SOLUTION BOOKLET
11th moving 12th (Non-Medical)

MAGNET TALENT SEARCH EXAM
(FOR CLASS: VII, VIII, IX, X, & XI STUDYING STD'S)
SUNDAY, 01 OCTOBER 2023

EASY LEVEL

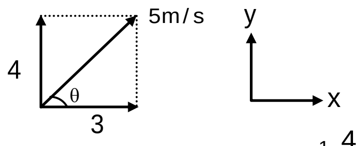
PHYSICS

Sol.1 [C] $\vec{v}_i = 25\,m/s\,(\rightarrow), \vec{v}_f = 15\,m/s\,(\leftarrow)$

$$\vec{v}_f - \vec{v}_i - = \xleftarrow{15} - \xrightarrow{25} = \xleftarrow{40\,m/s}$$

Sol.2 [A] $\vec{v} = \frac{d\vec{r}}{dt} = (3\hat{i} + 4t\hat{j})\,m/s$

$$\vec{v}_{t=1} = (3\hat{i} + 4\hat{j})\,m/s$$



$$\theta = \tan^{-1}\frac{4}{3} = 53^o$$

Sol.3 [A] $\langle\vec{v}\rangle = \frac{\Delta\vec{r}}{\Delta t} = \frac{\vec{r}_{t=10} - \vec{r}_{t=2}}{8} = \frac{(5+3)\hat{i} + (9-1)\hat{j} + 8\hat{k}}{8}\,m/s$

Sol.4 [B] $f = at$

$$\frac{dv}{dt} = at \Rightarrow \int_u^v dv = \int_0^t at\,dt \Rightarrow v - u = \frac{at^2}{2}$$

$$\Rightarrow v = u + a\frac{t^2}{2}$$

Sol.5 [C] to collide, $v_{A_\perp} = V_{B_\perp} \Rightarrow 2\sqrt{3}\sin 60^o = v\sin 45^o$

Sol.6 [C]

$$\left.\begin{matrix} F = 4m_1 = 6m_2 = (m_1 + m_2)\,a \\ m_1 = \frac{F}{4}\ \&\ m_2 = \frac{F}{6} \end{matrix}\right\} a = \frac{F}{(m_1 + m_2)} = \frac{F}{\frac{F}{4} + \frac{F}{6}}$$

Sol.7 [B] $f = ma$

$$= 4 \times 2 = 8N(\rightarrow)$$

$\because$ block does not slide $\Rightarrow$ static friction

Sol.8 [D] $\frac{\partial U}{\partial x} = \frac{2x\,y}{z^3}$; $\frac{\partial U}{\partial y} = \frac{x^2}{z^3}$, $\frac{\partial U}{\partial z} = -3\frac{x^2y}{z^4}$

$$\vec{F} - = \frac{\partial U}{\partial x}\hat{i} - \frac{\partial U}{\partial y}\hat{j} - \frac{\partial U}{\partial z}\hat{k}$$

$$= -\frac{2xy}{z^3}\hat{i} - \frac{x^2}{z^3}\hat{j} + \frac{3x^2y}{z^4}\hat{k}$$

$$\vec{f}_{-(-1,1,1)} = (2\hat{i} - \hat{j} + 3\hat{k})\,N$$

CHEMISTRY

Sol.9 [B] $CH_3 - CH_2 - \overset{2}{C} - \overset{1}{C}OOH$, with $\overset{2}{C} = {}^{3}CH_2$ (double bond)

Sol.10 [C] ERG increases stability of carbocation.

Sol. 11 [D] Geometry is seen from hybridisation

Sol. 12 [C] VBT comprises overlapping and hybridasation both concepts.

Sol. 13 [A] Hint:- D_2O is less polar.

