**

1) 398 2) 298 3) -398 4) 198

Sol: $(n-2r)^2 = n+2$

${}^nC_9, {}^nC_{10}, {}^nC_{11}$ are in AP

r = 10

$(n-20)^2 = n+2$

$n^2+400-40n = n+2$

$n^2 - 41n = -398$

19. **If $x = \frac{1}{5} + \frac{1.3}{5.10} + \frac{1.3.5}{5.10.15} + \ldots\infty$, then $3x^2 + 6x$=**

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

Sol: $1+x = 1+\frac{1}{1!}\frac{1}{5}+\frac{1.3}{2!}\left(\frac{1}{5}\right)^2+...$

$S=(1-x)^{-p/q};\ P=1,\ q=2$

$$\frac{x}{q}=\frac{1}{5}$$

$$x=\frac{2}{5}$$

$$(1+x) = \left(1-\frac{2}{5}\right)^{-1/2}$$

$$(1+x)=\left(\frac{3}{5}\right)^{-1/2}=\left(\frac{5}{3}\right)^{1/2}$$

$$1+x^2+2x=\frac{5}{3}$$

$$3x^2 + 6x + 3 = 5$$

$$3x^2 + 6x = 2$$

20. If $\sin\theta+\cos\theta=p$ and $\tan\theta+\cot\theta=q$ then $q(p^2-1)$ =

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

Sol: $\sin\theta+\cos\theta=P,\ \frac{1}{\sin\theta\cos\theta}=q$

$$\sin\theta\cos\theta=1/q$$

$$1+\frac{2}{q}=P^2 \Rightarrow \frac{2}{q}=p^2-1$$

$$\Rightarrow 2=q(p^2-1)\ .\quad q\,(p^2-1)=2$$

21. $\tan\frac{\pi}{5}+2\tan\frac{2\pi}{5}+4\cot\frac{4\pi}{5}=$

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

Sol: $\tan\theta+2\tan2\theta+4\tan4\theta=\cot\theta$

$$\tan\frac{\pi}{5}+2\tan\frac{2\pi}{5}+4\tan\frac{4\pi}{5}=\cot\frac{\pi}{5}$$

22. **If sinA+sin B+ sinC=0 and cos A+cosB+cos C =0,**

then $\cos(A+B)+\cos(B+C)+\cos(C+A)=$

1) Cos (A+B+C) 2) 2 3) 1 4) 0

Sol: Use complex numbers

$x = \cos A + i \sin A$

$y = \cos B + i \sin B$

$z = \text{cis } C + i \sin C$

$\frac{1}{x}+\frac{1}{y}+\frac{1}{z}=0$

$yz + zx + xy = 0$

$\text{Cis}(B+C)+\text{Cis}(C+A)+\text{Cis}(A+B)=0$

$\Rightarrow \cos(B+C)+\cos(C+A)+\cos(A+B)=0$

23. **If** $\tan\theta.\tan(120^0-\theta).\tan(120^0+\theta)=\frac{1}{\sqrt{3}}$**, then** θ **=**

1) $\frac{n\pi}{3}+\frac{\pi}{18}, n\in Z$ 2) $\frac{n\pi}{3}+\frac{\pi}{12}, n\in Z$ 3) $\frac{n\pi}{12}+\frac{\pi}{12}, n\in Z$ 4) $\frac{n\pi}{3}+\frac{\pi}{6}, n\in Z$

Sol: $\tan 3\theta = \text{Tan}\frac{\pi}{6} \Rightarrow 3\theta = n\pi+\frac{\pi}{6}$

24. **If** $\sin^{-1}\left(x-\frac{x^2}{2}+\frac{x^3}{4}-......\infty\right)+\cos^{-1}\left(x^2-\frac{x^4}{2}+\frac{x^6}{4}-....\infty\right)=\frac{\pi}{2}$ **and** $0<x<\sqrt{2}$ **then x =**

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

Sol: $x = x^2 \Rightarrow x[x-1]=0 \Rightarrow x=1$

25. **If** $2\sinh^{-1}\left(\frac{a}{\sqrt{1-a^2}}\right)=\log\left(\frac{1+x}{1-x}\right)$ **then x =**

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

Sol: $2.\cos\left[\frac{a}{\sqrt{1-a^2}}+\sqrt{1+\frac{a^2}{1-a^2}}\right]=2\cos\left[\frac{a+1}{\sqrt{1-a^2}}\right]=$

$= 2 \cos\sqrt{\frac{1+a}{1-a}}=\cos\left[\frac{1-a}{1-a}\right]$

26. **In a ΔABC, (a+b+c)(b+c-a)= λbc, then**

1) $\lambda < -6$ 2) $\lambda > 6$ 3) $0 < \lambda < 4$ 4) $\lambda > 4$

Sol: $2s\ 2(s-a) = \lambda bc \Rightarrow \frac{s(s-a)}{bc} = \frac{\lambda}{4}$

$\Rightarrow \cos^2\frac{A}{2} = \frac{\lambda}{4}$ $\Rightarrow 0 \le \frac{\lambda}{4} \le 1$

$\Rightarrow 0 < \lambda < 4$

27. **If in a ΔABC, $r_1 = 2r_2 = 3r_3$, then the perimeter of the triangle is equal to**

1) 3 a 2) 3 b 3) 3 c 4) 3(a+b+c)

Sol: $a:b:c = (2+3):(1+3):(2+1) = 5:4:3$

2S = 12K = 3 (4K) (or) 4(3K)

= 3b (or) 4C

28. **In ΔABC,** $\frac{a}{\tan A} + \frac{b}{\tan B} + \frac{c}{\tan C} =$

1) 2r 2) r+2R 3) 2r+R 4) 2(r+R)

Sol: 2R (Cos A+ CosB+ CosC) = $2R\left[1 + \frac{r}{R}\right]$ = 2R + 2r

29. **If m_1, m_2, m_3, m_4 are respectively the magnitudes of the vectors**

$\bar{a}_1 = 2\bar{i} - \bar{j} + \bar{k}, \bar{a}_2 = 3\bar{i} - 4\bar{j} - 4\bar{k}, \bar{a}_3 = -\bar{i} + \bar{j} - \bar{k}, \bar{a}_4 = -\bar{i} + 3\bar{j} + \bar{k}$, **then the correct order of**

m_1, m_2, m_3, m_4 is

1) $m_3 < m_1 < m_4 < m_2$ 2) $m_3 < m_1 < m_2 < m_4$ 3) $m_3 < m_4 < m_1 < m_2$ 4) $m_3 < m_4 < m_2 < m_1$

Sol: $|\bar{a}_1| = \sqrt{6}$, $|\bar{a}_2| : \sqrt{41}$, $|\bar{a}_3| = \sqrt{3}$, $|\bar{a}_4| = \sqrt{11}$

$m_3 < m_1 < m_4 < m_2$

30. **If $\bar{a}, \bar{b}, \bar{c}$ are unit vectors such that $\bar{a} + \bar{b} + \bar{c} = \bar{0}$, then the $\bar{a}.\bar{b} + \bar{b}.\bar{c} + \bar{c}.\bar{a} =$**

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

Sol: $1+1+1+2 \quad \sum \bar{a}.\bar{b} = 0 \Rightarrow \sum \bar{a}.\bar{b} = -3/2$

31. **If $\bar{a} = 2\bar{i} + \bar{k}, \bar{b} = \bar{i} + \bar{j} + \bar{k}, \bar{c} = 4\bar{i} - 3\bar{j} + 7\bar{k}$ then the vector $\bar{r}$ satisfying $\bar{r} \times \bar{b} = \bar{c} \times \bar{b}$ and $\bar{r}.\bar{a} = 0$ is**

1) $\bar{i} + 8\bar{j} + 2\bar{k}$ 2) $\bar{i} - 8\bar{j} + 2\bar{k}$ 3) $\bar{i} - 8\bar{j} - 2\bar{k}$ 4) $-\bar{i} - 8\bar{j} + 2\bar{k}$

Sol: $(\bar{r} - \bar{c}) \times \bar{b} = \bar{0} \Rightarrow \bar{r} = \bar{c} + t\bar{b}$

$\Rightarrow \bar{r}.\bar{a} = o \Rightarrow \bar{c}.\bar{a} + t(\bar{b}.\bar{a}) = 0 \Rightarrow t = -\frac{\bar{c}.\bar{a}}{\bar{b}.\bar{a}}$

$\bar{r} = \bar{c} - \frac{\bar{c}-\bar{a}}{\bar{b}.\bar{a}}(\bar{b}) = (4,-3,7) - \left(\frac{15}{3}\right)(1,1,1) \Rightarrow$ (-1, -8, 2)

32. **If $\bar{a},\bar{b},\bar{c}$ are three vectors such that $|\bar{a}| = 1, |\bar{b}| = 2, |\bar{c}| = 3,$ and $\bar{a}.\bar{b} = \bar{b}.\bar{c} = \bar{c}.\bar{a} = 0$, then $\left|\left[\bar{a}\ \bar{b}\ \bar{c}\right]\right|$ =**

