MATHEMATICS

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

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

KEY: 2

HINT:

$f(x)=5x-3$

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

$g(x)=x^2+3$

$gof^{-1}(3)=g\left(f^{-1}(3)\right)=g\left(\frac{6}{5}\right)=\frac{111}{25}$

2. **If** $A=\left\{x\in R/\frac{\pi}{4}\le x\le\frac{\pi}{3}\right\}$ **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)** $\left[\frac{\pi}{4},\frac{\pi}{3}\right]$

KEY: 1

HINT:

$f(x)=\sin x-x$

Which is decreasing function in $\left[\frac{\pi}{4},\frac{\pi}{3}\right]$

$\therefore\frac{\pi}{4}\le x\le\frac{\pi}{3}$

$\Rightarrow f\left(\frac{\pi}{4}\right)\ge f(x)\ge f\left(\frac{\pi}{3}\right)$

$\Rightarrow\frac{1}{\sqrt{2}}-\frac{\pi}{4}\ge f(x)\ge\frac{\sqrt{3}}{2}-\frac{\pi}{3}$

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

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

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

KEY: 4

HINT: 1.2.3+2.3.4+......+upto n terms

$$t_n = n(n+1)(n+2)$$

$$S_n = \sum t_n = \frac{1}{4}n(n+1)(n+2)(n+3)$$

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)** $ab+bc+ca$

KEY: 3

HINT: $\begin{vmatrix} b^2-ab & b-c & bc-ac \\ ab-a^2 & a-b & b^2-ac \\ bc-ac & c-a & ab-a^2 \end{vmatrix} = 0$

Put a=b=c=1

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

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

KEY: 3

HINT: $\left|adj\left(adj\ A^2\right)\right|$

$$Q = \left|A^2\right|^{(3-1)^2} = \left|A^2\right|^4 = |A|^8$$

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**

KEY: 4

HINT: $Rank\ of\ [A] \neq Rank\ of\ [AB]$

$\therefore$ 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

KEY: 4

HINT: $-i\sum_{k=1}^{6}\left(\cos\frac{2k\pi}{7}+i\sin\frac{2k\pi}{7}\right)$

$-i\left[1+\alpha+\alpha^2+....+\alpha^6-1\right]=-i\left[0-1\right]=i$

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**

KEY: 2

HINT: $\frac{1}{3}+\frac{2}{9}+\frac{4}{27}+......+\infty$ (infinte G.P.)

$S_\infty=\frac{a}{1-r}=1$

$\frac{1}{2}+\frac{3}{8}+\frac{9}{32}+.......+\infty$ (infinte G.P.)

$S_\infty=\frac{a}{1-r}=2$

$\therefore\ \omega^1+\omega^2=-1$

9. The common roots of the equations $z^3+2z^2+2z+1=0, z^{2014}+z^{2015}+1=0$ are

(1) ω,ω^2 **(2)** $1,\omega,\omega^2$ **(3)** $-1,\omega,\omega^2$ **(4)** $-\omega,-\omega^2$

KEY: 1

HINT: Clearly ω,ω^2 are the roots of given equations.

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

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

KEY: 2

HINT: $\left(\frac{1+\cos\left(\frac{\pi}{8}\right)-i\sin\left(\frac{\pi}{8}\right)}{1+\cos\left(\frac{\pi}{8}\right)+i\sin\left(\frac{\pi}{8}\right)}\right)^8=-1$

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**

KEY: 1

HINT: Clearly $x=1$ is a solution

$\therefore$ Product of the roots $=\frac{a-b}{b-c}$

$\therefore (1)(1)=\frac{a-b}{b-c}$

$\Rightarrow b-c=a-b$

$\Rightarrow 2\,b=a+c \Rightarrow a,b,c$ are in A.P.

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**

KEY: 2

HINT: Let $\frac{a}{r},a,ar$ be the roots

$\Rightarrow \frac{a}{r}.a.ar=8$ $\Rightarrow a^3=8$ $\Rightarrow a=2$

$a=2$ is a root of given equation

$\Rightarrow 8-4k+28-8=0$ $\Rightarrow k=7$

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) $4+\sqrt{5}$**

KEY: 3

HINT: Let α,β be the roots

$\Rightarrow \frac{2\alpha\beta}{\alpha+\beta}=4$ $\Rightarrow \frac{\frac{2\left(8-2\sqrt{5}\right)}{\sqrt{2}}}{\frac{b}{\sqrt{2}}}=4$

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

$\therefore b=4-\sqrt{5}$

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

(1) $(-\infty,0)\cup(1,\infty)$ **(2)** $\left[\frac{1}{2},2\right]$

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

KEY: 1

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

$\Rightarrow yx^2+2xy-y=x^2+2x+1$

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

$B^2-4AC\geq 0$ & $y\neq 1,\ y\neq 0$

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**

KEY: 2

HINT: No. of four digit numbers divisible by 5 = 6+4=10

_ _ _ 0 $\Rightarrow$ 3! = 6

_ _ _ 0 $\Rightarrow$ 3!-2! = 4

Total No. of four digit numbers = 4!-3! =18

$\therefore$ Required = 18-10=8

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**

KEY: 2

HINT: $T_{m+1}-T_m=15$

$\Rightarrow {}^{(m+1)}C_3-{}^{m}C_3=15$

By verification m=6 by solve.

