KAB MODEL TS EAMCET (E) 2017
(Engineering)

KEY

1) 3	**2)** 2	**3)** 4	**4)** 2	**5)** 2	**6)** 3	**7)** 4	**8)** 4	**9)** 2	**10)** 4
11) 3	**12)**	**13)** 1	**14)** 3	**15)** 3	**16)** 2	**17)** 1	**18)** 1	**19)** 1	**20)** 4
21) 1	**22)** 3	**23)** 1	**24)** 3	**25)** 4	**26)** 2	**27)** 3	**28)** 1	**29)** 2	**30)** 1
31) 3	**32)** 2	**33)** 2	**34)** 4	**35)** 3	**36)** 4	**37)** 2	**38)**	**39)** 1	**40)** 4
41) 3	**42)** 1	**43)** 3	**44)** 2	**45)** 4	**46)** 1	**47)** 4	**48)** 1	**49)** 3	**50)** 4
51) 1	**52)** 4	**53)** 2	**54)** 2	**55)** 4	**56)** 1	**57)** 4	**58)** 2	**59)** 2	**60)** 1
61) 2	**62)** 1	**63)** 2	**64)** 3	**65)** 4	**66)** 4	**67)** 1	**68)** 4	**69)** 4	**70)** 3
71) 1	**72)** 2	**73)** 2	**74)** 1	**75)** 2	**76)** 3	**77)** 2	**78)** 1	**79)** 2	**80)** 3
81) 3	**82)** 1	**83)** 4	**84)** 3	**85)** 1	**86)** 3	**87)** 2	**88)** 4	**89)** 1	**90)** 3
91) 1	**92)** 4	**93)** 2	**94)** 2	**95)** 2	**96)** 2	**97)** 1	**98)** 3	**99)** 1	**100)** 3
101) 2	**102)** 4	**103)** 2	**104)** 2	**105)** 3	**106)** 1	**107)** 3	**108)** 2	**109)** 2	**110)** 3
111) 3	**112)** 1	**113)** 4	**114)** 2	**115)** 1	**116)** 4	**117)** 1	**118)** 3	**119)** 4	**120)** 3
121) 4	**122)** 1	**123)** 4	**124)** 1	**125)** 3	**126)** 3	**127)** 1	**128)** 1	**129)** 4	**130)** 3
131) 1	**132)** 2	**133)** 1	**134)** 2	**135)** 3	**136)** 3	**137)** 3	**138)** 3	**139)** 4	**140)** 3
141) 1	**142)** 2	**143)** 2	**144)** 3	**145)** 3	**146)** 4	**147)** 4	**148)** 2	**149)** 4	**150)** 3
151) 2	**152)** 2	**153)** 1	**154)** 4	**155)** 1	**156)** 1	**157)** 3	**158)** 2	**159)** 2	**160)** 1

KAB MODEL TS EAMCET (E) 2017
SOLUTIONS

MATHEMATICS

1) 3

The domain is given by $x-3\geq 0$ and $7-x\geq 0 \Rightarrow 3\leq x\leq 7$

$$\left(f\left(x\right)\right)^2=\left(\sqrt{x-3}+\sqrt{7-x}\right)^2=x-3+7-x+2\sqrt{\left(x-3\right)\left(7-x\right)}$$

$$=4+2\sqrt{-21+10x-x^2}=4+2\sqrt{4-\left(x-5\right)^2}$$

$$f^2{}_{\max}=\left(f\left(5\right)\right)^2=8$$

$$f^2{}_{\min}=\left(f\left(3\right)\right)^2=\left(f\left(7\right)\right)^2=4$$

$$f_{\min}=2,\ f_{\max}=2\sqrt{2}$$

Range $=\left[2, 2\sqrt{2}\right]$.

2) 2

$f^{-1}\left(x\right)=y \qquad \Rightarrow f\left(y\right)=x$

$$\Rightarrow \frac{10^y-10^{-y}}{10^y+10^{-y}}=x \qquad \Rightarrow \frac{10^y-10^{-y}+10^y+10^{-y}}{10^y-10^{-y}-10^y-10^{-y}}=\frac{x+1}{x-1}$$

$$10^{2y}=\frac{-\left(x+1\right)}{\left(x-1\right)} \qquad \Rightarrow 10^{2y}=\frac{\left(x+1\right)}{\left(1-x\right)}$$

$$2y=\log_{10}\left(\frac{1+x}{1-x}\right) \qquad f^{-1}\left(x\right)=y=\frac{1}{2}\log_{10}\left(\frac{1+x}{1-x}\right)$$

3) 4

$$\text{Sum}=\sum\frac{\left(3n^2-3n+2\right)}{2} \qquad =\frac{3}{2}\sum n^2-\frac{3}{2}\sum n+\sum 1$$

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

$$\frac{n}{4}\left[2n^2+3n+1-3n-3+4\right] \qquad =\frac{n}{4}\left(2n^2+2\right)$$

$$\frac{n}{4}2\left(n^2+1\right)=\frac{n}{2}\left(n^2+1\right)$$

4) 2

$AB = -BA$

$\left(A+B\right)^2 = A^2 + B^2$

5) 2

$$A^2 = \begin{bmatrix} 1 & 1 \\ 1 & 1 \end{bmatrix}\begin{bmatrix} 1 & 1 \\ 1 & 1 \end{bmatrix} = \begin{bmatrix} 2 & 2 \\ 2 & 2 \end{bmatrix} = 2\begin{bmatrix} 1 & 1 \\ 1 & 1 \end{bmatrix} = 2A$$

$$A^3 = \begin{bmatrix} 1 & 1 \\ 1 & 1 \end{bmatrix}\begin{bmatrix} 2 & 2 \\ 2 & 2 \end{bmatrix} = \begin{bmatrix} 4 & 4 \\ 4 & 4 \end{bmatrix} = 4A \quad = 2^2 A$$

BY induction $A^n = 2^{n-1}A$

6) 3

Differentiate w.r.t 'x' on both sides and put $x = 0$ we get a_1 value is : 0

7) 4

$$f\left(-x\right) = \begin{vmatrix} -x^3 & \cos^2 x & 2^{x^4} \\ -\tan^5 x & 1 & \sec 2x \\ -\sin^3 x & x^4 & 5 \end{vmatrix} = -f\left(x\right)$$

$$\because \int_{-\pi}^{\pi} f\left(x\right)dx = 0$$

8) 4

$x^2 + x + 1 = 0$

$$\Rightarrow x = \left(\omega + \frac{1}{\omega}\right)^2 + \left(\omega^2 + \frac{1}{\omega^2}\right)^2 + \left(\omega^3 + \frac{1}{\omega^3}\right)^2 + ...$$