1)0 2) 2 3) 3 4) 6

Sol: $\left(\bar{a}\ \bar{b}\ \bar{c}\right)^2 = \begin{vmatrix} 1 & 0 & 0 \\ 0 & 4 & 0 \\ 0 & 0 & 9 \end{vmatrix} = 36 \Rightarrow \left(\bar{a}\ \bar{b}\ \bar{c}\right) = 6$

33. **If $\left[\bar{a}\times\bar{b}\ \bar{b}\times\bar{c}\ \bar{c}\times\bar{a}\right] = \lambda\left[\bar{a}\ \bar{b}\ \bar{c}\right]^2$, then λ =**

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

Sol: $\left[\bar{a}\times\bar{b}\ \ \bar{b}\times\bar{c}\ \ \bar{c}\times\bar{a}\right] = \left[\bar{a}\ \ \bar{b}\ \ \bar{c}\right]^2$

$\lambda = 1$

34. **The Cartesian equation of the plane passing through the point (3, -2,-1) and parallel to the vectors $\bar{b} = \bar{i} - 2\bar{j} + 4\bar{k}$ and $\bar{c} = 3\bar{i} + 2\bar{j} - 5\bar{k}$**

1) 2x-17y-8z+63 =0 2) 3x+17y+8z-36=0 3) 2x+17y+8z+36=0 4) 3x-16y+8z--63=0

Sol: Sol : $\begin{vmatrix} x-3 & y+2 & z+1 \\ 1 & -2 & 4 \\ 3 & 2 & -5 \end{vmatrix} = 0$

$\Rightarrow$ (2x -6) + 17 y + 34 + 8z + 8 =0

$\Rightarrow$ 2x +17 y +8z +36 = 0 Ans (3)

35. **The arithmetic mean of the observations 10, 8, 5, a,b is 6 and their variance is 6.8. Then ab=**

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

Sol: $AM = \frac{23+a+b}{5} = 6 \Rightarrow a+b = 7$

Variance $= \frac{16+4+1+(a-6)^2+(b-6)^2}{5} = 64$

$\therefore\ a^2 + b^2 = 25 \Rightarrow ab=12$ Ans (4)

36. **If the median of the data 6, 7, x-2, x, 18, 21 written in ascending order is 16, then the variance of that data is**

1) $30\frac{1}{5}$ 2) $31\frac{1}{3}$ 3) $32\frac{1}{2}$ 4) $33\frac{1}{3}$

Sol: Median = 16 $\Rightarrow$ x = 17

Variance = $\frac{64+49+1+9+16+49}{6} = 31\frac{1}{3}$ Ans (2)

37. Two persons A and B are throwing an unbiased six faced die alternatively, with the condition that the person who throws 3 fist wins the game. If A starts the game, the probabilities of A and B to win the same are respectively

1) $\frac{6}{11}, \frac{5}{11}$ 2) $\frac{5}{11}, \frac{6}{11}$ 3) $\frac{8}{11}, \frac{3}{11}$ 4) $\frac{3}{11}, \frac{8}{11}$

Sol: $p = \frac{1}{6}, q = \frac{5}{6}$

$P(A's\ win) = p + q^2p + q^4p + ... = p\left(\frac{1}{1-q^2}\right) = \frac{1}{1+q} = \frac{6}{11}$

Ans $\frac{6}{11}, \frac{5}{11}$ Ans (1)

38. The letters of the word "QUESTION" are arranged in a row at random. The probability that there are exactly two letters between Q and S is

1) $\frac{1}{14}$ 2) $\frac{5}{7}$ 3) $\frac{1}{7}$ 4) $\frac{5}{28}$

Sol:
1 2 3 4 5 6 7 8
Q U E S T I O N

(1,4) (2,5) (3,6) (4,7) (5,8) $\rightarrow$ 5 positions $\rightarrow$ 2 ways

Remaining letters be arranged in 6 ! ways

$P = \frac{5 \times 2 \times 6!}{8!} = \frac{5}{28}$ Ans (4)

39. If $\frac{1+3p}{3}, \frac{1-2p}{2}$ are probabilities of two mutually exclusive events, then p lies in the interval

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

Sol.

$0 \le \frac{1+3p}{3} \le 1$

$0 \le 1+3p \le 3$

$-1 \le 3p \le 2$

$-\frac{1}{3} \le p \le \frac{2}{3}$

$0 \le \frac{1-2p}{2} \le 1$

$0 \le 1-2p \le 2$

$-1 \le -2p \le 1$

$-\frac{1}{2} \le p \le \frac{1}{2}$

$0 \le \frac{1+3p}{3} + \frac{1-2p}{2} \le 1$

$0 < \frac{5}{6} < 1$

Ans (1)

$-\frac{1}{3} \le p \le \frac{1}{2}$

40. **The probability that an event does not happen in one trial is 0.8. The probability that the event happens atmost once in three trials is**

1) 0.896 2) 0.791 3) 0.642 4) 0.592

Sol. $q = \frac{8}{10} = \frac{4}{5}, p = \frac{1}{5}$

$P(X \le 1) = P(X = 0) + P(X = 1)$ Ans (1)

$= 3C_0 (1)\left(\frac{4}{5}\right)^3 + 3C_1 \frac{1}{5}\left(\frac{4}{5}\right)^2$

$= 0.896$

41. **The probability distribution of a random variable is given below:**

X=x	0	1	2	3	4	5	6	7
P(X=x)	0	K	2K	2K	3K	K^2	$2K^2$	$7K^2 + K$

Then $P(0 < X < 5)$

1) $\frac{1}{10}$ 2) $\frac{3}{10}$ 3) $\frac{8}{10}$ 4) $\frac{7}{10}$

Sol: $10k^2 + 9k = 1 \Rightarrow k(10k + 9) = 1$

$\Rightarrow 10k^2 + 9k - 1 = 0 \Rightarrow k = \frac{1}{10}$

$P(0 < x < 5) = P(x=1) + P(x=2) + P(x=3) + P(x=4)$

$= 8k = \frac{8}{10} = 0.8$

42. **If the equation to the locus of points equidistant from the points (-2,3) , (6,-5) is ax+by+c=0 where a > 0 then, the ascending order of a, b, c is**

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

Sol: A= (-2. 3) B = (6, -5)

Mid point of AB = (2, -1)

Slope of AB = $\frac{-8}{8} = -1$

Equ of perpendicular bisector of AB in

y+1= 1(x-2) $\Rightarrow x - y - 3 = 0$

Comparing with $ax + by + c = 0$

$\frac{a}{1} = \frac{b}{-1} = \frac{c}{-3} = k \Rightarrow a = k, b = -k, c = -3k$

$\Rightarrow c < b < a$

43. The point (2, 3) is first reflected in the straight line y =x and then translated through a distance of 2units along the positive direction of x-axis. The coordinates of the transformed point are

1) (5, 4) 2) (2, 3) 3) (5, 2) 4) (4, 5)

Sol: If (2, 3) in the line x = y in (3, 2) after shifting 2 units along positive x-axis it be comes (5, 2)

44. If the straight lines 2x+3y-1 = 0, x+2y -1 = 0 and ax +by -1 = 0 form a triangle with origin as ortho centre , then (a, b) =

1) (6, 4) 2) (-3, 3) 3) (-8 , 8) 4) (0, 7)

Sol: $\left(a_1a_2+b_1b_2\right)\ L_3=\left(a_1a_3+b_1b_3\right)L_2=\left(a_2a_3+b_2b_3\right)L_1$

$8\left(ax+by-1\right)=\left(2a+3b\right)\left(x+2y-1\right)=\left(a+2b\right)\left(2x+3y-1\right)$ it in satisfies by orthocenter

Sub (0, 0) , -8= -2a-3b = -a-2b

2a+3b=8

a + 2b=8

Solving a= -8, b = 8

45. The point on the line 4x –y-2 = 0 which is equidistant from the points (-5, 6) and (3, 2) is

1) (2, 6) 2) (4, 14) 3) (1, 2) 4) (3, 10)

Sol: Equation of perpendicular bisector of line joing (-5, 6), (3, 2) is

= 2x(-8)+2y(4)=25+36-9-4 $\Rightarrow -16x+8y=48$

$\Rightarrow 2x-y+6=0$ Solving with $4x-y-2=0$

$2x-8=0$

$x=4,\ y=14$

46. If the lines x + 2ay + a =0, x + 3by + b = 0, x + 4cy + c = 0 are concurrent, then a,b,c are in

1) Arithmetic progression 2) Geometric progression

3) Harmonic progression 4) Arithmetico – Geometric progression

Sol: $\begin{vmatrix}1 & 2a & a\\ 1 & 3b & b\\ 1 & 4c & c\end{vmatrix}=0$

$\Rightarrow 1\left(3bc-4bc\right)-\left(2ac-4ac\right)+1\left(2ab-3ab\right)=0$

$\Rightarrow -bc+2ac-ab=0 \Rightarrow ab+bc=2ac$

$\Rightarrow \frac{1}{c}+\frac{1}{a}=\frac{2}{b}$

$\therefore$ a,b,c are in H.P.