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)** $-\frac{31}{32}$

KEY: 2

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

$$A=\frac{3(2)}{2+1}=2 \;;\; B=\frac{3(-1)}{-1-2}=\frac{-3}{-3}=1$$

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

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

$$=-\left(1+\frac{x}{2}+\left(\frac{x}{2}\right)^2+.....+\left(\frac{x}{2}\right)^5+....\right)+\left(1-x+x^2-x^3+x^4-x^5+....\right)$$

Coefficient of $x^5=\frac{-1}{32}-1=\frac{-33}{32}$

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**

KEY: 3

HINT: ${}^nC_9, {}^nC_{10}, {}^nC_{11}$ are in A.P.

$$\Rightarrow 2\,{}^nC_{10}={}^nC_9+{}^nC_{11} \quad \Rightarrow 2=\frac{{}^nC_9}{{}^nC_{10}}+\frac{{}^nC_{11}}{{}^nC_{10}}$$

$$\Rightarrow 2=\frac{10}{n-9}+\frac{n-10}{11} \quad \Rightarrow 2=\frac{110+n^2-19n+90}{11n-99}$$

$$\Rightarrow n^2-41n=-398$$

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

(1) 1 **(2) 2** **(3) 3** **(4) 4**

KEY: 2

HINT: $1+x=1+\frac{1}{5}+\frac{1.3}{2!}\left(\frac{1}{5}\right)^2+\frac{1.3.5}{3!}\left(\frac{1}{5}\right)^3$

$(1+x)^{-p/q}=1+\frac{p(p+q)}{2!}\left(\frac{x}{q}\right)^2+.......$

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

$\Rightarrow p=1, p+q=2, \Rightarrow q=2$

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

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

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

$3x^2+6x=2$

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

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

KEY: 2

HINT: $(\sin\theta+\cos\theta)^2=p^2$

$\Rightarrow 1+\sin 2\theta=p^2$ $\quad\left[\because \sin 2\theta=p^2-1\right]$

$Tan\theta+\frac{1}{Tan\theta}=q$

$\Rightarrow \frac{Tan^2\theta+1}{2Tan\theta}=\frac{q}{2}$

$\cos ec2\theta=\frac{q}{2}$

$\Rightarrow \frac{1}{p^2-1}=\frac{q}{2} \Rightarrow 2=\left(p^2-1\right)q$

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)** $\cot\frac{4\pi}{5}$

KEY: 1

HINT: cotA - tanA = 2 cot2A

22. **If** $\sin A+\sin B+\sin C=0$ **and** $\cos A+\cos B+\cos C=0$, **then** $\cos(A+B)+\cos(B+C)+\cos(C+A)=$

(1) $\cos(A+B+C)$ **(2) 2** **(3) 1** **(4) 0**

KEY: 4

HINT: x = cisA, b = cis B, z = cis C

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)** $\frac{n\pi}{3}+\frac{\pi}{6},n\in Z$

KEY: 1

HINT: $\tan\theta\tan(120+\theta)\tan(120-\theta)=\tan 3\theta$

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**

KEY: 2

HINT: $x-\frac{x^2}{2}+\frac{x^3}{4}+......\infty=x^2-\frac{x^4}{2}+\frac{x^6}{4}-......\infty$

$x=x^2\Rightarrow x=1$

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

KEY: 1

HINT: $\sinh^{-1}x=\log(x+\sqrt{1+x^2})$

26. **In a** $\Delta ABC,(a+b+c)(b+c-a)=\lambda bc$, **then**

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

KEY: 3

HINT: $0<\frac{\lambda}{4}<1$

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

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

KEY: 2

HINT: $\frac{\Delta}{S-a} = \frac{2\Delta}{S-b} = \frac{3\Delta}{S-c} = \frac{1}{K}$

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

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

KEY: 4

HINT: a = b = c = 1,

$\angle A = \angle B = \angle C = 60^{\circ}$

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)** $m_3 < m_4 < m_2 < m_1$

KEY: 1

HINT: Find magnitudes

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)** $-\frac{1}{2}$

KEY: 2

HINT: S.O.B.S

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)** $-\bar{i} - 8\bar{j} + 2\bar{k}$

KEY: 4

HINT: $\bar{r} \times \bar{b} = \bar{c} \times \bar{b}$

$\bar{r} \times \bar{b} - \bar{c} \times \bar{b} = \bar{0}$

$(\bar{r} - \bar{c}) \times \bar{b} = \bar{0}$

$(\bar{r} - \bar{c}) // \bar{b}$

$\bar{r} - \bar{c} = t\bar{b}$

$\bar{r} = \bar{c} + t\bar{b}$

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

$\frac{-(\bar{c}.\bar{a})}{\bar{b}.\bar{a}} = t$

$\vec{r} = \vec{c} - \left(\frac{\vec{c}.\vec{a}}{\vec{b}.\vec{a}}\right)$

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

KEY: 4

HINT: $\left\|\left[\bar{a}\ \bar{b}\ \bar{c}\right]\right\|^2 = \begin{vmatrix} \bar{a}.\bar{a} & \bar{a}.\bar{b} & \bar{a}.\bar{c} \\ \bar{b}.\bar{a} & \bar{b}.\bar{b} & \bar{b}.\bar{c} \\ \bar{c}.\bar{a} & \bar{c}.\bar{b} & \bar{c}.\bar{c} \end{vmatrix}$

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 $\lambda =$

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

KEY: 2

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

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 $\bar{c} = 3\bar{i} + 2\bar{j} - 5\bar{k}$ is

(1) 2x – 17y – 8z + 63 = 0 (2) 3x + 17y + 8z - 36 = 0

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

KEY: 3

HINT: $\begin{vmatrix} x-x_1 & y-y_1 & z-z_1 \\ a_1 & b_1 & c_1 \\ a_2 & b_2 & c_2 \end{vmatrix} = 0$