$= \left(1+1+4\right)........$ 9 times

$= 6 \times 9 = 54$

9) 2

$$\vec{z} = \begin{vmatrix} 1 & 1+2i & 3-5i \\ 1-2i & -5 & -10i \\ 3+5i & -10i & 11 \end{vmatrix} = z$$

$\therefore z \ is \ purely \ real.$

10) 4

$(a+2b)^2+\left(aw+2bw^2\right)+\left(aw^2+2bw\right)$

$= a^2+4ab+4b^2+a^2w^2+4ab+4b^2w\ +a^2w+4ab+4b^2w^2$

$= a^2\left(1+w+w^2\right)+4b^2\left(1+w+w^2\right)+12ab$

$=12ab\left(\because 1+w+w^2=0\right)$

11) 3

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

$$=(-1)^8\left[\left(\cos\frac{\pi}{8}-i\sin\frac{\pi}{8}\right)^2\right]^8=\cos 2\pi-i\sin 2\pi=1$$

12)

13) 1

$\frac{1}{2}$ is a root of the given equation and $\frac{1}{2},\frac{1}{3},\frac{1}{4}$ are in H.P.

14) 3

$2^5-2=30$

15) 3

The No. of choices $={}^6C_5\times{}^7C_5+{}^6C_6\times{}^7C_4=161$

16) 2

Let x_1 be the number of stations before the first halting station, x_2 between first and second, x_3 between second and third, x_4 between third and fourth and x_5 on the right of 4th stations.

Then $x_1\ge 0, x_5\ge 0, x_2, x_3, x_4\ge 1$ satisfying $x_1+x_2+x_3+x_4+x_5=8$

The total number of ways is the number of solution of the above equation

Let $y_2=x_2-1, y_3=x_3-1, y_4=x_4-1$

Then (i) reduces to $x_1+y_2+y_3+y_4+x_5=5,$ where $y_2, y_3, y_4\ge 0.$

The number of solution of this equation is ${}^{5+5-1}C_{5-1}={}^9C_4$.

17) 1

$^{n}c_r = a,\ ^{n}c_{r+1} = b,\ ^{n}c_{r+2} = c,\ ^{n}c_{r+3} = d$

Substitute above in the expansion and simplify.

18) 1

$2^{2006} = 4.8^{668}$

$= 4[7 + 1]^{668}$ leaves remainder 4

$2006 = 7 \times 268 + 4$ leaves remainder 4

$\therefore 2^{2006} - 2006$ leaves remainder = 0

19) 1

$\left(1 + x + x^2 + x^3\right)^{11} = (1 + x)^{11}\left(1 + x^2\right)^{11}$

$= \left(^{11}C_0 + ^{11}C_1 x + ... + ^{11}C_{11} x^{11}\right)\left(^{11}C_0 + ^{11}C_1 x^2 + ... + ^{11}C_{11} x^{22}\right)$

$\therefore$ Coefficient of $x^4 = ^{11}C_0\,^{11}C_2 + ^{11}C_2\,^{11}C_1 + ^{11}C_4\,^{11}C_0$

= 990

20) 4

$^{11}C_6 a^5 . \frac{1}{b^6} = ^{11}C_5 . a^6 \left(\frac{1}{b^5}\right) \Rightarrow ab = 1$

21) 1

$\left.\begin{array}{l}\alpha + \beta = 90^\circ \\ \alpha - \beta = 30^\circ\end{array}\right\} \Rightarrow \alpha = 60^\circ, \beta = 30^\circ$

22) 3

$= 256\left[\left(\sin x - \operatorname{cosec} x\right)^2 + 2\right] + 68 \operatorname{cosec}^2 x$ is minimum when $x = \frac{\pi}{2}$ and minimum value is 580.

23) 1

$\cos^{100} x - \sin^{100} x = 1$

$\Rightarrow \cos^{100} x = 1 + \sin^{100} x$

$\cos^{100} x \le 1$

$\Rightarrow 1 + \sin^{100} x \le 1$

$\sin^{100} x = 0$

$\Rightarrow \sin x = 0$

$\Rightarrow x = n\pi$

24) 3

Domain of $\sin^{-1}x+\cos^{-1}x+Tan^{-1}x$ is [–1, 1]

Range is $\left[\frac{\pi}{2}+\tan^{-1}(-1)\frac{\pi}{2}+\tan^{-1}(1)\right]$

$=\left[\frac{\pi}{2}-\frac{\pi}{4},\frac{\pi}{2}+\frac{\pi}{4}\right]$

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

25) 4

$f(x)=\cosh x+\sinh x$

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

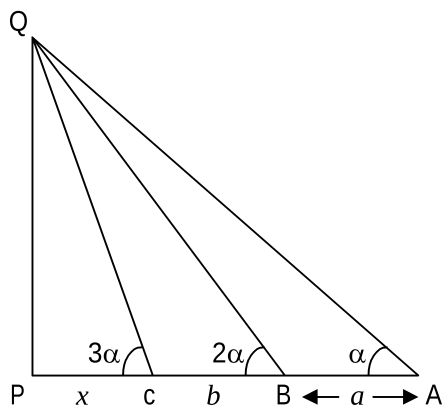
$f\left(x_1+x_2+x_3+......+x_n\right)=e^{x_1}e^{x_2}e^{x_3}.....e^{x_n}$

$f(x_1)\,f(x_2)\,f(x_3).......f(x_n)$

26) 2

$AB=a,\ BC=b\ mts$

height of the tower $PQ=h\ mts$



$\cot\alpha=\frac{a+b+x}{h}\Rightarrow a+b+x=h\cot\alpha$ .... (1)

$\cot 2\alpha=\frac{b+x}{h}\Rightarrow b+x=h\cot 2\alpha$ .... (2)

$\cot 3\alpha=\frac{x}{h}\Rightarrow x=h\cot 3\alpha$ .... (3)

$\frac{a}{b}=\frac{h(\cot\alpha-\cot 2\alpha)}{h(\cot 2\alpha-\cot 3\alpha)}\Rightarrow\frac{a}{b}=\frac{\sin 3\alpha}{\sin\alpha}$