47. **The angle between the straight lines represented by** $(x^2+y^2)\sin^2\alpha=(x\cos\alpha-y\sin\alpha)^2$ is

1) $\frac{\alpha}{2}$ 2) α 3) 2α 4) $\frac{\pi}{2}$

Sol: Given equation $x^2\cos 2\alpha - xy\sin 2\alpha = 0$

$$\cos\theta=\frac{(\cos 2\alpha+0)}{\sqrt{\cos^2 2\alpha+\sin^2 2\alpha}}\Rightarrow\theta=2\alpha$$

48. **If the slope of one of the lines represented by** $ax^2-6xy+y^2=0$ is the square of the other, then the value of a is

1) -27 or 8 2) -3 or 2 3) -64 or 27 4) -4 or 3

Sol: $m+m^2=\frac{6}{1}, m.m^2=\frac{a}{1}$

$$m^3+m^6+3m.m^2\left(m+m^2\right)=216$$

$$\Rightarrow a+a^2+3a\left(6\right)=216\Rightarrow a^2+19a-216=0$$

$$\Rightarrow a=-27 \text{ or } 8$$

49. **The sum of the minimum and maximum distances of the point (4, -3) to the circle** $x^2+y^2+4x-10y-7=0$ is

1) 10 2) 12 3) 16 4) 20

Sol: P = (4, -3), centre of circle C = (-2,5)

Radius r = 6

Minimum distance of P = CP – r

Maximum distance of P = CP + r

Sum = 2CP = $2\sqrt{36+64}=20$

50. **The locus of centres of the circles which cut the circles** $x^2+y^2+4x-6y+9=0$

$x^2+y^2-5x+4y+2=0$ orthogonally is

1) 3x + 4y – 5 = 0 2) 9x – 10y + 7= 0 3) 9x + 10y -7 = 0 4) 9x – 10y + 11 = 0

Sol: Required locus is radical axis of given circles

i.e 9x – 10y + 7 = 0

51. **The equation of the circle passing through (2 , 0) and (0, 4) and having the minimum radius is**

1) $x^2+y^2=20$ 2) $x^2+y^2-2x-4y=0$

3) $x^2+y^2=4$ 4) $x^2+y^2=16$

Sol: Required circle is a circle on (2,0), (0,4) as ends of diameter

i.e (x-2) (x-0) + (y-0) (y-4) = 0

$\Rightarrow x^2 + y^2 - 2x - 4y = 0$

52. **If** $x^2+y^2-4x-2y+5=0$ and $x^2+y^2-6x-4y-3=0$ are members of a coaxal system of circles then centre of a point circle in the system is

1) (-5, -6) 2) (5, 6) 3) (3, 5) 4) (-8, -13)

Sol: Equation of coaxal system of circles is $S + \lambda L = 0$

$\Rightarrow x^2 + y^2 - 4x - 2y + 5 + 2\lambda(x+y+4)=0$

$C=(-\lambda+2,-\lambda+1), r=\sqrt{(-\lambda+2)^2+(-\lambda+1)^2-5-8\lambda}$

$r=0 \Rightarrow (\lambda-2)^2+(\lambda-1)^2-5-8\lambda=0 \Rightarrow 2\lambda^2-14\lambda=0 \Rightarrow \lambda=0,7$

C = (-5, -6)

53. **If x – y +1 = 0 meets the circle** $x^2+y^2+y-1=0$ at A and B then the equation of the circle with AB as diameter is

1) $2(x^2+y^2)+3x-y+1=0$ 2) $2(x^2+y^2)+3x-y+2=0$

3) $2(x^2+y^2)+3x-y+3=0$ 4) $x^2+y^2+3x-y+1=0$

Sol: Concept

54. **An equilateral triangle is inscribed in the parabola** $y^2=8x$, with one of its vertices is the vertex of the parabola. Then, the length of the side of that triangle is

1) $24\sqrt{3}$ 2) $16\sqrt{3}$ 3) $8\sqrt{3}$ 4) $4\sqrt{3}$

Sol: $\tan 30^0 = \frac{2at}{at^2} \Rightarrow \frac{1}{\sqrt{3}} = \frac{2}{t} \Rightarrow t = 2\sqrt{3}$

Length of side = 4at = $4(2)(2\sqrt{3}) = 16\sqrt{3}$

55. **The point (3, 4) is the focus and 2x -3y + 5 = 0 is the directrix of a parabola. Its latus rectum is**

1) $\frac{2}{\sqrt{13}}$ 2) $\frac{4}{\sqrt{13}}$ 3) $\frac{1}{\sqrt{13}}$ 4) $\frac{3}{\sqrt{13}}$

Sol: Distance from focus (3,4) to directrix 2x – 3y + 5 = 0

$=\frac{|6-12+5|}{\sqrt{13}}=\frac{1}{\sqrt{13}}$ $\therefore 2a=\frac{1}{\sqrt{13}}$

Length of latus rectum is = 4a = $\frac{2}{\sqrt{13}}$

56. The radius of the circle passing through the foci of the ellipse $\frac{x^2}{16}+\frac{y^2}{9}=1$ and having its centre at (0,3) is

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

Sol: Centre of circle = (0,3) is B, the end of minor axis

The circle passes through the focus S

$\therefore$ radius of circle = SB = a = 4

57. The values that m can take so that the straight line y = 4x + m touches the curve $x^2+4y^2=4$ is

1) $\pm\sqrt{45}$ 2) $\pm\sqrt{60}$ 3) $\pm\sqrt{65}$ 4) $\pm\sqrt{72}$

Sol: Ellipse is $\frac{x^2}{4}+\frac{y^2}{1}=1$

It touches y = 4x + m

$\therefore c^2=a^2m^2+b^2 \Rightarrow m^2=4(4)^2+1=65$

$m=\pm\sqrt{65}$

58. The foci of the ellipse $\frac{x^2}{16}+\frac{y^2}{b^2}=1$ and the hyperbola $\frac{x^2}{144}-\frac{y^2}{81}=\frac{1}{25}$ coincide. Then , the value of b^2 is

1) 5 2) 7 3) 9 4) 1

Sol: $\frac{x^2}{16}+\frac{y^2}{b^2}=1, \quad \frac{x^2}{\frac{144}{25}}-\frac{y^2}{\frac{81}{25}}=1$

Foci $=\left(\pm\sqrt{16-b^2},0\right),\left(\pm\sqrt{\frac{144}{25}+\frac{81}{25}},0\right)$

Same $\therefore 16-b^2=\frac{225}{25}$

$\Rightarrow 16-b^2=9 \Rightarrow b^2=7$

59. If (2, -1, 2) and (K, 3, 5) are the triads of direction ratios of two lines and the angle between them is 45°, then a value of K is

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

Sol: $\cos\theta=\frac{a_1a_2+b_1b_2+c_1c_2}{\sqrt{a_1^2+b_1^2+c_1^2}\sqrt{a_2^2+b_2^2+c_2^2}}$

$$\frac{1}{\sqrt{2}}=\frac{2k-3+10}{\sqrt{9}\sqrt{k^2+34}}$$

$$\Rightarrow 9\left(k^2+34\right)=2\left(2k+7\right)^2$$

$$\Rightarrow k^2-56k+208=0$$

$$\Rightarrow k=4 \text{ or } 52$$

60. **The length of perpendicular from the origin to the plane which makes intercepts** $\frac{1}{3},\frac{1}{4},\frac{1}{5}$ respectively on the coordinate axes is

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

Sol: Equation of plane is $\frac{x}{\frac{1}{3}}+\frac{y}{\frac{1}{4}}+\frac{z}{\frac{1}{5}}=1 \Rightarrow 3x+4y+5z=1$

Distance from origin to the plane = $\frac{|1|}{\sqrt{9+16+25}}=\frac{1}{\sqrt{50}}=\frac{1}{5\sqrt{2}}$

61. **Match the following :**

I) The centroid of the triangle formed by (2, 3, -1), (5, 6, 3), (2, -3, 1) is	a) (2, 2, 2)
II) The circumcentre of the triangle formed by (1, 2, 3), (2, 3, 1), (3, 1, 2) is	b) (3, 1, 4)
III) The orthocentre of the triangle formed by (2, 1, 5), (3, 2, 3), (4, 0, 4) is	c) (1, 1, 0)
IV) The incentre of the triangle formed by (0, 0, 0), (3, 0, 0), (0, 4, 0) is	d) (3, 2, 1)
	e) (0, 0, 0)

	I	II	III	IV		I	II	III	IV
1)	d	a	b	c	2)	a	b	c	d
3)	d	e	b	c	4)	d	a	e	c

Sol: I.G = (321)

II. Equilateral triangle S = G = (2,2,2)

III. Equilateral triangle H = G = (3,1,4)

IV. I = (1,1,0)

62. **If** $g(x)=\frac{x}{[x]}$ for x > 2 then $\lim_{x\to 2^+}\frac{g(x)-g(2)}{x-2}=$