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

KEY: 4

HINT: $\frac{10+8+5+a+b}{5} = 6,$

$\frac{1}{n}\sum(x_i - \bar{x})^2 = 6.8$

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)** $33\frac{1}{3}$

KEY: 2

HINT: $M = \frac{x-2+x}{2} = 16$

Variance = $\frac{1}{n}\sum\left(x_i - \bar{x}\right)^2$

37. Two persons A and B are throwing an unbiased six faced die alternatively, with the condition that the person who throws 3 first 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)** $\frac{3}{11},\frac{8}{11}$

KEY: 1

HINT: $\therefore A = p + pq^2 + pq^4 + ...$

= $p(1 + q^2 + q^4 + ...)$

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

38. The letters of the work "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)** $\frac{5}{28}$

KEY: 4

HINT: $n(E) = {}^6P_2 \times 2! \times 5!$

$n(S) = 8!$

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

KEY: 1

HINT: $0 \le \frac{1+3P}{3} \le 1,\ 0 \le \frac{1-2P}{2} \le 1$

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 trails is

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

KEY: 1

HINT: p = 0.2, q = 0.8, n = 3

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)** $\frac{7}{10}$

KEY: 3

$\sum P(X=x_i)=1$

HINT:

$$9K+10K^2=1$$
$$10K^2+9K-1=0$$
$$10K^2+10K-K-1=0$$
$$10K(K+1)-1(K+1)=0$$
$$K=\frac{1}{10}$$
$$P(0<X<5)=P(X=1)+P(X=2)+P(X=3)+P(X=4)=8K=\frac{8}{10}$$

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**

KEY: 2

HINT: $A(-2,3);B(6,-5)$

$$P(x,y)$$
$$PA^2=PB^2$$
$$(x+2)^2+(y-3)^2=(x-6)^2+(y+5)^2$$
$$4x+4+9-6y=-12x+36+10y+25$$
$$16x-16y-48=0$$
$$x-y-3=0$$
$$ax+by+c=0$$
$$a=1;b=-1;c=-3$$

Ascending order : c, b, a

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

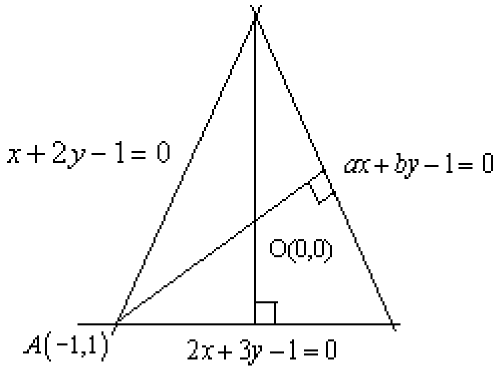
1) (5, 4) **2) (2, 3)** **3) (5, 2)** **4) (4, 5)**

KEY: 3
HINT: Reflection of (2,3) in y=x is (3,2)
Required point (3+2,2) = (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)**

KEY: 3
HINT:



$$\begin{bmatrix} 3 & -1 & 2 & 3 \\ 2 & -1 & 1 & 2 \end{bmatrix}$$

$$\frac{x}{-1}=\frac{y}{1}=\frac{1}{1}$$

Verification

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)**

KEY: 2
Verification (or) Solving
HINT:

$2x-y+6=0$ & $4x-y-2=0$

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**

KEY: 3

HINT: $\begin{vmatrix} 1 & 2a & a \\ 1 & 3b & b \\ 1 & 4c & c \end{vmatrix}=0$ H.P

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

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

KEY: 3

$\cos\theta = \cos 2\alpha$

HINT:

$\Rightarrow \theta = 2\alpha$

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**

KEY: 1

$m + m^2 = 6$

HINT:

$m^3 = a$

$m^3 + m^6 + 3.m^3.6 = 6^3$

$a^2 + 19a - 216 = 0$

$a = -27, 8$

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**

KEY: 4

$Cp + r$

HINT:

$Cp - r$

$2Cp = 2(10) = 20$

50. The locus of centres of the circles which cut the circles $x^2 + y^2 + 4x - 6y + 9 = 0$ and $x^2 + y^2 - 5x + 4y + 2 = 0$ orthogonally is

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

KEY: 2

$S - S^1 = 0$

HINT:

$9x - 10y + 7 = 0$

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)** $x^2 + y^2 = 16$

KEY: 2

$(x-2)(x-0) + (y-0)(y-4) = 0$

HINT:

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

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)

KEY: 1

$S+\lambda L=0$

HINT:

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

$$centre=\left(\frac{4-\lambda}{2},\frac{2-\lambda}{2}\right)$$

$$r=0$$

$$\Rightarrow \lambda=0,14$$

$$centre=(-5,-6)$$

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

KEY: 1

$S+\lambda L=0$

HINT:

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

$$center=\left(\frac{-\lambda}{2},\frac{\lambda-1}{2}\right)$$

$$Centre\ lies\ on\ x-y+1=0$$

$$\Rightarrow \lambda=3/2$$

$$Eq: x^2+y^2+y-1+\frac{3}{2}(x-y+1)=0$$

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

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) $4\sqrt{3}$

KEY: 2

$\left(\frac{\sqrt{3}x}{2}, \frac{x}{2}\right)$ lies on $y^2 = 8x$

HINT:

$\Rightarrow side\ x = 16\sqrt{3}$

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)** $\frac{3}{\sqrt{13}}$

KEY: 1

$4a = 2(\text{distance from focus to directrix})$

HINT:

$= 2\frac{|6-12+5|}{\sqrt{4+9}} = \frac{2}{\sqrt{13}}$

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

KEY: 2

$ae = \sqrt{7}$

HINT:

$r = \sqrt{ae^2 + b^2}$

$= \sqrt{7+9} = 4$

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)** $\pm\sqrt{72}$

KEY: 3

$C = \pm\sqrt{a^2m^2 + b^2}$

HINT:

$= \pm\sqrt{4(16)+1} = \pm\sqrt{65}$

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

KEY: 2

For ellipse focus $= \left(\sqrt{16-b^2}, 0\right)$

HINT:

For hyperbola focus is $\left(\frac{\cancel{12}}{\cancel{5}} \times \frac{\overset{3}{\cancel{15}}}{\cancel{12}}, 0\right) = (3,0)$

$\therefore \sqrt{16-b^2} = 3$

$b^2 = 7$

59. **If (2,-1,2) and (K,3,5) are the triads of direction ratios of two lines and the angle between them is 45^0, then a value of K is**

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

KEY: 3

HINT: $\frac{1}{\sqrt{2}}=\frac{2K-3+10}{3\times\sqrt{K^2+34}}$

Verfication $K=4$

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**

KEY: 1

HINT: Equation of plane $\frac{x}{a}+\frac{y}{b}+\frac{z}{c}=1$

$3x+4y+5z-1=0$

distance from origin $\frac{1}{\sqrt{50}}=\frac{1}{5\sqrt{2}}$

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 thetriangle formed by (1,2,3), (2,3,1),(3,1,2) is	**b) (3,1,4)**
III. The orthocenter 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**
1)	**d**	**a**	**b**	**c**
2)	**a**	**b**	**c**	**d**
3)	**d**	**e**	**b**	**c**
4)	**d**	**a**	**e**	**c**

KEY: 1

HINT: I $A(2,3,-1),B(-5,6,3),C=(2,-3,1)$

$$G=\left(\frac{x_1+x_2+x_3}{3},\frac{y_1+y_2+y_3}{3},\frac{z_1+z_2+z_3}{3}\right)=(3,2,1)$$

II. ABC is a equilateral

$G=s=(2,2,2)$

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**

KEY: 3

HINT: $S(x)=\frac{x}{2}\ \underset{x\to 2}{Lt}\frac{s(x)-g(2)}{x-2}$

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

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

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

KEY: 3

HINT: L.H.R

Ans : -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, is**

1) Continuous and differentiable **2) Continuous but not differentiable**
3) Discontinuous but differentiable **4) Neither continuous nor differentiable**

KEY: 2

HINT: F is centime but not differentable

$\underset{x\to 1^-}{Lt} f(x)=\underset{x\to 1^+}{Lt} f(x)=f(1)$

$\underset{x\to 1^-}{Lt}\frac{f(x)-f(1)}{x-1}\ne\underset{x\to 1^+}{Lt}\frac{f(x)-f(1)}{x-1}$

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)** $\frac{y^2}{x^2}$

KEY: 2

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

$\left(x^2+y^2\right)^2=\left(t+\frac{1}{t}\right)^2$

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

$2x^2y^2=2$

$x^2y^2=1$

66. Let D be the domain of a twice differentiable function f. For all $x\in D,\ f''(x)+f(x)=0$ **and** $f(x)=\int g(x)dx+$ **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**

KEY: 3

HINT: $f(x)$ is constant function

$h(2015)-h(2014)=5-5=0$

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

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

KEY: 4

HINT: $\frac{dy}{dx}=\frac{1}{t}$

$\frac{d^2y}{dx^2}=\frac{1}{t^2}\frac{dy}{dx}=\frac{1}{t^2 2at}=\frac{1}{2at3}$

Put $t=\frac{1}{2}$

$\frac{d^2y}{dx^2}=\frac{-4}{a}$

68. The volume of a sphere is increasing at the rate of 1200 c.cm/sec. The rawte 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

KEY: 2

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

$\frac{dy}{dt}=\frac{4}{3}\pi 3r^2\frac{dy}{dx}$

$\frac{dv}{dt}=4\pi x^2\frac{dx}{dt}$

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

KEY: 3

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

$m=\left(\frac{dy}{dx}\right)x=1=\frac{1}{1+1}=\frac{1}{2}$

70 If $x^2+y^2=25$**, then** $\log_5\left[Max\left(3x+4y\right)\right]$ **is**

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

KEY: 4

HINT: $\log_5 5^2$

$=2\log_5 5=2(1)=2$

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)** $(6,11)$

KEY: 3

HINT: $f^1(x) = 3x^2 + 2bx + a$

$f^1(c) = 0$

$3c^2 + 2bc + a = 0$

$\Rightarrow a = 11, b = -6$

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

(c is a constant)

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)** $\sqrt{\frac{x^2+1}{x-1}} + C$

KEY: 3

HINT: $\int \frac{dx}{(x-1)\sqrt{x^2-1}}$

Put $x - 1 = \frac{1}{t}$

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)** $e^x \frac{(x+1)}{x-1} + C$