$=1+2\cos 2\alpha$

27) 3

$$\frac{\Delta}{S-a}\frac{\Delta}{S-b}\sqrt{\frac{4R}{r_1+r_2}-1}$$

$$=\frac{\Delta^2}{(S-a)(S-b)}\sqrt{\frac{4R}{4R\cos^2\frac{C}{2}}-1}$$

$$=\frac{\Delta^2}{(S-a)(S-b)}\tan c/2$$

$$=\frac{\Delta^2}{(s-a)(S-b)}\times\frac{(S-a)(S-b)}{\Delta}=\Delta$$

28) 1

$$\sum a\cot A$$

$$=\sum 2R.\sin A.\frac{\cos A}{\sin A}$$

$$=\sum 2R\cos A$$

$$=2R(\cos A+\cos B+\cos C)$$

$$=2R\left[1+4\sin\frac{A}{2}\ \sin\frac{B}{2}\sin\frac{C}{2}\right]$$

$$=2R\left[1+\frac{4R}{R}\sin\frac{A}{2}\sin\frac{B}{2}\sin\frac{C}{2}\right]$$

$$=2R\left(1+\frac{r}{R}\right)$$

$$=2R\frac{(R+r)}{R}$$

$$=2(R+r)$$

29) 2

$$\frac{b-c}{b+c}=\frac{\sqrt{2}-1}{2+\sqrt{3}}$$

$$\Rightarrow\tan\left(\frac{B-C}{2}\right)\tan\frac{A}{2}=\frac{\sqrt{2}-1}{2+\sqrt{3}}\Rightarrow\tan\left(\frac{B-C}{2}\right)=\sqrt{2}-1$$

$$\Rightarrow B-C=45^0$$

30) 1

$$\frac{b+c}{11}=\frac{c+a}{12}=\frac{a+b}{13}=\frac{2(a+b+c)}{36}=K(\text{say})$$

or $a=7K, b=6K, c=5K$

$$\therefore \cos A=\frac{(6K)^2+(5K)^2-(7K)^2}{2(6K)(5K)}=\frac{1}{5}$$

31) 3

$$\overline{AB}+\overline{AE}+\overline{BC}+\overline{DC}+\overline{ED}=\left(\overline{AB}+\overline{BC}\right)+\left(\overline{AE}+\overline{ED}+\overline{DC}\right)$$

$$=2\overline{AC}$$

$$\therefore A=3$$

32) 2

Let $\overline{d}=d_1\hat{i}+d_2\hat{j}+d_3\hat{k}$. Then $\left|\overline{d}\right|^2=d_1^2+d_2^2+d_3^2=51$...........(1)

$$\cos\theta=\frac{\overline{d}.\overline{a}}{\left|\overline{d}\right|\left|\overline{a}\right|}=\frac{\overline{d}.\overline{b}}{\left|\overline{d}\right|\left|\overline{b}\right|}=\frac{\overline{d}.\overline{c}}{\left|\overline{d}\right|\left|\overline{c}\right|}=\frac{1}{3}(d_1-2d_2+2d_3)=\frac{1}{5}(-4d_1-3d_3)=d_2$$

$$\Rightarrow d_1-5d_2+2d_3=0, 4d_1+5d_2+3d_3=0$$

$$\Rightarrow \frac{d_1}{5}=\frac{d_2}{-1}=\frac{d_3}{-5}=\lambda \Rightarrow d_1=5\lambda, d_2=-\lambda, d_3=-5\lambda$$

From (1) $\lambda=\pm 1$ $\therefore \overline{d}=\pm\left(5\hat{i}-\hat{j}-5\hat{k}\right)$

33) 2

$$\left|\overline{a}\times\overline{b}\right|=\left|-3(\overline{p}\times\overline{q})\right|$$

$$=3\left|\overline{p}\right|\left|\overline{q}\right|\sin(p,q)$$

34) 4

$$\vec{b}\times\vec{c}=\begin{vmatrix}\vec{i} & \vec{j} & \vec{k}\\ 2 & 1 & -1\\ 1 & 0 & 3\end{vmatrix}=\vec{i}(3-0)-\vec{j}(6+1)+\vec{k}(0-1) \qquad =3\vec{i}-7\vec{j}-\vec{k}$$

$$\left[\vec{a}\ \vec{b}\ \vec{c}\right]=\vec{a}.\left(\vec{b}\times\vec{c}\right)=\vec{a}.\left(3\vec{i}-7\vec{j}-\vec{k}\right) \qquad =\left|\vec{a}\right|\left|3\vec{i}-7\vec{j}-\vec{k}\right|\cos\theta$$

Where $\theta=\left(\vec{a}, 3\vec{i}-7\vec{j}-\vec{k}\right)$ $\qquad =\sqrt{9+49+1}\cos\theta$

$$=\sqrt{59}\cos\theta$$

$\therefore$ Maximum value of $\left[\vec{a}\ \vec{b}\ \vec{c}\right]$ is $\sqrt{59}$

35) 3

$\left[\bar{a}\ \bar{b}\ \bar{c}\right] = |\bar{a}||\bar{b}||\bar{c}|(\cos 0)\left(\sin\frac{2\pi}{3}\right)$

$= 12\sqrt{3}$

36) 4

The equation of two lines are

$\left(\bar{r}-\bar{b}\right)\times\bar{a}=\bar{0}$ and $\left(\bar{r}-\bar{a}\right)\times\bar{b}=\bar{0}$

$\left(\bar{r}-\bar{b}\right)$is parallel to $\bar{a}$ and $\bar{r}-\bar{a}$ is parallel to $\bar{b}$

$\therefore \bar{r}=\bar{b}+\bar{p}a$

$\bar{r}=\bar{a}+q\bar{b}$

$p=q=1$

[For intersection of their equations]

37) 2

E_1=Event that the maximum number=6

E_2=Event that the minimum number=3

Favourable cases to $E_1=5_{C2}$ among favourable case to E_1.

(3, 4, 6) and (3, 5, 6) are favourable to E_2.

$\therefore P\left(\frac{E_2}{E_1}\right)=\frac{n\left(E_1\wedge E_2\right)}{n\left(E_1\right)}=\frac{2}{5_{C_2}}=\frac{1}{5}$

38)

39) 1

$P(x<3)=\frac{1}{2^{15}}\left[16_{C_0}+16_{C_1}+16_{C_2}\right]$

$=\frac{137}{2^{16}}.$

40) 4

Error is atleast 15 paise when we round off 15p, 16p, ……49p, 50p, 51p….. 85p.

$\Rightarrow P(E)=\frac{71}{100}.$

41) 3

First we give two coins to each of three persons. Remaining coins are 7. These seven can be distributed among three in $(7+3-1)_{C_{3-1}}$ way i.e., 9_{C_2} ways, which is 36.