Sol. 14 [D] $X^{3+} = [Ar]\ 3d^5$

$\therefore X = [Ar]\ 4s^2\ 3d^6$

$\therefore X = Fe.$

Sol. 15 [A] $\underset{B.O = 3.5}{NO} \longrightarrow \underset{B.O = 3}{NO^+}$

No. of unpaired electron = 1   0

Sol. 16 [D] Hint:- $\lambda = \frac{h}{mv}$

MATHS

Sol.17 [B] $\because |x+1| < 2$

$-2 < x+1 < 2$

$-3 < x < 1$

$A \in (-3, 1)$

$|x-1| \geq 2$

$x-1 \leq -2$ OR $x-1 \geq 2$

$x \leq -1$ or $x \geq 3$

$B \in (-\infty, -1] \cup [3, \infty)$

$B - A = (-\infty, -3] \cup [3, \infty)$

$= R - (-3, 3)$

Sol.18 [B] $f(0)\ f(3) < 0$

$[-(k^2 + k + 1)]\ [-(k^2 + 4k + 3)] < 0$

$(k^2 + k + 1)\ (k^2 + 4k + 3) < 0$

$k^2 + 4k + 3 < 0 \quad \because k^2 + k + 1 > 0\ \forall\ k \in R$

$(k+1)\ (k+3) < 0$

$k \in (-3, -1)$

Sol.19 [C] $\alpha + \beta = -p$ ....(1)

$\frac{\alpha}{3} + 3\beta = -q$ ....(2)

Eq (1) – 3 × Eq (2)

$(\alpha + \beta) - (\alpha + 9\beta) = (-p) - (-3q)$

$-8\beta = 3q - p$

$\beta = \frac{p - 3q}{8}$

Put value of β in (1)

$\alpha = \frac{3(q - 3p)}{8}$

Now Product of Roots $= \alpha\beta = -r$

$r = \frac{3}{64}(p - 3q)\ (3p - q)$

Sol.20 [B] $2x^2 - 3x + 5 = 0 \rightarrow$ has real roots $\because D < 0$

$\because$ above Eq. has

Common Root with quadratic

$ax^2 - bx + c = 0$; $a, b, c \in N$

$\therefore$ Both roots will be common

$\because$ Imaginary roots come in conjugate pair.

$\Rightarrow \frac{a}{2} = \frac{b}{3} = \frac{c}{5} = k$

$\Rightarrow a = 2k, b = 3k, c = 5k$

$\Rightarrow a + b + c = 10k$

$\because a,b,c \in N \ \therefore a+b+c = 20$ is possible

Sol.21 [B] $2\cos^2 x + \sin^2 x = 1 - (2y-1)^2$

$\underbrace{1+\cos^2 x}_{\text{Minmum value is 1}} = \underbrace{1-(2y-1)^2}_{\text{Maximum value is 1}}$

$\Rightarrow$ Possible only if $\cos^2 x = 0$ & $2y - 1 = 0$

$\cos x = 0 \quad \& \quad y = \frac{1}{2}$

$x = (2n+1)\frac{\pi}{2} \quad \& \quad y = \frac{1}{2}$

$\because x \in [0, 2\pi]$

$\Rightarrow x = \frac{\pi}{2}, \frac{3\pi}{2} \quad \& \quad y = \frac{1}{2}$

No. of $sol^n = 2$ **Ans.**

Sol.22 [C] ${}^nC_o + {}^nC_1 + ... + {}^nC_n = 64$

$2^n = 64$

$n = 6$

greatest binomial coefficient term = 4th term

$\because t_4 - t_3 = n - 1 = 5$

$6_{C_3}\left(3^{-\frac{x}{4}}\right)^3\left(3^{\frac{5x}{4}}\right)^3 - 6_{C_2}\left(3^{-\frac{x}{4}}\right)^4\left(3^{\frac{5x}{4}}\right)^2 = 5$