KEY: 3

HINT: $\int e^x \left(\frac{(x^2-1)}{(x+1)^2} + \frac{1}{(x+1)^2} \right) dx$

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

74. $\int \frac{x+1}{x(1+xe^x)} dx = 0$

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)** $Log(1+xe^x) + C$

KEY: 2

HINT: $\int \frac{e^x(x+1)}{xe^x(1+xe^x)}dx$

Put $xe^x = t$

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

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

KEY: 2

HINT: Put $\log(g(x_1))-\log(f(x_1))=t$

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

1) $\frac{1}{2}Log3$ **2)** $Log2$ **3)** $Log3$ **4)** $\frac{1}{4}Log3$

KEY: 4

HINT: Put $\sin x-\cos x=t$

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**

KEY: 3

HINT: Odd function

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

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

KEY: 3

HINT: Solve $x^2 + y^2 = 1$

$y^2 = 1 - x$

Area $= \frac{\pi}{2} + \frac{4}{3}$

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

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

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

KEY: 1

HINT: Dividing with e^y

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

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 equation**

KEY: 2

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

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

Linear 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**

KEY: 3

HINT: $P = \frac{F}{A} = \frac{F}{\pi R^2}$

$$\frac{\Delta P}{P}\times 100=\frac{\Delta F}{F}\times 100+2\frac{\Delta R}{R}\times 100$$

$$=5+2(3)=5+6=11$$

$$\frac{\Delta P}{P}\times 100=11\%$$

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) $\frac{R}{2}$ **2)** $\frac{R}{3}$ **3)** $\frac{R}{4}$ **4)** $\frac{R}{5}$

KEY: 2

HINT: $V=KV_e (K<1)$ then

$$h=\frac{RK^2}{1-K^2}=\frac{R\left(\frac{1}{4}\right)}{\left(1-\frac{1}{4}\right)}=\frac{R}{4}\times\frac{4}{3}=\frac{R}{3}$$

$$h=\frac{R}{3}$$

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

KEY: 4

HINT: $R_1=R-10$

$$R_2=R+15$$

$$\frac{R-10}{R+15}=\frac{\sin 2\theta_1}{\sin 2\theta_2}=\frac{\sin 30°}{\sin 90°}=\frac{1}{2}$$

$$2R-20=R+15$$

$R=35$ $\qquad R\max=\frac{u^2}{g}$

$R = \frac{u^2 \sin 2\theta}{g}$ $\qquad 50 = \frac{u^2}{g}$

$35 = \frac{50g \times \sin 2\theta}{g}$ $\qquad u^2 = 50g$

$\sin 2\theta = \frac{35}{50} = \frac{7}{10}$

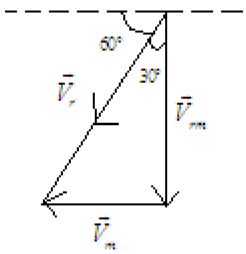
$2\theta = \sin^{-1}\left[\frac{7}{10}\right]$

$\theta = \frac{1}{2}\sin^{-1}\left[\frac{7}{10}\right]$

84. **A man running at a speed of 5kmph find 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)** $5\sqrt{3}kmph$

KEY: 4



HINT:

$Tan30^0 = \frac{V_m}{V_{rm}}$

$V_{rm} = \frac{5}{1/\sqrt{3}} = 5\sqrt{3}\,kmph$

85. **A horizontal force just sufficient to move a body of mass 4kg lying on a rough horizontal surface, is applied on it. Coefficients 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** $\left(g = 10ms^{-2}\right)$

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

KEY: 3

HINT: $a=\left(\mu_s-\mu_k\right)g=(0.8-0.6)\times 10$

$=0.2\times 10$

$a=2ms^{-2}$

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

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

KEY: 2

HINT: $F=\sqrt{4+1+1}=\sqrt{6}$

$V=\sqrt{16+4+4}=\sqrt{24}$

$F=m\left(\frac{v-u}{t}\right)$

$\sqrt{6}=m\left(\frac{\sqrt{24}-0}{20}\right)$

$m=\frac{\sqrt{6}\times 20}{\sqrt{24}}=\frac{20}{2}=10$

$m=10kg$

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

KEY: 3

HINT: $P=(M+x)gh/t$

$2000=\frac{(50+x)\times 10\times 20}{10}$

$1000=500+10x$

$10x=500\Rightarrow x=50kg$

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

1) $30\,\mathrm{ms^{-1}}$ **2)** $40\,\mathrm{ms^{-1}}$ **3)** $50\,\mathrm{ms^{-1}}$ **4)** $60\,\mathrm{ms^{-1}}$

KEY: 2

HINT: $m(v-10)=mV_2$

$$v_2=(v-10)$$

$$e=\frac{v_2-v_1}{u_1+u_2}=\frac{(v-10)-0}{(v+10)}$$

$$0.6=\frac{v-10}{v+10}$$

$$0.6v+6=v-10$$

$$0.4v=16$$

$$v=40ms^{-1}$$

89. **A particle of mass m = 5 units is moving with uniform speed $\mathrm{V}=3\sqrt{2}$ 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**

KEY: 2

HINT: $L=mvb\cos\theta$

$$=5\times3\sqrt{2}\times4\times\cos45°$$

$$L=60kg\,m^2s^{-1}$$

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 = 1m) approximately.**

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

KEY: 3

HINT: $KE=\frac{1}{2}I\omega^2=\frac{1}{2}\times\frac{3}{2}mr^2 4\pi^2 f^2$

$$=3mr^2\times\pi^2 f^2=3\times5\times1\times10\times1$$

$$KE=150J$$

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

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

KEY: 1

HINT: $\frac{K.E}{P.E}=\frac{\frac{1}{2}mw^2(A^2-x^2)}{\frac{1}{2}mw^2x^2}$

$\frac{K.E}{P.E}=\frac{A^2-x^2}{x^2}$

$=\frac{10^2-4^2}{4^2}$

$=\frac{84}{16}$

$\frac{K.E}{P.E}=\frac{21}{4}=5.25$

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

KEY: 3

HINT: $V_e = (\sqrt{2}-1)V_0$

$= (1.414-1)V_0 = 0.414\times 10 = 4.14$ km/s

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)** $\frac{l_2-l_1}{F_2-F_1}$ **3)** $\frac{l_1F_2-l_2F_1}{F_2-F_1}$ **4)** $\frac{l_1F_1-l_2F_2}{F_2-F_1}$