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

Sol: $\underset{x\to 2}{Lt}+\frac{\frac{x}{2}-1}{x-2}=\frac{1}{2}$

63. $\lim_{x\to\frac{\pi}{2}}\left(\frac{2x-\pi}{\cos x}\right)=$

1) 0 2) 1/2 3) -2 4)5

Sol: apply L^1 H rule

$\underset{x\to\frac{\pi}{2}}{Lt}\frac{2}{-\sin x}=-2$

64. **If f is defined by** $f(x)=\begin{cases} x, \text{ for } 0\le x<1 \\ 2-x, \text{ for } x\ge 1\end{cases}$, then at x = 1, f is

1) Continuous and differentiable 2) Continuous but not differentiable

3) Discontinuous but differentiable 4) Neither continuous nor differentiable

Sol: $\frac{LHL}{\underset{x\to 1-}{Lt}} f(x)=\frac{Lt}{n-1} x=1 \frac{RHL}{\underset{x\to 1+}{Lt}} 2-n=1$

$f(1)=1$

$\therefore \underset{x\to 1}{Lt} f(x)=f(1)$

$\therefore$ f is continuous at x = 1

$f^1(x)=\begin{pmatrix} 1 \text{if } 0<x<1 \\ -1 \text{if } x>1 \end{pmatrix}$

$f^1(1+)\ne f^1(1-)\therefore$ f is not differentiable at x = 1

65. **If** $x^2+y^2=t+\frac{1}{t}$ and $x^4+y^4=t^2+\frac{1}{t^2}$ then $\frac{dy}{dx}=$

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

Sol: $x^2+y^2=t+\frac{1}{t}$

So BS

$x^4+y^4+2x^2y^2=t^2+\frac{1}{t^2}+2$

$x^2y^2=1$

Different wrt 'x'

$\frac{dy}{dx}=-y/x$

66. **Let D be the domain of a twice differentiable function f. For all** $x \in D, f''(x)+f(x)=0$ and $f(x)=\int g(x)dx+\text{constant}$. If $h(x)=(f(x))^2+(g(x))^2$ and h (0) = 5 then h (2015) – h (2014) =

1) 5 2) 3 3) 0 4)1

Sol: h(x) is constant function $\forall x \in R$

Since h(0) = 5

h(2015) = 5

h(2014) = 5

now h(2015) –h(2014) = 5-5=0

67. **If** $x=at^2 \text{and } y=2at, \text{then } \frac{d^2y}{dx^2} \text{at } t=\frac{1}{2}$ is

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

Sol: $\frac{dx}{dt}=2at, \frac{dy}{dt}=2a$

$\frac{dy}{dt}=\frac{1}{t} \Rightarrow \frac{d^2y}{dx^2}=\frac{-1}{t^2}.\frac{1}{2at} \text{ at } t=\frac{1}{2}$

$=-\frac{4}{a}$

68. **The volume of a sphere is increasing at the rate of 1200 c.cm/sec. The rate of increase in its surface area when the radius is 10 cm is**

1)120 sq. cm/sec 2))240 sq. cm/sec 3)) 200 sq. cm/sec 4))100 sq. cm/sec

Sol: $\frac{dv}{dt}=1200, r=10$

$V=\frac{4}{3}\pi r^3$

$\Rightarrow \frac{dr}{dt}=\frac{3}{\pi}$

$S=4\pi r^2$

$\frac{dS}{dt}=4\pi.2r\frac{dr}{dt}$

$=4\pi 2.10\frac{3}{\pi}$

= 240 sq. cm/sec

69. **The slope of the tangent to the curve** $y=\int_0^x \frac{dt}{1+t^3}$ at the point where x = 1 is

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

Sol: Diff b.s

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

At x = 1

70. **If** $x^2+y^2=25$, then $\log_5[\text{Max}(3x+4y)]$ is

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

Sol: $x=3,\ y=4$

$\log_5(\max(3x+4x))=\log_5^{25}=2$

71. **If f is defined in [1, 3] by** $f(x)=x^3+bx^2+ax$, such that $f(1)-f(3)=0$ and $f'(c)=0$ where $c=2+\frac{1}{\sqrt{3}}$, then (a,b) =

1) (-6, 11) 2) $\left(2-\frac{1}{\sqrt{3}},2+\frac{1}{\sqrt{3}}\right)$ 3) (11, -6) 4) (6, 11)

Sol: $\text{since } f(1)=f(3)$

$\Rightarrow 1+b+a=27+96+3a \Rightarrow 8b+2a=-2b$

From options $a=11, b=-6$, satisfies

72. $\int\frac{dx}{(x-1)\sqrt{x^2-1}}=$

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

(c is a constant)

Sol: Rmt $x-1=\frac{1}{t}\Rightarrow dx=-\frac{1}{t^2}dt$

G.I = $-\int(1+2t)^{\frac{-1}{2}}dt=-\sqrt{\frac{x+1}{x-1}}+c$

73. $\int e^x \frac{x^2+1}{(x+1)^2}dx =$

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

Sol: G.I $\int e^x\left[\frac{x^2-1+2}{(x+1)^2}\right]dx$

$= \int e^x\left(\frac{x-1}{x+1}+\frac{2}{(x+1)^2}\right)dx = e^x/\left(\frac{x-1}{x+1}\right)+c$

$=$ use $\int e^x[f(x)+f'(x)]dx = e^x.f(x)+c$

74. $\int \frac{x+1}{x(1+xe^x)}dx =$

1) $\log\left|\frac{1+xe^x}{xe^x}\right|+c$ 2) $\log\left|\frac{xe^x}{1+xe^x}\right|+c$

3) $\log\left|xe^x(1+xe^x)\right|+c$ 4) $\log(1+xe^x)+C$

Sol: Sub $1+xe^x=t$

$G.I = \int \frac{1}{t(t-1)}dt$

$= \int\left(-\frac{1}{t}+\frac{1}{t-1}\right)dt$

$= \log\left|\frac{t-1}{t}\right|$

$= \log\left|\frac{xe^x}{1+xe^x}\right|+c$

75. $\int \frac{f(x)g'(x)-f'(x)g(x)}{f(x)g(x)}[\log(g(x))-\text{Log}(f(x))]dx =$

1) $\log\left(\frac{g(x)}{f(x)}\right)+C$ 2) $\frac{1}{2}\left[\log\left(\frac{g(x)}{f(x)}\right)\right]^2+C$

3) $\frac{g(x)}{f(x)}\text{Log}\left(\frac{g(x)}{f(x)}\right)+C$ 4) $\text{Log}\left[\frac{g(x)}{f(x)}\right]-\frac{g(x)}{f(x)}+C$

(C is a constant)

Sol: Sub $\log\left(\frac{g(x)}{f(x)}\right) = t$

$$G.I = \int t\,dt = \frac{t^2}{2} = \frac{1}{2}\left[\log\left(\frac{g(x)}{f(x)}\right)\right]^2 + c$$

76. $\int_0^{\pi/4} \frac{\sin x + \cos x}{3 + \sin 2x}\,dx =$

1) $\frac{1}{2}\text{Log}3$ 2) Log 2 3) Log 3 4) $\frac{1}{4}\text{Log}3$

Sol: Sub sin x – cos x = t

$$G.I = \int_{-1}^{0} \frac{1}{2^2 - t^2}\,dt = \frac{1}{4}\log 3$$

77. $\int_{-1}^{1} \frac{\sqrt{1+x+x^2} - \sqrt{1-x+x^2}}{\sqrt{1+x+x^2} + \sqrt{1-x+x^2}}\,dx =$

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

Sol: Odd function. Use $\int_{-a}^{a} f(x)\,dx = 0$ if $f(x)$ is odd function

G.I = 0

78. The area of the region described by $\{(x,y)/x^2 + y^2 \le 1 \text{ and } y^2 \le 1 - x\}$ is

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

Sol: Area= circle area $+2\int_0^1 (1 - y^2)\,dy$

$$= \frac{\pi}{2} + 2\left(y - \frac{y^3}{3}\right)_0^1$$

$$= \frac{\pi}{2} + 2\left(\frac{2}{3}\right) = \frac{\pi}{2} + \frac{4}{3}$$

79. The solution of $\frac{dy}{dx} + \frac{1}{x} = \frac{e^y}{x^2}$ is

1) $2x = (1 + Cx^2)e^y$ 2) $x = (1 + Cx^2)e^y$ 3) $2x^2 = (1 + Cx^2)e^{-y}$ 4) $x^2 = (1 + Cx^2)e^{-y}$

(C is a constant)