$20\ 3^{3x} - 15 \times 3^{\frac{3x}{2}} = 5$

Let $3^{x/2} = t$

$20t^2 - 15t = 5$

$4t^2 - 3t - 1 = 0$

$4t^2 - 4t + t - 1 = 0$

$(t-1)(4t+1) = 0$

$\Rightarrow t = 1, \quad \underbrace{t = \frac{-1}{4}}_{\text{Not possible}}$

$3^{x/2} = 1$

$\frac{x}{2} = 0$

$x = 0$

Sol.23 [D] $\Rightarrow (1+t)(1+t)^{40}(1-t+t^2)^{40}$

$\Rightarrow (1+t)(1-t^3)^{40}$

Coefficient of t^{50} in $(1-t^3)^{40} + t(1-t^3)^{40}$

$\Rightarrow$ coefficient of t^{50} in $(1-t^3)^{40}$ + coefficient of t^{49} in $(1-t^3)^{40}$

$\because$ all terms of the expansion have powers multiple of 3, so above both coefficient will be zero.

Ans:- 0

Sol.24 [D] $y = \dfrac{1}{5(1+\tan^2\theta) - \tan^2\theta + 4(1+\cot^2\theta)}$

$$\Rightarrow \frac{1}{9 + 4\left(\tan^2\theta + \dfrac{1}{\tan^2\theta}\right)}$$

$$\because \left(\tan^2\theta + \frac{1}{\tan^2\theta}\right) \text{ minimum} = 2$$

$$\therefore y \text{ maximum} = \frac{1}{9+8} = \frac{1}{17}$$

MODERATE LEVEL

PHYSICS

Sol.25 [C] Area of a vs t graph = change in velocity

$$= \vec{v}_f - \vec{v}_i$$

$$-\frac{1}{2} \times 15 \times 10 = v_f - 25$$

$$v_f = (25 - 75)\ m/s$$

Sol.26 [A] $a \propto t^{3/5}$

$$\frac{dv}{dt} \propto t^{3/5} \Rightarrow \int_0^v dv = \int_0^t t^{3/5} dt$$

$$\Rightarrow v \propto t^{8/5}$$

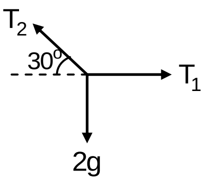
$$\Rightarrow \frac{dx}{dt} \propto t^{8/5} \Rightarrow \int_0^x dx \propto \int_0^t t^{8/5}\, dt$$

$$\Rightarrow x \propto t^{13/5}$$

Sol.27 [D] At complementary angles, range are same.

$$\Rightarrow \text{reqd. angle} = \frac{\pi}{2} - \frac{5\pi}{36}$$

Sol.28 [C] F.B.D. of knot

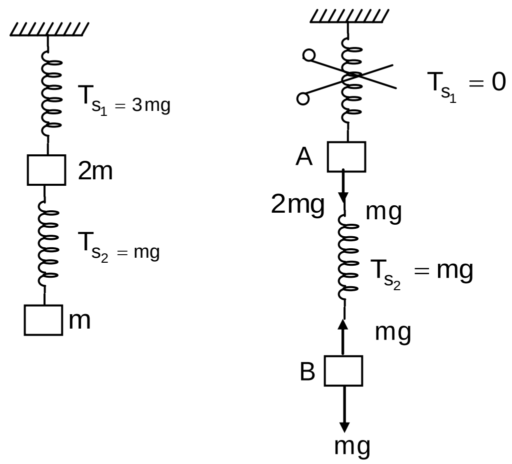


$$\left.\begin{array}{l} T_1 = T_2 \cos 30^o \\ T_2 \sin 30^o = 2g \end{array}\right\} T_1 = 4g \times \frac{\sqrt{3}}{2}$$

$$= 2\sqrt{3}\, g$$

$$= 2\sqrt{3}\ kg - wt$$

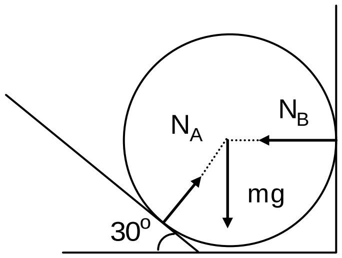
Sol.29 [D]