KEY: 3

HINT: $F_1 \propto e_1$

$F_1 \propto l_1 - l$

$F_2 \propto l_2 - l$

$\frac{F_1}{F_2}=\frac{l_1-l}{l_2-l}$

$F_1l_2 - F_1l = F_2l_1 - F_2l$

$(F_2 - F_1)l = F_2l_1 - F_1l_2$

$l = \dfrac{F_2l_1 - F_1l_2}{F_2 - F_1}$

94. The average depth of Indian ocean is about 3000m. The value of fractional compression $\left(\dfrac{\Delta V}{V}\right)$ of water at the bottom of the ocean is (given that the bulk modulus of water is $2.2\times10^9\ Nm^{-2}, g = 9.8\ ms^{-2}, P_{H_2O} = 1000\ kg.m^{-3}$)

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

KEY: 2

HINT: $\dfrac{\Delta v}{v} = \dfrac{h\rho g}{k} = \dfrac{3\times10^3\times10^3\times9.8}{22\times10^8}$

$= \dfrac{3}{22}\times10^{-3}\times98 = \dfrac{147}{11}\times10^{-3} = 1.34\times10^{-2}m$

95. The ratio of energies of emitted radiation by a black body at 600 k and 933 k when th e surrounding temperature is 300 k

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

KEY: 3

HINT: $\dfrac{E_1}{E_2} = \dfrac{T_1^4 - T_S^4}{T_2^4 - T_2^4}$

$= \dfrac{(600)^4 - (300)^4}{(900)^4 - (300)^4} = \dfrac{3}{16}$

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 termperatrue 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**

KEY: 4

HINT: $C_V = 12.6$

$R = 8.314$

$C_P = C_V + R = 12.6 + 8.314 = 21$

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**

KEY: 2

HINT: dQ= 0

dU = -dW

dU = -4.5 J

98. **The relation between efficiency $'\eta'$ of a heat engine and the co-efficient of performance $'\alpha'$ of a refrigerator is**

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

KEY: 2

HINT: $\eta = \frac{1}{1+\alpha}$

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 average kinetic energies of two gases per molecule is**

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

KEY: 1

HINT: Independent of nature $K.E_1 : K.E_2 = 1 : 1$.

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

1) $15ms^{-1}$ **2)** $0.75ms^{-1}$ **3)** $3.75ms^{-1}$ **4)** $300ms^{-1}$

KEY: 2

HINT: y = 2sin (30t – 40x)

= Asin (wt – kx)

V= $\frac{w}{k} = \frac{30}{40} = 0.75m/\sec$

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**

KEY: 1

HINT: $n = \frac{V}{4l}$

$\frac{V_H}{V_O} = \frac{l_H}{l_O} = \frac{4}{1}$ $\frac{V_H}{V_O} = \sqrt{\frac{M_2}{M_1}} = \sqrt{\frac{32}{2}} = 4$

$V_O : V_H = 1:4$

102. An image is formed at a distance of 100 cm 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) 40cm** **3) 30 cm** **4) 50 cm**

KEY: 1

$$\frac{\mu_2}{V} - \frac{\mu_1}{U} = \frac{\mu_2 - \mu_1}{R}$$

HINT:

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

$$R = 20cm$$

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**

KEY: 3

$$\frac{I_1}{I_2} = \frac{9}{4}$$

HINT:

$$\frac{I_{max}}{I_{min}} = \left(\frac{\sqrt{I_1} + \sqrt{I_2}}{\sqrt{I_1} - \sqrt{I_2}}\right)^2 = \left(\frac{\sqrt{9} + \sqrt{4}}{\sqrt{9} - \sqrt{4}}\right)^2 = \frac{25}{1}$$

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 the distance between them is twice the original distance, then the electrostatic energy becomes.

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

KEY: 3

$$E = \frac{1}{2}cv^2 \qquad c\alpha\frac{1}{d} \qquad \frac{c_1}{c_2} = \frac{d_2}{d_1} = \frac{2d}{d} = 2$$

HINT:

$$\frac{E_1}{E_2} = \frac{C_1}{C_2} = \frac{C}{C/2} = \frac{2}{1}$$

$$\frac{E}{E_2} = \frac{2}{1}$$

$$E_2 = \frac{E}{2}$$

105. Two point charges +8 μ c and +12 μ c repel each other with a force of 48N. When an additional charge of -10 μ 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 24N **4) Attractive force of 2N**

KEY: 4

$q_1 = +8\mu c \quad q_2 = +12\mu c$

HINT:

$F = 48N$

$q_1^1 = -2\mu c \; q_2^1 = +2\mu c$

$\frac{F_1}{F_2} = \frac{q_1 q_2}{q_1^1 q_2^1}$

$F_2 = 2N$

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

1) $\frac{\in_0}{3}$ 2) $3\in_0$ 3) $\frac{4}{3}\in_0$ 4) $\frac{3}{4}\in_0$

KEY: 1

$\in_r = 1 + \frac{\in}{\in_0}$

HINT:

$K = 1 + \frac{\in}{\in_0}$

$\frac{4}{3} = 1 + \frac{\in}{\in_0}$

$\frac{\in}{\in_0} = \frac{1}{3}$

$\in = \frac{\in_0}{3}$

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)** $\frac{2Et^2}{em_e}$

KEY: 2

$S = \frac{1}{2}at^2$

HINT: $= \frac{1}{2}\frac{eE}{m}t^2$

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**

KEY: 2

HINT: $V_d \propto \frac{1}{l}$

$$\frac{V_{d_1}}{V_{d_2}} = \frac{l_2}{l_1} = \frac{4l}{l}$$

$$V_{d_1} : V_{d_2} = 4:1$$

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

KEY: 2

HINT: $\frac{2(3+x)}{3x} = \frac{62.5}{37.5}$

On simplifying $x = 2\Omega$

110. Two long straight parallel conductors 10 cm 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)** $4\times10^{-5}T$