42) 1

N(S) = 16, *n*(E) = 6

43) 3

$$\text{Mean} = \frac{6+8+10}{3} = \frac{24}{3} = 8$$

$$\text{and variance } = \frac{6^2+8^2+10^2}{3} - 8^2$$

$$= \frac{36+64+100}{3} - 64 = \frac{8}{3}$$

44) 2

148, 146, 144, ….. is an A.P. with a = 148, d = –2

$$n^{\text{th}} \text{ term } = a + (n-1)d = 148 + (n-1)(-2)$$

$$= 150 - 2n$$

$$\text{Average } 125 \Rightarrow \frac{148+146+.....+(150-2n)}{n} = 125$$

$$\Rightarrow \frac{\frac{n}{2}\left[296+(n-1)(-2)\right]}{n} = 125 \Rightarrow n = 24$$

45) 4

$Q = \left(\frac{-4}{7}, 0\right)$ at $R = \left(0, \frac{4}{7}\right)$ because the locus of P is $7x - 7y + 4 = 0$.

46) 1

$x = X + h, y = Y + k$

The transformed equation of $xy - x + 2y = 6$ is

$$(X+h)(Y+k) - (X+h) + 2(Y+k) - 6 = 0$$

$$\Rightarrow XY + (k-1)X + (h+2)Y + (hk - h + 2k - 6) = 0$$

Comparing this equation with $xy = c$ we get k – 1 = 0

$$h + 2 = 0 \,\&\, c = -(hk - h + 2k - 6) \Rightarrow k = 1, h = -2 \,\&\, c = -\left[(-2)(1) + 2 + 2 - 6\right] = 4$$

47) 4

As the line passes through (13, 32), we have

$\frac{13}{5}+\frac{32}{b}=1 \Rightarrow \frac{32}{b}=1-\frac{13}{5}=-\frac{8}{5} \Rightarrow b=-20$

Thus the line is $\frac{x}{5}-\frac{y}{20}=1$, i.e., $4x-y=20$

The equation of line parallel to $4x-y=20$ has slope 4. Thus $-\frac{3}{c}=4, \therefore c=-\frac{3}{4}$

Then the equation to line k is $4x-y=-3$

The distance between lines k and c is $\frac{20+3}{\sqrt{4^2+1^2}}=\frac{23}{\sqrt{17}}$

48) 1

Hint given curve $(y-2)^2=4(x+1)$

Vertex $(\alpha,\beta)-(-1,2)$, Focus S = (0, 2)

Point of intersection of $y=4$ and the curve is = (0, 4)

reflected ray passes through focus S = (0, 2).

$\therefore$ Equation of the line along reflected ray travels is x=0.

49) 3

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

$\therefore 2x^2-5xy+2y^2=0$ represents the lines $2x-y=0 \rightarrow (1), x-2y=0 \rightarrow (2)$

Clearly the origin O is the point of intersection of (1) and (2)

Let OAB be the triangle such that (1) represents $\overrightarrow{OA}$ and (2) represents $\overrightarrow{OB}$

Since A lies in (1), A=(I, 2I) for some I.

Since B lies in (2), B = (2k, k) for some k

Centroid $=\left(\frac{I=2k}{3},\frac{2I+k}{3}\right) \Rightarrow \left(\frac{I+2k}{3},\frac{2I+k}{3}\right)=(1,1) \Rightarrow \frac{I+2k}{3}=1, \frac{2I+k}{3}=1$

$\Rightarrow l+2k=3, 2l+k=3 \Rightarrow l=1, k=1, \therefore A=(1,2) B=(2,1)$

$\Rightarrow I+2k=3, 2I+k=3 \Rightarrow I=1, k=1, \therefore A=(1,2) B=(2,1)$

Slope of $\overleftrightarrow{AB}$ is $\frac{1-2}{2-1}=-1$

Equation of $\overleftrightarrow{AB}$ is y – 2 = –1 (x – 1) $\Rightarrow y-2=-x+1 \Rightarrow x+y-3=0$

50) 4

Point of intersection of $x^2+2xy-35y^2-4x+44y-12-0$ is $\left(\frac{hg-bg}{ab-b^2},\frac{gh-af}{ab-h^2}\right)$

$\therefore\left(\frac{1(22)-(-35)(-2)}{35-1},\frac{(-2)(1)-1(22)}{35-1}\right)=\left(\frac{48}{36},\frac{-24}{-36}\right)=\left(\frac{4}{3},\frac{2}{3}\right)$

Given lines are concurrent $\Rightarrow(4/3,2/3)$ lies on

$5x+\lambda y-8=0\Rightarrow 5(4/3)+\lambda(2/3)-8=0$

$\Rightarrow 20+2\lambda-24=0\Rightarrow 2\lambda-4\Rightarrow\lambda=2$

51) 1

Length of perpendicular from centre < radius.

52) 4

Let PA and PB be the tangents drawn from the point P(h, k) to the given circle with centre C(–2, 3). So that $\angle APB=2\alpha$ and $\angle APC=\angle CPB=\alpha$ $\angle PAC=\angle PBC=90^0$

From triangle PCA,

$\Rightarrow\sin\alpha=\frac{CA}{CP}$ and CA = $\sqrt{4+9-(9\sin^2\alpha+13\cos^2\alpha}$

$=2\sin\alpha\Rightarrow CP=2$

$\Rightarrow 4=h^2+k^2+4h-6k+13$

The locus of P(*h*, k) is therefore $x^2+y^2+4x-6y+9=0$

53) 2

P=(–9,7) C=(3, –2); cp=d the require d point divides PC in the ratio –(d + r):r.

54) 2

Chord of S=0, $S'=0$ is $S-S^1=0$

Equation circle $S+\lambda L=0$ Centre lies on L=0. We get λ value.