Sol: B.D.E

$\div e^{y}$

$$e^{-y}\frac{dy}{dx}+\frac{1}{x}.e^{-y}=\frac{1}{x^2}$$

Part $e^{-y}=t$

$$-e^{-y}\frac{dy}{dx}=\frac{dt}{dx}$$

D.E is $\frac{dt}{dx}-\frac{1}{x}t=\frac{1}{x^2}$

I.F = $e^{\int -\frac{1}{x}dx}=e^{-\log x}=\frac{+1}{x}$

G.S. is $\frac{1}{e^y}.\frac{1}{x}=\int\frac{-1}{x^2}.\frac{1}{x}dx$

$$\frac{1}{e^y x}=\frac{1}{2x^2}+c$$

$= 2x=e^y\left(1+cx^2\right)$

80. The differential equation $\frac{dy}{dx}=\frac{1}{ax+by+c}$ where a, b , c are all non zero real numbers, is

1) Linear in y 2) Linear in x 3) Linear in both x & y 4) Homogeneous equaton

Sol: $\frac{dx}{dy}=ax+by+c$

$$\frac{dx}{dy}-ax=by+c$$

L.D.E in (x)

PHYSICS

81. The pressure on a circular plate is measured by measuring the force on the plate and the radius of the plate. If the errors in measurement of the force and the radius are 5% and 3% respectively, the percentage of error in the measurement of pressure is

1) 8 2) 14 3) 11 4) 12

Sol: $\frac{\Delta p}{p} \times 100 = \left(\frac{\Delta F}{F} + \frac{2\Delta r}{r}\right)100 = 5 + 2 \times 3 = 11$

82. A body is projected vertically from the surface of the earth of radius 'R' with a velocity equal to half of the escape velocity. The maximum height reached by the body is

1) R/2 2) R/3 3) R/4 4) R/5

Sol: $-\frac{GMm}{R} + \frac{1}{2}\frac{mVe^2}{4} = \frac{-GMm}{R+h}$

$\frac{1}{2}m\frac{Ve^2}{4} = +\frac{GMm}{R} - \frac{GMm}{R+h}$

$\frac{2GM}{8R} = \frac{GMn}{R(R+h)}$

$\frac{1}{4} = \frac{h}{R+h}$

$R + h = 4h$

$h = R/3$

83. A particle aimed at a target, projected with an angle 15^0 with the horizontal is short of the target by 10m. If projected with an angle of 45^0 is away from the target by 15m, then the angle of projection to hit the target is

1) $\frac{1}{2}\sin^{-1}\left(\frac{1}{10}\right)$ 2) $\frac{1}{2}\sin^{-1}\left(\frac{3}{10}\right)$ 3) $\frac{1}{2}\sin^{-1}\left(\frac{9}{10}\right)$ 4) $\frac{1}{2}\sin^{-1}\left(\frac{7}{10}\right)$

Sol: $R - 10 = \frac{u^2 \sin 30}{g} \Rightarrow R + 10 = \frac{u^2}{g}$

$\frac{R-10}{R+10} = \frac{1}{2} \Rightarrow R = 35$

$\frac{u^2}{g} = 50$

$\theta = \frac{1}{2}\sin(7/10)$

84. A man running at a speed of 5kmph finds that the rain falls vertically. When he stops running he finds that the rain is falling at an angle of 60^0 with the horizontal. The velocity of rain with respect to running man is

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

Sol: $V_R = xi - yj$

$V_m = 5i$

$V_{Rm} = (x-5)i - yj$

$X = 5$

$y/x = \sqrt{3} = \tan 60^0$

$y = 5\sqrt{3}$

85. A horizontal force just sufficient to move a body of mass 4kg lying on a rough horizontal surface, is applied on it. Coefficient of static and kinetic frictions are 0.8 and 0.6 respectively. If the force continues to act even after the body has started moving, the acceleration of the body is ($g = 10ms^{-2}$)

1) $6ms^{-2}$ 2) $8ms^{-2}$ 3) $2ms^{-2}$ 4) $4ms^{-2}$

Sol: $a = (\mu_s - \mu_k)g$

$= (0.8 - 0.6)\ 10$

$= 2\ m/s^2$

86. A force $(2\hat{i}+\hat{j}-k)N$ acts on a body which is initially at rest. At the end of 20 sec the velocity of the body is $(4\hat{i}+2\hat{j}-2k)ms^{-1}$, then the mass of the body is

1) 8 kg 2) 10 kg 3) 5 kg 4) 4.5 kg

Sol: $V = \frac{F}{m}t$

$\sqrt{24} = \frac{\sqrt{6}\times 20}{m}$

$M = 10$ kg

87. A man of weight 50kg carries an object to a height of 20m in a time of 10sec. The power used by the man in this process is 2000W, then find the weight of the object carried by the man [assume g = 10 ms^{-2}]

1) 100 kg 2) 25 kg 3) 50 kg 4) 10 kg

Sol: $p = \frac{(M+m)gh}{1}$

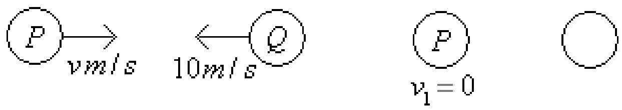
$2000 = \frac{(50+m)10\times20}{10}$

m = 50 kg

88. A ball 'P' moving with a speed of $\upsilon\, ms^{-1}$ collides directly with another identical ball 'Q' moving with a speed $10ms^{-1}$ in the opposite direction. P comes to rest after the collision. If the coefficient of restitution is 0.6, the value of υ is

1) $30ms^{-1}$ 2) $40ms^{-1}$ 3) $50ms^{-1}$ 4) $60ms^{-1}$

Sol:



$V_1 = \frac{m_1 - em_2}{m_1+m_2}u_1 + \frac{(1+e)m_2}{m_1+m_2}u_2 = \frac{1-e}{2}v + \frac{1+e}{2}(-10)$

$O = \frac{1-0.6}{2}v + \frac{1.6}{2}(-10)$

$O = \frac{0.4}{2}v - 8$

$0.2v = 8$

v = 40

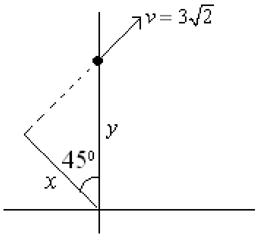
89. A particle of mass m = 5 units is moving with uniform speed $V = 3\sqrt{2}$ units in the XY plane along the line Y = X + 4. The magnitude of the angular momentum about origin is

1) zero 2) 60 units 3) 7.5 units 4) 40 units

Sol: $L = mvr\sin\theta$

$= 5\times3\sqrt{2}\times4\times\frac{1}{\sqrt{2}}$

= 60



90. **The kinetic energy of a circular disc rotating with a speed of 60 r.p.m. about an axis passing through a point on its circumference and perpendicular to its plane is (mass of circular disc = 5kg, radius of disc = 1 m) approximately.**

1) 170 J 2) 160 J 3) 150 J 4) 140 J

Sol: $\frac{1}{2}\left[\frac{3}{2}MR^2\right]\left(60\times\frac{2\pi}{60}\right)^2$

$\frac{3}{4}5(1)^2\times 4\pi^2$

$15\pi^2$

$\approx 150J$

91. **The amplitude of a simple pendulum is 10cm. When the pendulum is at a displacement of 4cm from the mean position, the ratio of kinetic and potential energies at the point is**

1) 5.25 2) 2.5 3) 4.5 4) 7.5

Sol: $\frac{KE}{PE}=\frac{A^2-x^2}{x^2}=\frac{100-16}{16}=\frac{84}{16}$

$= 5.25$

92. **A satellite revolving around a planet has orbital velocity 10 km/s. The additional velocity required for the satellite to escape from the gravitational field of the planet is**

1) 14.14 km/s 2) 11.2 km/s 3) 4.14 km/s 4) 41.4 km/s

Sol: $\Delta v = v_e - v_o$

$= \left(\sqrt{2}-1\right)v_o$

$= 0.414\ v_o$

$= 0.414\times 10$

$= 4.14$

93. **The length of a metal wire is** l_1 **when the tension in it is** F_1 **and** l_2 **when the tension is** F_2**. Then original length of the wire is**

1) $\frac{l_1F_1+l_2F_2}{F_1+F_2}$ 2) $\frac{l_2-l_2}{F_2-F_1}$ 3) $\frac{l_1F_2-l_2F_1}{F_2-F_1}$ 4) $\frac{l_1F_1-l_2F_2}{F_2-F_1}$

Sol: $l_o=\frac{l_1T_2-l_2T_2}{T_2-T_1}$

94. **The average depth of Indian ocean is about 30000m. The value of fractional compression** $\left(\frac{\Delta V}{V}\right)$ **of water at the bottom of the ocean is (given that the bulk modulus of water is** $2.2\times10^{9}\,Nm^{-2}$, $g=9.8ms^{-2}$, $p_{H_2O}=1000kg.m^{-3}$)

1) 3.4×10^{-2} 2) 1.34×10^{-2} 3) 4.13×10^{-2} 4) 13.4×10^{-2}

Sol: $\frac{\Delta V}{V}=\frac{p}{k}=\frac{hdg}{k}=\frac{3\times10^{3}\times10^{3}\times9.8}{2.2\times10^{9}}$