KEY: 3

HINT: At the midpoint two conductors $B_1 = B_2 = B$

$$B_R = B_1 - B_2 = 0$$

111. In a crossed field, the magnetic field induction is 2.0T and electric field intensity is 20 x 10^3 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)** $40\times10^3 ms^{-1}$

KEY: 2

HINT: $QvB = QE$

$$\Rightarrow V = \frac{E}{B}$$

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, $\mu_0 = 4\pi \times 10^{-7} Hm^{-1}$)

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

KEY: 3

HINT: $\mu = (X = 1)\mu$

$\varnothing = BA = \mu HA = \mu(X+1)A$

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

KEY: 1

HINT: $|\Sigma| = L\frac{di}{dt} \quad \Rightarrow \Sigma = L\frac{\Delta i}{\Delta t}$

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

KEY: 1

HINT: $P = \frac{\Sigma i_0}{2}\cos\varnothing$

Here $\varepsilon_0 = 50$

$i_0 = 50\ \varnothing = \frac{\pi}{3}$

115. Light with an energy flux of 9 Wcm^{-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)** $3.16\times10^{-4} kgms^{-1}$

KEY: 3

HINT: $\Delta p = \left(\frac{IA}{C}\right)t$

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)** $m_e^{\ 2} : m_p^{\ 2}$

KEY: 1

HINT: $mV = \dfrac{H}{\lambda}$

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

1) $\dfrac{5}{36}$ **2)** $\dfrac{7}{20}$ **3)** $\dfrac{7}{144}$ **4)** $\dfrac{5}{27}$

KEY: 2

HINT: $\dfrac{1}{\lambda_B} = R\left[\dfrac{1}{A2^2} - \dfrac{1}{3^2}\right]$

$$\frac{1}{\lambda_p} = r\left[\frac{1}{3^2} - \frac{1}{4^2}\right]$$

$$\Rightarrow \frac{\lambda_b}{\lambda_p} = \frac{7}{10}$$

118. In the following nuclear reaction $'x'$ stands for

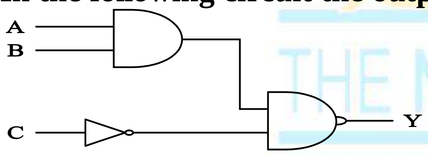
$n \to p + e^- + x$

1) α-particle **2) positron** **3) nutrino** **4) Antinutrino**

KEY: 4

HINT: Conceptual

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**

KEY: 4

HINT: $Y = \overline{\left(AB\right)\overline{C}}$

$= \overline{A} + \overline{B} + C$

$Y = 0 \Rightarrow A = 1, B = 1, C = 0$

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

KEY: 3

HINT: $M = \frac{A_B}{A_C}$

$A_{\max} = A_C + A_s$

$A_{\min} = A_C - A_s$

CHEMISTRY

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

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

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

KEY: 3

HINT: for 3d, $n = 3, l = 2, m = -2 \text{ to } +2, s = \pm\frac{1}{2}$

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

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

KEY: 4

HINT: $\frac{\lambda_1}{\lambda_2} = \sqrt{\frac{KE_2}{KE_1}}$

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

$\lambda_2 = \sqrt{2}\,\lambda_1$

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

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

KEY: 3

HINT: Acidic nature of oxides increases from left to right in period. (or) Oxide of more EN atom is more acidic in nature.

124. Match the following

List-I	List – II
A) Rubedium	I) Germanium
B) Platinum	II) Radio active chalcogen
C) Ekasilicon	III) S-block element
D) Polonium	IV) Atomic number 78

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

KEY: 2

HINT:

1. Rubedium - s-block element
2. Platinum - Atomic number:78
3. EkaSilicon - Ge
4. Polonium - Radio active chalcogen

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

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

KEY: 3

HINT: Iso electronic species have same properties. NO molecule has 15 electrons. Its bond order = 2.5

126. In which one of the following pairs the 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

KEY: 1

HINT: Both I_3^- and $BeCl_2$ have same structure (linear) and but differ in hybridization (sp^3d and sp) .

127. On the top of a mountain water boils at

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

KEY: 4

HINT: Low temperature

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 an intermediate state between gaseous and solid state

KEY: 2

HINT: Evaporation of liquids increases with increase in surface area.

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: H = 1.008, C = 12.0, Br = 79.9)

1) CH_3Br 2) CH_2Br_2I 3) $C_2H_4Br_2$ 4) $C_2H_3Br_3$

KEY: 3

HINT:

Element	%	At. wt	relative number	simple ratio
C	12.8	12	$\frac{12.8}{12}=1.06$	$\frac{106}{1.06}=1$
H	2.1	1	$\frac{2.1}{1}=2.1$	$\frac{2.1}{1.06}=2$
Br	85.1	80	$\frac{85.1}{80}=1.06$	$\frac{1.06}{1.06}=1$

EF= CH_2Br

Wt. of EF = $12+2+80=94$

$$n=\frac{M.W}{wt\ of\ \ EF}=\frac{187.9}{94}=2$$

$MF=(EF)_n=(CH_2Br)_2 \quad =C_2H_4Br_2$

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

KEY: 1

HINT:

$3.011\times10^{22}=1.15g$

$6.023\times10^{23}=?$

$$\Rightarrow\frac{1.15}{3.011\times10^{22}}\times6.023\times10^{23}=23$$

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) $\Delta W=0$

KEY: 2

HINT:

Since $\Delta E=q+W$

for an adiabatic reaction $\Delta q=0$

So $\Delta E=\Delta W$.