55) 4

Length of the latusrectum = $\left|\frac{12}{4}\right|=3$

56) 1

Any tangent to the parabola $y=x^2$ is $y=mx-\frac{1}{4}m^2$

It is tangent to $y=-(x-2)^2$

$\Rightarrow 2m-\frac{m^2}{4}=\frac{m^2}{4}\Rightarrow m=0,m=4.$

57) 4

$r^2 - r - 6 > 0 \; and \; r^2 - 6r + 5 > 0 \; also \; r^2 - r - 6 \neq r^2 - 6r + 5$

58) 2

$16 - b^2 = \frac{144}{25} + \frac{81}{25} \quad \Rightarrow b^2 = 7.$

59) 2

Equation of the tangent at $(ct, c/t)$ to hyperbola $xy = c^2$ *is*

$\frac{cx}{t} + cty = 2c^2$

Slope of the tangent $= -1/t^2$ and slope of the normal $= t^2$

Equation of the normal at $(ct, c/t) \, is \; y - c/t = t^2(x - ct)$ If it passes through $(ct', c/t')$,

then $ct' - c/t = t^2(ct' - ct) \Rightarrow (t - t') = t^3 \; t'(t' - t) \Rightarrow t^3 t' = -1$

60) 1

Equation of plane through (3, 2, –1) is

a(x–3) + b(y – 2) + c(z + 1) = 0 ……………(i)

also (3, 4, 2) and (7, 0, 6) lie on Eq. (i) , then

0.a + 2b + 3c = 0 …………… (ii)

And 4a – 2b + 7c = 0 …………… (iii)

Eliminating a,b,c from eqs. (i), (ii), and (iii), we get

$$\begin{vmatrix} x-3 & y-2 & z+1 \\ 0 & 2 & 3 \\ 4 & -2 & 7 \end{vmatrix} = 0$$

We get. 5x+3y–2z=23

$\lambda = 23$

61) 2

Let DC's of shortest distance line are l,m,n which is perpendicular to both the given lines

$\therefore \quad 2l - 7m + 5n = 0 \quad \ldots(i)$

and $\quad 2l + m - 3n = 0 \quad \ldots(ii)$

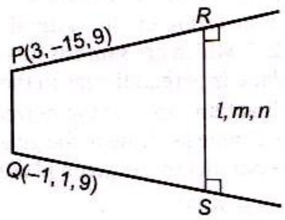
From Eqs. (i) and (ii),

l	m	n	l	m
2	−7	5	2	−7
2	1	−3	2	1

$$\therefore \quad \frac{l}{16} = \frac{m}{16} = \frac{n}{16}$$

$$\Rightarrow \quad \frac{l}{1} = \frac{m}{1} = \frac{n}{1} = \frac{\sqrt{(l^2 + m^2 + n^2)}}{\sqrt{(1^2 + 1^2 + 1^2)}} = \frac{1}{\sqrt{3}}$$

$$\Rightarrow \quad l = \frac{1}{\sqrt{3}}, m = \frac{1}{\sqrt{3}}, n = \frac{1}{\sqrt{3}}$$



$\therefore$ Required shortest distance = Projection of PQ on RS

$$= |(3-(-1))l + (-15-1)m + (9-9)n|$$

$$= |4l - 16m| = \left|\frac{-12}{\sqrt{3}}\right|$$

$$= 4\sqrt{3}$$

62) 1

The plane $7x + 11y + 13z = 3003$ meets the coordinate axes in

$A(429,0,0), B(0,273,0), C(0,0,231)$

Centroid of triangle ABC is $(429/3, 273/3, 231/3) = (143, 91, 77)$

63) 2

$$f(0) = \underset{x\to 0}{\text{Lt}}\, f(x) = \underset{x\to 0}{\text{Lt}}\, \frac{\log(1+ax) - \log(1-bx)}{x} = \underset{x\to 0}{\text{Lt}}\left(\frac{a}{1+ax} + \frac{b}{1-bx}\right) = a + b$$

64) 3

$$\lim_{\lambda\to 0} \frac{\frac{2x\tan x}{1-\tan^2 x} - 2x\tan x}{\left(1 - \frac{1-\tan^2 x}{1+\tan^2 x}\right)^2} \text{........simplify.}$$

65) 4

$$\lim_{\lambda \to 0} \frac{x\left[1+a\left(1-\frac{x^2}{2!}+\frac{x^4}{4!}-\frac{x^6}{6!}+.........\right)\right]-b\left[x-\frac{x^3}{3!}+\frac{x^5}{5!}-.......\right]}{x^3}$$

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

$$\Rightarrow 1+a-b=0; \frac{b}{6}-\frac{a}{2}=1$$

66) 4

Hint: $\frac{d}{dy}\left(\frac{dx}{dy}\right)=\frac{d}{dy}\left(\frac{1}{\frac{dy}{dx}}\right)$

67) 1

Put $x=\tan\theta$

$$(fog)(x)=f\left(\frac{x}{\sqrt{1+x^2}}\right)=f(\sin\theta)=\frac{\sin\theta}{\sqrt{1-\sin^2\theta}}=\tan\theta=x \Rightarrow \frac{d}{dx}\left[(fog)(x)\right]=1$$

68) 4

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

$$\frac{dy}{dx}=2x-1=ax+b$$

Then $a=2$ $b=-1$

$a^2+b^2=4+1=5$

69) 4

For increasing $f'(x)>0 \Rightarrow \frac{x^2+x+1}{x(1+x)}>0.$ $x\in(-\infty,-1)\cup(0,\infty)$

$f'(x)>0$ only when R – {–1, 0}.

70 3

$f(x)=x^3+ax^2+bx+c$

$f'(x)=3x^2+2ax+b$

$\triangle=4a^2-12b$

$=4(a^2-3b)<0$

$\therefore$ $f'(x)$ Never zero

$\therefore$ No extreme values

71) 1

$$\frac{dy}{dx} = -\left(\frac{y}{x}\right)^{\frac{1}{3}}$$

Slope at given point is m=1

Equation of tangent is $x + y = \frac{a}{\sqrt{2}}$

Perpendicular distance from (0, 0) to $x + y = \frac{a}{\sqrt{2}}$ is $\frac{a}{2}$

72) 2

$f(x) = |x| \Rightarrow f'(x) = \frac{|x|}{x} \Rightarrow f$ is not derivable at ‘0’ and $0 \in [-1, 2]$

$\therefore$ Lagrange’s mean value theorem is not applicable for $f(x) = |x|$

73) 2

Resolve in the partial fractions.