$\approx\frac{29.4}{2.2}\times10^{-3}$

$\approx\frac{2.9}{2.2}\times10^{-2}$

$\approx1.34\times10^{-2}$

95. **The ratio of energies of emitted radiation by a black body at 600 k and 900 k when the surrounding temperature is 300 k**

1) $\frac{5}{16}$ 2) $\frac{7}{16}$ 3) $\frac{3}{16}$ 4) $\frac{9}{16}$

Sol: $\frac{Q}{At}\alpha\left(T^{4}-T\right)$

$\frac{Q_1}{Q_2}=\frac{600^4-300^4}{900^4-300^4}=\frac{2^2-1}{3^4-1}=\frac{15}{18}=\frac{3}{16}$

96. **The specific heat of helium at constant volume is** $12.6\,Jmol^{-1}k^{-1}$. **The specific heat of helium at constant pressure in** $Jmol^{-1}k^{-1}$ **is about (Assume the temperature of the gas is moderate, universal gas constant,** $R=8.314\,Jmol^{-1}k^{-1}$)

1) 12.6 2) 16.8 3) 18.9 4) 21

Sol: $cp=C_v+R=12.6+8.3$

≈20.9

≈21

97. A gas does 4.5 J of external work during adiabatic expansion. If its temperature falls by 2K, then its internal energy will be

1) increased by 4.5 J
2) decreased by 4.5 J
3) decreased by 2.25 J
4) increased by 9.0 J

Sol: $dQ = dU + dW$

$O = dU + dW$

$dU = -dW = -4.5\text{ J}$

98. The relation between efficiency 'η' of a heat engine and the co-efficient of performance 'α' of a refrigerator is

1) $\eta = \frac{1}{1-\alpha}$
2) $\eta = \frac{1}{1+\alpha}$
3) $\eta = 1+\alpha$
4) $\eta = 1-\alpha$

Sol: $n = \frac{1}{1+\beta} = \frac{1}{1+\frac{T_2}{T_1-T_2}} = \frac{T_1-T_2}{T_1}$

$= 1-\frac{T_2}{T_1}$

99. A flask contains argon and chlorine in the ratio of 2 : 1 by mass. The temperature of the mixture is 27^0C. The ratio of a average kinetic energies of two gases per molecule is

1) 1 : 1
2) 2 : 1
3) 3 : 1
4) 6 : 1

Sol: K.E per molecule $\frac{3}{2}KT$ so 1 : 1

100. A transverse wave is represented by the equation y = 2sin (30t – 40x) and the measurements of distances are in meters, then the velocity of propagation is

1) $15\,ms^{-1}$
2) $0.75\,ms^{-1}$
3) $3.75\,ms^{-1}$
4) $30\,ms^{-1}$

Sol: $v = \frac{w}{k} = \frac{30}{40} = 0.75\,m/s$

101. Two closed pipes have the same fundamental frequency. One is filled with oxygen and the other with hydrogen at the same temperature. Ratio of their lengths respectively is

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

Sol: $\frac{v_0}{4l_0} = \frac{v_H}{4l_H} = \frac{l_0}{l_H} = \frac{v_0}{v_H} = \sqrt{\frac{m_H}{M_0}} = \sqrt{\frac{2}{32}} = \frac{1}{4}$

102. An image is formed at a distance of 100cm from the glass surface when light from point source in air falls on a spherical glass surface with refractive index 1.5. The distance of the light source from the glass surface is 100 cm. The radius of curvature is

1) 20 cm 2) 40 cm 3) 30 cm 4) 50 cm

Sol: $\frac{\mu_2}{v}-\frac{\mu_1}{u}=\frac{\mu_2-\mu_1}{R}$

$\frac{1.5}{100}+\frac{1}{100}=\frac{0.5}{R}$

$\frac{1}{100}\times 2.5=\frac{0.5}{R}\Rightarrow R=20cm$

103. Two coherent sources of intensity ratio 9 : 4 produce interference. The intensity ratio of maxima and minima of the interference pattern is

1) 13 : 5 2) 5 : 1 3) 25 : 1 4) 3 : 2

Sol: $\frac{I_{Max}}{I_{Min}}=\frac{\left(\sqrt{I_1}+\sqrt{I_2}\right)^2}{\left(\sqrt{I_1}-\sqrt{I_2}\right)^2}=\frac{\left(\sqrt{\frac{I_1}{I_2}}+1\right)^2}{\left(\sqrt{\frac{I_1}{I_2}}-1\right)^2}=\frac{\left(\frac{3}{2}+1\right)^2}{\left(\frac{3}{2}-1\right)^2}=\frac{\frac{25}{4}}{\frac{1}{4}}=25:1$

104. The energy of a parallel plate capacitor when connected to a battery is E. With the battery still in connection, if the plates of the capacitor are separated so that distance between them is twice the original distance, then the electrostatic energy becomes

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

Sol: $E=\frac{1}{2}CV^2=\frac{1}{2}\frac{\epsilon_0 A}{d}V^2$

$E^1=\frac{1}{2}\frac{\epsilon_0 A}{2d}V^2=\frac{E}{2}$

105. Two point charger $+8\mu c$ and $+12\mu c$ repel each other with a force of 48N. When an additional charge of $-10\mu c$ is given to each of these charges (the distance between the charges is unaltered) then the new force is

1) Repulsive force of 24N 2) Attractive force of 24N

3) Repulsive force of 2N 4) Attractive force of 2N

Sol: $F=\frac{k\times 8\times 12}{d^2}$ $F^1=\frac{k\times 2\times 2}{d^2}$

$\frac{F^1}{F}=\frac{4}{8\times 12}\Rightarrow F^1=\frac{F}{24}=\frac{48}{24}=2N$

Attractive force of 2N

106. **If the dielectric constant of substance is $K = \frac{4}{3}$, then the electric susceptibility ψ_e is**

1) $\frac{\epsilon_0}{3}$ 2) $3\epsilon_0$ 3) $\frac{4}{3}\epsilon_0$ 4) $\frac{3}{4}\epsilon_0$

Sol: $\chi = (k-1)\epsilon_0 = \frac{\epsilon_0}{3}$

107. **In a region of uniform electric field of intensity E, an electron of mass m_e is released from rest. The distance travelled by the electron in a time 't' is**

1) $\frac{2m_e t^2}{e}$ 2) $\frac{eEt^2}{2m_e}$ 3) $\frac{m_e g t^2}{eE}$ 4) $\frac{2Et^2}{em_e}$

Sol: $S = ut + \frac{1}{2}at^2$

$S = (0)t + \frac{1}{2}\frac{Ee}{m_e}t^2$

$S = \frac{1}{2}\frac{Ee}{m_e}t^2$

108. **A constant potential difference is applied between the ends of the wire. If the length of the wire is elongated 4 times, then the drift velocity of electrons will be**

1) increases 4 times 2) decreases 4 times 3) increases 2 times 4) decreases 2 times

Sol: $i = \text{nc AVd} \Rightarrow \frac{V}{R} = \text{neAVd}$

$\frac{V}{\rho \times l} \times A = neAV_d \Rightarrow V_d \alpha \frac{1}{l}$

So drift velocity decreases 4 times

109. **In a metre bridge, the gaps are enclosed by resistances of 2Ω and 3Ω. The value of shunt to be added to 3Ω resistor to shift the balancing point by 22.5 cm is**

1) 1Ω 2) 2Ω 3) 2.5Ω 4) 5Ω

Sol: $\frac{2}{3} = \frac{l}{100-l}$

$l = 400\text{cm}$

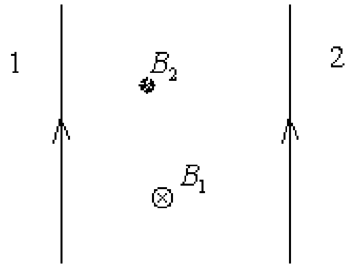
$\frac{2}{\frac{3x}{3+x}} = \frac{40+22.5}{100-62.5} \Rightarrow x = 2\Omega$

110. Two long straight parallel conductors 10cm apart, carry equal currents of magnitude 3A in the same direction. Then the magnetic induction at a point midway between them is

1) $2\times10^{-5}T$ 2) $3\times10^{-5}T$ 3) Zero 4) $4\times10^{-5}T$

Sol: $B = B_1 - B_2$

$B_1 = B_2 \Rightarrow B = 0$



111. Ina crossed field, the magnetic field induction is 2.0T and electric field intensity is $20\times10^3\,v/m$. At which velocity the electron will travel in a straight line without the effect of electric and magnetic fields?