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 decrease

KEY: 2

HINT: As the temperature increases the reaction proceeds towards endothermic direction.

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**

KEY: 4

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

$P^{OH} = 2$, $P^{H} = 12$

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

1) Treatment with washing soda **2) Calgon metod**

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

KEY: 4

HINT: Refer text book – Memory based

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

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

1) Both (A) and (R) are not true

2) (A) is true but (R) is not correct explanation of (A)

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

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

KEY: 4

HINT: Refer text book – Memory based

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

KEY: 1

HINT: Refer text book – Memory based

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 but (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)

KEY: 4

HINT: Refer text book – Memory based

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 exhaut pipes.

D) H_2SO_4, herbicides and insecticides from mist.

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

KEY: 4

HINT: Refer text book – Memory based

139. The bond angle of $C\overset{O}{\wedge}C$ bond in methoxy methane is

1) 111.7º 2) 109º 3) 108.9º 4) 180º

KEY: 1

HINT: Refer text book – Memory based

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

KEY: 1

HINT: Refer text book – Memory based

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

KEY: 2

HINT: Conceptual

142. Pure silicon doped with phosphorus is

1) Amorphous 2) p-type semiconductor

3) n-type semiconductor 4) Insulator

KEY: 3

HINT: Conceptual

143. 18gm of glucose is dissolved in 90gm 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

KEY: 4

HINT: $\dfrac{P_o - P_s}{P_o} = \dfrac{w}{m} \times \dfrac{M}{W}$

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

KEY: 3

HINT: $P = P_0 X$

$$\frac{P_1}{P_2} = \frac{X_1}{X_2}$$

$$Xsolute + Xsolvent = 1$$

145. Calculate ΔG^o for the following cell reaction

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

$$E^0_{Ag^+/Ag} = +0.80V \text{ and } E^0_{Zn^{+2}/Zn} = -0.76V$$

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

KEY: 2

HINT: $E^0{}_{cell} = E^0{}_R - E^0{}_L$

$$\Delta G^0 = -nFE^0{}_{cell}$$

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) 2*t* 2) 3*t* 3) *t* 4) 4*t*

KEY: 1

HINT: $\frac{t_{90\%}}{t_{99\%}} = \frac{\log\left(\frac{100}{10}\right)}{\log\left(\frac{100}{1}\right)} = \frac{1}{2}$

$$t_{99\%} = 2t$$

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) $K_3[Fe(CN)_6]$

KEY: 4

HINT: Conceptual

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

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

KEY: 4

HINT: Conceptual

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) $PH_3 = NH_3$

KEY: 1

HINT: Conceptual

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

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

KEY: 2

HINT: From the given data the possible complex is

$\left[Co\left(NH_3\right)_4 Cl_2\right]Cl$

$So\,x\,is\,4$

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

1) $[Fe(H_2O)_6]Cl_3$ **2) $K_4[Fe(CN)_6]$** **3) $Fe(CO)_5$** **4) $[Fe(H_2O)_6]Cl_2$**

KEY: 3

HINT: 1) $x+6(0)+3(-1)=0$

$x=+3$

2) $4+6(-1)+x=0$

$x-2=0$

$x=+2$

3) $x+0=0$

$x=0$

4) $x+6(0)-2=0$

$x=+2$

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

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

KEY: 4

HINT: Conceptual

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**

KEY: 3

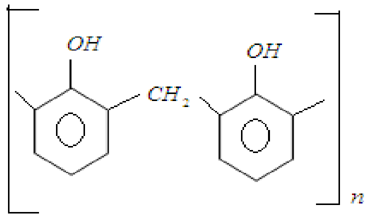
HINT: Conceptual

154. The polymer obtained with methylene bridges by condensation polymer

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

KEY: 4

HINT:



155. The amino acid containing Inhole part is

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

KEY: 1

HINT: Conceptual

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

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

KEY: 4

HINT: Conceptual

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**

KEY: 2

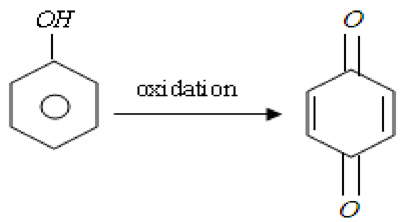
HINT: $X = CHI_3\left(Tri\ \ Iodomethane\right)$

158. Phenol on oxidation in air gives

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

KEY: 1

HINT:



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

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

1) $SOCl_2, H_2/pd\text{-}BaSO_4$ **2)** $H_2/pd\text{-}BaSO_4, SOCl_2$

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

KEY: 1

HINT: $CH_3COOH \xrightarrow{SOCl_2} CH_3COCl \xrightarrow{H_2/Pd-BaSO_4} CH_3CHO$

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

$Ar - NH_2 \xrightarrow{X} Ar - \overset{+}{N} \equiv N - \bar{C}l \xrightarrow{Y} Ar - Cl$ ***Ar – NH₂ A***

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

3) $NaNO_2 - HCl$ **&** Cu/HCl **4)** $NaNO_2 - HCl$ **&** $NaNH_2$

KEY: 3

HINT: $Ar - NH_2 \xrightarrow{NaNO_2-HCl} Ar\ \ N_2^+Cl \xrightarrow{Cu/HCl} Ar - Cl$