74) 1

$$\int(\sin 2x - \cos 2x)dx = -\frac{1}{2}\cos 2x - \frac{1}{2}\sin 2x + c = -\frac{1}{2}[\cos 2x + \sin 2x] + c$$

$$= -\frac{1}{2}\sqrt{2}.\sin(2x + \pi/4) + c = -\frac{1}{\sqrt{2}}\sin(2x + \pi/4) = \frac{1}{\sqrt{2}}\sin(2x + 5\pi/4) \Rightarrow \alpha = -5\pi/4$$

75) 2

$$\int\frac{1-7\cos^2 x}{\sin^7 \cos^2 x}dx = \int\frac{\sec^2 x}{\sin^7 x}dx - 7\int\frac{1}{\sin^7 x}dx = I_1 - I_2$$

$$I_1 = \int\frac{\sec^2 x}{\sin^7 x}dx$$

$$I_1 = \int\frac{\sec^2 x}{\sin^7 x}dx \Rightarrow \frac{\tan x}{\sin^7 x} + 7\int\frac{\tan x \cos x}{\sin^8 x}dx \qquad I_1 = \frac{\tan x}{\sin^7 x} + I_2$$

76) 3

Given series can be written as

$\underset{x\to\infty}{Lt}\frac{1}{n}\sum_{r-1}^{n}\left(\frac{r}{n}\right)^9$. Then use definite integration as limit of sum.

77) 2

$$g(x)=\int_0^x \cos 4t dt=\left[\frac{\sin 4t}{4}\right]_0^x=\frac{\sin 4x}{4}$$

$$g(x+\pi)=\int_0^{x+\pi} \cos 4t\ dt$$

$$=\left[\frac{\sin 4t}{4}\right]_0^{x+\pi}=\frac{1}{4}\sin 4(\pi+x)=\frac{1}{4}\sin 4x$$

$$g(\pi)=0[\therefore \sin 4\pi=0]$$

$$\therefore g(x+\pi)=g(n)\pm g(\pi)$$

78) 1

$$\int_0^1 \tan^{-1}\left(\frac{1}{1-x(1-x)}\right)dx=\int_0^1 \tan^{-1}\left(\frac{x+(1-x)}{1-x(1-x)}\right)dx$$

$$\int_0^1 \tan^{-1} x\,dx+\int_0^1 \tan^{-1}(1-x)\,dx = 2\int_0^1 \tan^{-1} x\,dx$$

79) 2

Solving we get $x^4+4x^2-32=0 \Rightarrow x=-2,2$

$\therefore$ The area is $S=\int_{-2}^{2}\left(\frac{8}{x^2+4}-\frac{x^2}{4}\right)dx$

$$=\left(4Tan^{-1}\left(\frac{x}{2}\right)-\frac{x^3}{12}\right)_{-2}^{2}=2\pi-\frac{4}{3}$$

80) 3

Consider the equation at the conics has center at (0, 0). $ax^2 + 2hxy + by^2 + c = 0$

a,h,b are parameter.

PHYSICS

81) 3

Units and Measurements- Dimensional analysis

82) 1

$$\frac{\Delta V}{V}=\frac{\Delta l}{l}+\frac{\Delta b}{b}+\frac{\Delta h}{h}=\frac{0.1}{10}+\frac{0.1}{20}+\frac{0.1}{5}=\frac{0.7}{20};$$

Hence the percentage error is $\frac{\Delta V}{V}(100)=\frac{0.7}{20}(100)=3.5\%$

83) 4

Conceptual

84) 3

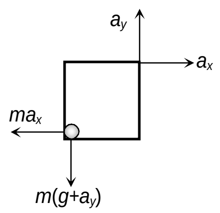
Motion in a straight line- Kinematic equations for uniformly accelerated motion

85) 1

$\mathrm{Fx}=\frac{1}{2}\mathrm{Kx}^2+\frac{1}{2}\mathrm{mV}^2$, calculate for V

86) 3

As $\vec{V}=5t\,\hat{i}+2t\,\hat{j}\;\therefore\;\vec{a}=a_x\hat{i}+a_y\hat{j}=5\hat{i}+2\hat{j}$



$$\vec{F}=ma_x\hat{i}+m(g+a_y)\hat{j}$$

$$\therefore|\vec{F}|=m\sqrt{a_x^2+(g+a_y)^2}=26\ N$$

87) 2

$$\mathrm{mgh}=\frac{1}{2}\mathrm{I}\omega^2,\mathrm{I}=\frac{\mathrm{ml}^2}{3}$$

88) 4

Apply law of conservation of energy

89) 1

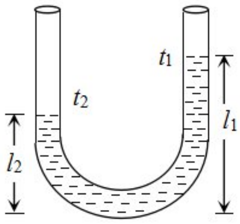
Conceptual

90) 3

$$\frac{d_1+d_2}{2}$$

91) 1

Suppose, height of liquid in each arm before rising the temperature is *l*.



With temperature rise height of liquid in each arm increases *i.e.* $l_1 > l$ and $l_2 > l$

Also $l = \frac{l_1}{1+\gamma t_1} = \frac{l_2}{1+\gamma t_2}$

$\Rightarrow l_1 + \gamma l_1 t_2 = l_2 + \gamma l_2 t_1 \Rightarrow \gamma = \frac{l_1 - l_2}{l_2 t_1 - l_1 t_2}$

92) 4

Conceptual

93) 2

$f_1 = \frac{1}{2\pi}\sqrt{\frac{k_1}{m_2}} \Rightarrow k_1 = 4\pi^2 m f_1^2; k_2 = 4\pi^2 m f_2^2 \qquad \therefore k_p = k_1 + k_2$

94) 2

$F = \frac{YAe}{\ell} = \frac{Y(\pi r^2)e}{\ell}$

95) 2

$\frac{1}{2} mV^2 = \Delta U = nC_V \Delta T = \frac{m}{M}\left(\frac{R}{\gamma - 1}\right)\Delta T$

96) 3

Let the temperature of junction be θ, under steady state condition

$K_A(100 - \theta) = K_B(\theta - 0°)$

$\therefore \theta = 40°C$

97) 1

Conceptual

98) 3

$t = 2\sqrt{\frac{\ell}{g}}$

99) 1

For resonance, the amplitude must be maximum which is possible only when the denominator of expression is zero *i.e.* $a\omega^2 - b\omega + c = 0 \Rightarrow \omega = \dfrac{+b \pm \sqrt{b^2 - 4ac}}{2a}$

100) 3

Frequency of reflected sound heard by driver $n' = n\left(\dfrac{V + V_O}{V - V_S}\right)$

It is given that $n' = 2n$. Hence, $2n = n\left(\dfrac{V + V_{car}}{V - V_{car}}\right) \Rightarrow V_{car} = \dfrac{V}{3}$.