1) $\frac{20}{1.6}\times10^3 ms^{-1}$ 2) $10\times10^3 ms^{-1}$ 3) $20\times10^3 ms^{-1}$ 4) $40\times10^3 ms^{-1}$

Sol: $V = \frac{E}{B} = \frac{20\times10^3}{2} = 10\times10^3 m/s$

112. A material of 0.25 cm^2 cross sectional area is placed in a magnetic field of strength (H) 1000 Am^{-1}. Then the magnetic flux produced is (Susceptibility of material is 313) (Permeability of free space, $\mu_0 = 4\pi\times10^{-7} Hm^{-1}$)

1) 8.33×10^{-8} weber 2) 1.84×10^{-6} weber 3) 9.87×10^{-6} weber 4) 3.16×10^{-6} weber

Sol: $\phi = \vec{B}.\vec{A} = BA = \mu HA = \mu_0(1+\chi)HA = 4\pi\times10^{-7}[314]\times10^3\times25\times10^{-6}$

$= 9\times10^{-6}$ weber

113. The magnitude of the induced emf in a coil of inductance 30 mH in which the current changes from 6A to 2A in 2 sec. is

1) 0.06V 2) 0.6V 3) 1.06V 4) 6V

Sol: $e = -L\frac{di}{dt} = -30\times10^{-3}\left(\frac{4}{2}\right) = 0.06A$

114. In an AC circuit V and I are given below, then find the power dissipated in the circuit

$V = 50\sin(50t)\,V,\ I = 50\sin\left(50t + \frac{\pi}{3}\right) mA$

1) 0.625 W 2) 1.25 W 3) 2.50 W 4) 5.0 W

Sol: $\text{power} = V_{rms} i_{rms} \cos\phi = \frac{50}{\sqrt{2}} \times \frac{50}{\sqrt{2}} \cos\frac{\pi}{3} = \frac{2500}{2} \times \frac{1}{2} = 625\times10^{-3}\,\text{watt}$

115. Light with an energy flux of 9W cm^{-2} falls on a non-reflecting surface at normal incidence. If the surface has an area of 20 cm^2. The total momentum delivered for complete absorption in one hour is

1) $2.16\times10^{-4}\,kgms^{-1}$ 2) $1.16\times10^{-3}\,kgms^{-1}$ 3) $2.16\times10^{-3}\,kgms^{-1}$ 4) $3.16\times10^{-4}\,kgms^{-1}$

Sol: $I = \frac{E}{At}$

$9 = \frac{E}{20\times3600} \Rightarrow E = 9\times20\times3600$

$p = \frac{E}{C} = 2.16\times10^{-3}\,kgm/s$

116. The ratio of the deBroglie wave lengths for the electron and proton moving with the same velocity is (m_p-mass of proton, m_e-mass of electron)

1) $m_p : m_e$ 2) $m_p^2 : m_e^2$ 3) $m_e : m_p$ 4) $m_e^2 : m_p^2$

Sol: $\frac{\lambda_e}{\lambda_p} = \frac{h/m_eV}{h/m_pV} = \frac{m_p}{m_e}$

117. The ratio of longest wavelength lines in the Balmer and Paschen series of hydrogen spectrum is

1) $\frac{5}{16}$ 2) $\frac{7}{20}$ 3) $\frac{7}{144}$ 4) $\frac{5}{27}$

Sol: $\lambda_{Balmer}\, \alpha \left[\frac{1}{2^2} - \frac{1}{3^2}\right]$

$\lambda_{Paschen}\, \alpha \left[\frac{1}{3^2} - \frac{1}{4^2}\right]$

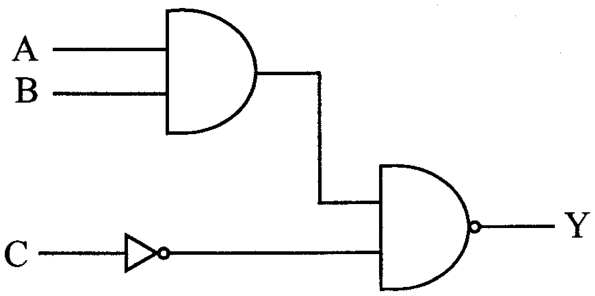
$\frac{\lambda_1}{\lambda_2} = \frac{7}{20}$

118. In the following nuclear reaction 'x' stands for $n \to p + e^- + x$

1) $\alpha-$particle 2) positron 3) neutrino 4) Antinutrino

Sol: $n \to p + e^- + \bar{\nu}$

119. In the following circuit the output Y becomes zero for the input combinations



1) A = 1, B = 0, C = 0 2) A = 0, B = 1, C = 1

3) A = 0, B = 0, C = 0 4) A = 1, B = 1, C = 0

Sol: $\overline{(AB).\overline{C}} = Y$

$\overline{(1.1)\overline{0}} = \overline{(1.1).1} = 0$

120. The maximum amplitude of an amplitude modulated wave is 16V, while the minimum amplitude is 4V. The modulation index is

1) 0.4 2) 0.5 3) 0.6 4) 4

Sol: $E_c + E_m = 16$

$E_c - E_m = 4$

$2E_c = 20$

$E_c = 10$

$E_m = 6$

$\mu = \frac{E_m}{E_C} = \frac{6}{10} = 0.6$

CHEMISTRY

121. Which of the following sets of quantum numbers is correct for an electron in 3d orbital.

1) $n=3, l=2, m=-3, s=+\frac{1}{2}$
2) $n=3, l=2, m=+3, s=-\frac{1}{2}$
3) $n=3, l=2, m=-2, s=+\frac{1}{2}$
4) $n=3, l=2, m=-3, s=-\frac{1}{2}$

Sol: 3d orbital = n = 3, l = 2, m = –2, s = +1/2

122. If the kinetic energy of a particle is reduced to half, Debroglie wave length becomes

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

Sol: $\lambda_1 = \frac{h}{\sqrt{2m(KE)}} : \lambda_2 = \frac{h}{\sqrt{2m\left(\frac{KE}{2}\right)}}$

$\frac{\lambda_1}{\lambda_2} = \frac{1}{\sqrt{2}}$

123. Identify the most acidic oxide among the following oxides based on their reaction with water

1) SO_3
2) P_4O_{10}
3) Cl_2O_7
4) N_2O_5

Sol: Acidic nature is directly proportional to the electronegativity of the central non metallic atom.

124. Match the following

List-I	**List-II**
A) Rubidium	**I) Germanium**
B) Platinum	**II) Radioactive chalcogen**
C) Ekasilicon	**III) S- block element**
D) Polonium	**IV) Atomic number 78**

	A	B	C	D
1)	IV	III	II	I
2)	III	IV	I	II
3)	II	I	IV	III
4)	IV	III	I	II

Sol : Conceptual

125. Which of the following does not have triple bond between the atoms?

1) N_2
2) CO
3) NO
4) C_2^{2-}

Sol: N_2, CO and C_2^{2-} are isoelectronic with bond order 3. They have triple bond.

126. In which one of the following pairs two species have identical shape but differ in hybridization

1) $I_3^-, BeCl_2$ 2) NH_3, BF_3 3) XeF_2, I_3^- 4) NH_4^+, SF_4

Sol: $I_3^- = \text{linear}(sp^3d)$; $BeCl_2 = \text{linear}(sp)$

127. On the top of a mountain water boils at

1) High temperature 2) Same temperature 3) High Pressure 4) Low temperature

Sol: on the top of mountain water boils at low temperature due to lesser pressure.

128. Which one of the following is the wrong statement about the liquid?

1) It has intermolecular force of attraction

2) Evaporation of liquids increases with the decrease of surface area

3) It resembles a gas near the critical temperature

4) It is in an intermediate state between gaseous and solid state

Sol: Conceptual

129. A carbon compound contains 12.8% of carbon, 2.1% of hydrogen and 85.1% of bromine. The molecular weight of the compound is 187.9. Calculate the molecular formula of the compound. (Atomic wts = 1.008, C = 12.0, Br = 79.9)

1) CH_3Br 2) CH_2Br_2 3) $C_2H_4Br_2$ 4) $C_2H_3Br_3$

Sol:

Element	%	Relative no. of atoms	Simple ratio
C	12.8	$\frac{12.8}{12} \approx 1$	1
H	2.1	$\frac{2.1}{1} \approx 2$	2
Br	85.1	$\frac{85.1}{80} \approx 1$	1

Empirical formula = CH_2Br

Empirical weight = 94

Molecular weight = 188 $\therefore n = \frac{188}{94} = 2$

$\therefore$ molecular formula $= (CH_2Br) \times n$

$= (CH_2Br) \times 2$

$= C_2H_4Br_2$

130. 3.011×10^{22} **atoms of an element weights 1.15 gm. The atomic mass of the element is**

1) 23 2) 10 3) 16 4) 35.5

Sol: 3.011×10^{22} atoms = 1.15 gm

6.023×10^{23} atoms (1 mole) = ?