101) 2

102) 4

$$\frac{1}{(75 - x)} - \frac{1}{-x} = \frac{1}{12}$$

103) 2

$\mu = \text{Tan}\theta$

$\Rightarrow \dfrac{1}{\sin c} = \tan\theta$

$\Rightarrow c = \sin^{-1}(\cot\theta)$

104) 2

By using phase difference $\phi = \dfrac{2\pi}{\lambda}(\Delta)$

For path difference λ, phase difference $\phi_1 = 2\pi$ and for path difference $\lambda/4$, phase difference $\phi_2 = \pi/2$. Also by using $I = 4I_0 \cos^2 \dfrac{\phi}{2} \Rightarrow \dfrac{I_1}{I_2} = \dfrac{\cos^2(\phi_1/2)}{\cos^2(\phi_2/2)}$

$$\Rightarrow \frac{K}{I_2} = \frac{\cos^2(2\pi/2)}{\cos^2\left(\dfrac{\pi/2}{2}\right)} = \frac{1}{1/2} \Rightarrow I_2 = \frac{K}{2}.$$

105) 3

Conceptual

106) 1

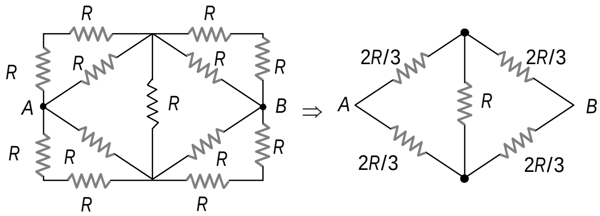
$q_1 = 2CV,\ q_2 = CV$

Now condenser of capacity C is filled with dielectric K, therefore $C_2 = KC$

As charge is conserved

$\therefore q_1 + q_2 = (C_2^{'} + 2C)V' \Rightarrow V' = \dfrac{3CV}{(K+2)C} = \dfrac{3V}{K+2}$

107) 3



Hence $R_{eq} = \frac{2R}{3}$.

108) 2

$V_g = 50\mu A \times 100\Omega, i_g = 50\mu A$

1) $n = \frac{50V}{5mV} = 10000$

$R = G(n-1) = 100(9999) = 999900\,\Omega$

2) $n = \frac{10V}{5mV} = 20,000$

$R = G(n-1) = 100(19999) = 200\,k\Omega$

109) 2

At $t = \infty, i_1 = \frac{E}{R}$

At t = 1 sec, $= \frac{E}{R}\left(1 - e^{-2}\right)$

$\frac{i_1}{i_2} = \frac{e^2}{e^2 - 1}$

110) 3

Magnetic field at any point lying on the current carrying straight conductor is zero.

Here H_1 = Magnetic field at *M* due to current in *PQ*.

H_2= Magnetic field at M due to *QR*

+ magnetic field at *M* due to *QS*

+ magnetic field at *M* due to *PQ*

$= 0 + \frac{H_1}{2} + H_1 = \frac{3}{2}H_1 \Rightarrow \frac{H_1}{H_2} = \frac{2}{3}$

111) 3

Given $X_L = R$

and $Z = \sqrt{2}R$

$P = V_{rms}\, i_{rms} \cos\theta$

$= \frac{E_0^2}{4R}$

112) 1

$$2\pi r_n = n\lambda$$

113) 4

$$\frac{M}{L} = \frac{e}{2m}$$

114) 2

$$\frac{K_1}{K_2} = \frac{h\nu_1 - \phi}{h\nu_2 - \phi}$$

115) 1

Conceptual

116) 4

$$\frac{1}{e} = \frac{N_0 e^{-10\lambda t}}{N_0 e^{-\lambda t}}$$

117) 1

$$\lambda = \frac{12400}{E \text{ in } eV} A^0$$

118) 3

$$V_d = \frac{i}{neA}$$

119) 4

$$m = \frac{E_{max} - E_{min}}{E_{max} + E_{min}}$$

120) 3

$$l = \frac{\lambda}{4}$$

CHEMISTRY

121) 4

$$\frac{\Delta T_f\left(KCl\right)}{\Delta T_f\left(X\right)}=\frac{4}{1}=\frac{i\left(KCl\right)}{i\left(x\right)}=\frac{2}{i\left(x\right)}$$

$$\therefore\ ix=\frac{2}{4}=0.5$$

For association of 3 molecules $i\left(x\right)=1-\left(1-\frac{1}{n}\right)\alpha$

$$=1-\left(1-\frac{1}{3}\right)\alpha=0.5$$

$$\therefore \alpha=0.75$$

122) 1

$$\mathrm{TV}^{\gamma-1}=\text{constant}$$

$$\frac{\mathrm{T}_2}{\mathrm{T}_1}=\left(\frac{\mathrm{V}_1}{\mathrm{V}_2}\right)^{\gamma-1}$$

123) 4

Orthoboric acid (H_3BO_3) is a Lewis acid, it accepts OH^- from water

$$H_3BO_3+H_2O \rightleftharpoons \left[B\left(OH\right)_4\right]^- + H^{\oplus}$$

It is not a H^+ donor.

124) 1

'NO' is paramagnetic due to odd electrons.

125) 3

Soframicine - Anti septic
Aspirin - Anti pyretic
Valium - Sedative

126) 3

$\left[NiCl_4\right]^{2-}$ is paramagnetic as $'Cl^-'$ being a weak ligand, does not cause pairing-up of d-electrons.

127) 1

In hcp unit cell Effective number of atoms are 6, packing fraction is 74% and coordination number is 12. The arrangement of atoms in layers is ABABAB….

128) 1

$\left[Co\left(NH_3\right)_3\left(NO_2\right)_3\right]$ exists in facial and meridonial forms which are Achiral.

129) 4

In, Chlorine atom is at its highest possible Oxidation state therefore cannot undergo disproportionation

130) 3

NO_2 group is strongly deactivating

C*l* is weakly deactivating

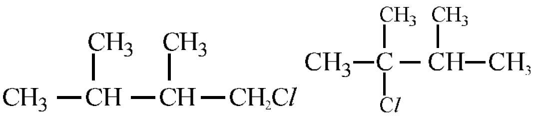
CH_3 is weakly activating

131) 1

Carboxylic acids are stronger acids than phenols

–‘C*l*’ increases acidity and $-CH_3$ group decreases acidity due to hyper conjugation.

132) 2



133) 1

i) In Reimer-Tiemann reaction, phenon turns into salicylaldehyde in presence of alk-$KMnO_4$.

ii) In sandmeyer reaction, benzene diazonium chloride turns into chlorobenzene in presence of cuprous chloride and HCl.

iii) In Gatterman-Koch reaction, Benzene turns into benzaldehyde in presence of CO, HC*l* and $AlCl_3$.

iv) In Etard reaction, Toluene turns into Benzaldehyde in presence of CrO_2Cl_2.

134) 2

Electrometallurgical process is employed to extract highly electropositive elements by taking their fused salts.

Anhydrous $ZnCl_2$ can’t be prepared by heating alone the hydrated salt of $ZnCl_2$ since it undergoes hydrolysis with its own water of crystallization.

Bauxite containing SiO_2 as impurity is known as White Bauxite, which is purified by Serpeck’s Process.

Bauxite containing Fe_2O_3 as impurity is known as Red Bauxite which is purified by Baeyer’s process.

135) 3

Tollen’s reagent oxideses Aldehydes to Carboxylates and HCOOH to CO_2.

136) 3

Order of the reaction is equal to the sum of powers of concentration of the reactants in rate law expression.

For any chemical reaction, $A+B \rightarrow$ products; Rate = $k[A]^x[B]^y$; order = $x + y$

137) 3

$NH_4NO_3 \xrightarrow{\Delta} N_2O$

$NH_4Cl + NaNO_2 \xrightarrow{\Delta} N_2$ (Impure)

$Ba(N_3)_2 \xrightarrow{\Delta} N_2$ (Pure)

$NH_3 + Cl_2(\text{excess}) \rightarrow NCl_3 + HCl$

$NH_3(\text{excess}) + Cl_2 \rightarrow N_2 + NH_4Cl$

138) 3

meq of acid = meq of KOH

139) 4

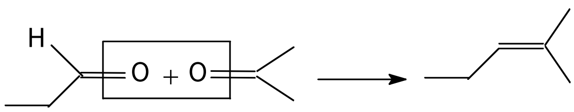
$$\frac{1}{\lambda} = Z^2 R_H \left[\frac{1}{n_1^2} - \frac{1}{n_2^2}\right];$$

$$n_1 = 2$$
$$n_2 = \propto$$

$$\frac{1}{\lambda} = 4R\left[\frac{1}{2^2} - \frac{1}{\propto^2}\right]$$

$$\frac{1}{\lambda} = \frac{1}{R_H}$$

140) 3



141) 1

F_2 oxidizes water to O_2

142) 2

$$\frac{r_{O_2}}{r_{CH_4}} = \frac{n_{O_2}}{n_{CH_4}}\sqrt{\frac{M_{CH_4}}{M_{O_2}}} = \frac{\frac{3}{32}}{\frac{2}{16}}\sqrt{\frac{16}{32}}$$

143) 2

BuNa – N is a type of rubber an Elastomer.

144) 3

$PCl_5 + SO_2 \rightarrow POCl_3 + SOCl_2$

$P_4 + 8SOCl_2 \rightarrow 4PCl_3 + 4SO_2 + 2S_2Cl_2$

$C_2H_5OH + PCl_5 \rightarrow C_2H_5Cl + POCl_3 + HCl$

$CH_3COOH + SOCl_2 \rightarrow CHCOCl + SO_2 + HCl$

$PCl_3 \xrightarrow{\text{Hydrolysis}} H_3PO_3$

$S_2Cl_2 + CH_2 = CH_2 \rightarrow \text{mustard gas}$

145) 3

Ag^+ ion has strong affinity for X^- ions, so in presence of aq $AgNO_3$ reaction take place by SN^1 mechanism, via formation of carbocation intermediate.

146) 4

$$K_1 = \frac{[NH_3]^2}{[N_2][H_2]^3}$$

$$K_2 = \frac{[NO]^2}{[N_2][O_2]}$$

$$K_3 = \frac{[H_2O]}{[H_2][O_2]^{\frac{1}{2}}}$$

$$2NH_3 + \frac{5}{2}O_2 \rightleftharpoons 2NO + 3H_2O,\ K = \frac{[NO]^2[H_2O]^3}{[NH_3]^2[O_2]^{\frac{5}{2}}}$$

147) 4

For $HClO_4, CH_3COOH, HCl$ - pH < 7

For NaCl, pH = 7

148) 2

i) Fructose is a reducing Sugar where as Sucrose is non-reducing.

ii) D-Glucose & D-Mannose have same configuration at C-3, C-4 & C-5.

Therefore they give same Osazone.

149) 4

$Au^{+} + e^{-} \rightarrow Au, E^{0} = 1.69V \quad ....(1)$

$Au^{3+} + 3e^{-} \rightarrow Au, E^{0} = 1.40V \quad ....(2)$

From $(2)-(1)$, $Au^{3+} + 2e^{-} \rightarrow Au^{+}$

$\Delta G_3^0 = \Delta G_2^0 - \Delta G_1^0$

$-2 \times F \times E^{\circ} = (-3 \times F \times 1.4) + (1 \times 1.69 \times F)$

$E^{0} = 1.255V$

$E^{0}_{Au^{+}/Au^{3+}} = -1.255V$

150) 3

In NF_3 and ClO_3^- the central atoms N and C*l* have one lone pair and 3 bond pairs.

151) 2

Proteins give violet colouration with Biuret reagent.

152) 2

Saturated compounds cannot exhibit ring-chain isomerism

153) 1

$n_{eq} H_2O_2 \equiv n_{eq} Na_2SO_3$

$\frac{N \times 25}{1000} = \frac{0.3 \times 20}{1000}$

$N = 0.3 \times \frac{4}{5} = 0.24N$

$\therefore N = \frac{V.S}{5.6}$

$\therefore V.S = 0.24 \times 5.6 = 1.344$

154) 4

In the partial hydrolysis of XeF_6 different products formed are $XeOF_4$ *and* XeO_2F_2

155) 1

$Na + H_2O \longrightarrow NaOH + H_2$

$(A) \qquad (C) \qquad (B)$

$Zn + 2NaOH \longrightarrow Na_2ZnO_2 + H_2$

(D)

$Zn + H_2SO_4 \longrightarrow ZnSO_4 + H_2$

156) 1

$$C_2H_5OH \xrightarrow[PDC]{PCC} CH_3CHO$$

$$CH_3CHO + I_2 \xrightarrow{KOH} CHI_3$$

157) 3

Cannizaro reaction is given by aldehydes with no alpha hydrogen.

158) 2

$$CH_3COOH + NH_3 \xrightarrow{KOH} \underset{(X)}{CH_3COONH_4} \longrightarrow \underset{(Y)}{CH_3CONH_2} + H_2O$$

159) 2

As_2S_3 is a negative sol, so it is coagulated by a positive ion Al^{3+}

160) 1

B.O.D. of fairly pure water = 1ppm