$\therefore$ atomic mass = $\frac{6.023\times10^{23}\times1.15}{3.011\times10^{22}}=23$

131. Which one of the following is applicable for an adiabatic expansion of an ideal gas

1) $\Delta E=0$ 2) $\Delta W=\Delta E$ 3) $\Delta W=-\Delta E$ 4) $\Delta W=0$

Sol: $\Delta q=\Delta E+W$

For adiabatic process, $\Delta q=0$

$\therefore\Delta W=-\Delta E$

132. On increasing temperature, the equilibrium constant of exothermic and endothermic reactions, respectively

1) Increases and decreases 2) Decreases and increases

3) Increases and increases 4) Decreases and decreae

Sol: Conceptual

133. What is the pH of the NaOH solution when 0.04 gm of it dissolved in water and made to 100 ml solution?

1) 2 2) 1 3) 13 4) 12

Sol: $[OH^-]=\frac{0.04}{40}\times\frac{1000}{100}=10^{-2}$

$P^{OH}=2;\ \ P^{H}=12$

134. Which of the following methods is used for the removal of temporary hardness of water?

1) Treatment with washing soda 2) Calgon method

3) Ion-exchange method 4) Clark's method

Sol: Conceptual

135. Assertion (A): Alkali metals are soft and have low melting and boiling point.

Reason (R): This is because inter atomic bonds are weak.

1) Bothe (A) and (R) are not true 2) (A) is true but (R) is not correct explanation of (A)

3) (A) is not true but (R) is true 4) Both (A) and (R) are true and (R) is correct explanation of (A)

Sol: Conceptual

136. Identify the correct statement

1) Lead forms compounds in +2 oxidation state due to inert pair effect.

2) All halogens form only negative oxidation.

3) Catenation property increases from boron to oxygen.

4) Oxygen oxidation state is -1 in ozonides.

Sol: Conceptual

137. Assertion (A): Noble gases have very low boiling points.

Reason(R): All Noble gases have general electronic configuration of ns^2np^6 (except He)

1) Both (A) and (R) are true and (R) is correct explanation of (A)

2) (A) is false but (R) is true   3) (A) is true but (R) is false

4) Both (A) and (R) are true but (R) is not the correct explanation of (A)

Sol: Conceptual

138. Which of the following statements are correct?

(A) Ocean is sink for CO_2.

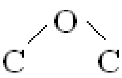
(B) Green house effect causes lowering of temperature of earth's surface.

(C) To control CO emission by automobiles usually catalytic convertor are fitted into exhaust pipes.

(D) H_2SO_4, herbicides and insecticides from mist.

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

Sol: Conceptual

139. The bond angle of  **bond in methoxy methane is**

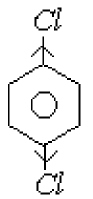
1) 111.7^0 2) 109^0 3) 108.9^0 4) 180^0

Sol: Conceptual

140. Which of the following compounds has zero Dipolemoment?

1) 1,4 – Dichlorobenzene   2) 1,2 –Dichlorobenzene

3) 1,3-Dichlorobenzene   4) 1-chloro-2-methyl benzene

Sol: 

$\mu = 0$

141. Which of the following reagent is used to find out carbon-carbon multiple bonds?

1) Grignard reagent
2) Bayer's reagent
3) Sandmayer's reagent
4) Gatterman reagent

Sol: Bayer's reagent is used to test for unsaturation

142. Pure silicon doped with phosphorus is

1) Amorphous
2) p-type semiconductor
3) n-type semiconductor
4) Insulator

Sol: n – type semi conductor

143. 18 gm if glucose is dissolved in 90 gm of water. The relative lowering of vapour pressure of the solution is equal to

1) 6
2) 0.2
3) 5.1
4) 0.02

Sol: $\frac{P^0 - P_S}{P^0} = \frac{w}{m} \times \frac{M}{W} = \frac{18}{180} \times \frac{18}{90} = 0.02$

144. A gas 'X' is dissolved in water at '2' bar pressure. Its mole fraction is 0.02 in solution. The mole fraction of water when the pressure of gas is doubled at the same temperature is

1) 0.04
2) 0.98
3) 0.96
4) 0.02

Sol: $P = P_A^O \times A$

$2 = P_A^O(0.02)$

$4 = P_A^O(X_A)$

$\therefore X_A = 0.04$

$X_{solvent} = 1 - 0.04 = 0.96$

145. Calculate ΔG^O for the following cell reaction

$zn_{(s)} + Ag_2O_{(s)} + H_2O_{(l)} \rightarrow Zn^{2+}_{(aq)} + 2Ag_{(s)} + 2\overline{OH}_{(aq)}$

$E^o_{Ag^+/Ag} = +0.80V$ **and** $E^o_{zn^{2+}/zn} = -0.76V$

1) -3.5 kJ/mol
2) -301 kJ/mol
3) 305 kJ/mol
4) 301 kJ/mol

Sol: $\Delta G = -nFE^0$

$= -(2)(96500)(1.56)$

$= -301KJ$

146. **The time required for a first order reaction to complete 90% is't'. What is the time required to complete 99% of the same reaction**

1) 2t 2) 3t 3) t 4) 4t

Sol: $t = \frac{2.303}{k} \log \frac{100}{100-90}$ ____________ (1)

$x = \frac{2.303}{k} \log \frac{100}{100-99}$ ____________ (2)

On simplifiying x = 2t

147. **Which of the following is the most effective in causing coagulation of ferric hydroxide sol?**

1) KCl 2) KNO_3 3) K_2SO_4 4) $K_3[Fe(CN)_6]$

Sol: $Fe(OH)_3$ is positive sol. $\therefore$ negative ion with high charge is effective coagulationg agent.

148. **Which of the following process does not involve heating?**

1) Calcination 2) Smelting 3) Roasting 4) Levigation

Sol: Levigation

149. **Which one of the following is correct with respect to basic character?**

1) $P(CH_3)_3 > PH_3$ 2) $PH_3 > P(CH_3)_3$ 3) $PH_3 > NH_3$ 4) $PH_3 = NH_3$

Sol: $P(CH_3)_3$ is more basic than PH_3 due to +I effect of $-CH_3$ groups

150. **When $AgNO_3$ solution is added in excess to 1M solution of $CoCl_3 \times NH_3$ one mole of AgCI is formed? What is the value of 'X'?**

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

Sol: $[Co(NH_3)_4Cl_2]Cl$

151. **In which of the following coordination compounds, the central metal ion is in zero oxidation state?**

1) $[Fe(H_2O)_6]CI_3$ 2) $K_4[Fe(CN)_6]$ 3) $Fe(CO)_5$ 4) $[Fe(H_2O)_6]CI_2$

Sol: In metal carbonyls metal exhibit zero oxidation state.

152. **The percentage of lanthanides and iron, respectively, in Misch metal are**

1) 50, 50 2) 75, 25 3) 90, 10 4) 95, 5

Sol: 95, 5

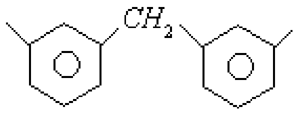
153. **Sea divers use a mixture of**

1) O_2, N_2 2) O_2,H_2 3) O_2, H_e 4) N_2, H_2

Sol: O_2, He because of low solubility of He

154. The polymer obtained with methylene bridges by condensation polymer

1) PVC 2) Buna-S 3) Poly acrylo nitrile 4) Bakelite

Sol: Bakelite 

155. The amino acid containing Indole part is

1) Tryptophan 2) Tyrosine 3) Proline 4) Methionine

Sol: Tryptophan secondary amine group

156. The drug used as post operative analgesic in medicine is

1) L-Dopa 2) Amoxycilin 3) Sulphapyridine 4) Morphine

Sol: Morphine

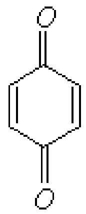
157. $C_2H_5OH + 4I_2 + 3Na_2CO_3 \rightarrow X + HCOONa + 5NaI + 3CO_2 + 2H_2O$. **In the above reaction 'X' is**

1) Di iodo methane 2) Tri iodo methane 3) Iodo methane 4) Tetra iodo methane

Sol: CHI_3

158. Phenol on oxidation in air gives

1) Quinone 2) Catechol 3) Resorsinol 4) O-Cresol

Sol: Quinone 

159. Identify the reagents A and B respectively in the following reactions.

$CH_3COOH \xrightarrow{A} CH_3COCl \xrightarrow{B} CH_3CHO$

1) $SOCl_2$, H_2/pd-$BaSO_4$ 2) H_2/pd-$BaSO_4$, $SOCl_2$

3) $SOCl_2$, H_2O_2 4) $SOCl_2$, OsO_4

Sol: $CH_3COOH + SOCl_2 \rightarrow CH_3COCl \xrightarrow{H_2/Pd-BaSO_4} CH_3CHO$

160. Predict respectively 'X' and 'Y' in the following reactions

$Ar-NH_2 \xrightarrow{X} Ar-\overset{+}{N} \equiv N-\overline{C}l \xrightarrow{Y} Ar-Cl$

1) $NaNO_3$, & Cl_2 2) $NaNO_3$-HCl & HCl

3) $NaNO_2$ – HCl & Cu/HCl 4) $NaNO_2$ – HCl & $NaNH_2$

Sol: $C_6H_5-NH_2 \xrightarrow[HCl]{NaNO_2} C_6H_5N_2^+Cl^- \xrightarrow{Cu/HCl} C_6H_5Cl$

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