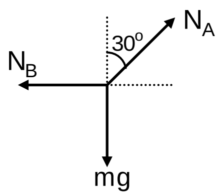


$$3mg = 2ma_A \Rightarrow a_A = \frac{3g}{2} (\downarrow)$$

$$0 = ma_B \Rightarrow a_B = 0$$

Sol.30 [B]





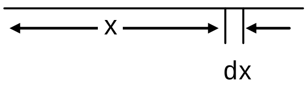
$$N_A \cos 30^o = mg$$
$$N_A \sin 30^o = N_B$$

Sol.31 [D] $S = \frac{t^3}{3} \Rightarrow v = \frac{ds}{dt} = t^2 \Rightarrow v_{t=2} = 4m/s$

W.E.T. $\Rightarrow \sum W = \Delta K.E.$

$$= K.E._f - K.E._i$$
$$= \left(\frac{1}{2} \times 3 \times 4^2 - 0\right) J$$

Sol.32 [B]

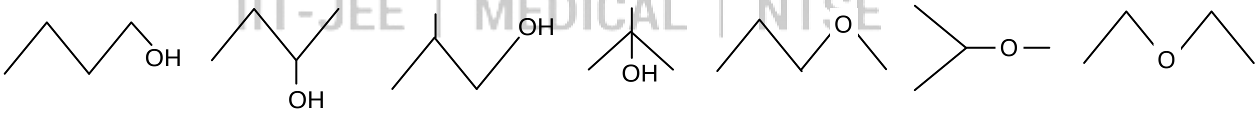


$\lambda = \frac{dm}{dx} = 2 + x \Rightarrow dm = (2 + x)\,dx$

$$x_{cm} = \frac{\int x\,dm}{\int dm} = \frac{\int_0^3 x(2+x)\,dx}{\int_0^3 (2+x)\,dx} = \frac{12}{7}$$

CHEMISTRY

Sol. 33 [B]



Sol. 34 [D] ERG decreases Acidic Strength.

Sol. 35 [D] Fact based

Sol. 36 [D] $CH_3 \equiv \overset{\ominus}{C}$ 

Sol. 37 [A] no. of moles of $H_2SO_4 = \frac{100}{1000} \times 0.02$

no. of molecules of $H_2SO_4 = \frac{100}{1000} \times 0.2 \times N_A$

Sol. 38 [A] 1st oxide:- $Fe_{78}\,O_{22} \Rightarrow Fe_{39}O_{11} \Rightarrow Fe_{39\times3}\,O_{33}$

2^{nd} oxide: $Fe_{70}O_{30} \Rightarrow Fe_7O_3 \Rightarrow Fe_{7\times11}\,O_{3\times11}$

iron weight ratio = $39 \times 3 : 7 \times 11$

$\not{8}7 : \not{7}7$

$8 : 7$

Sol. 39 [A] $KO_2 \to K^+\,O_2{}^-$

17 $O_2^- :-$ no. of unpaired $e^- = 1$

Sol. 40 [B] Fact

MATHS

Sol. 41 [D] $\log_5^5 + \log_5 (x^2 + 1) \le \log_5 (\alpha x^2 + 4x + \alpha)$

$\log_5 5x^2 + 5 \le \log_5 \alpha x^2 + 4x + \alpha$

$5x^2 + 5 \le \alpha x^2 + 4x + \alpha$

$(\alpha - 5)x^2 + 4x + (\alpha - 5) \ge 0 \ \forall x \in R$

$(\alpha - 5) > 0$ & $D \le 0$

$\alpha > 5$ & $16 - 4(\alpha - 5)^2 \le 0$

$16 \le 4(\alpha - 5)^2$

$4 \le \alpha^2 + 25 - 10\alpha$

$\alpha^2 - 10\alpha + 21 \ge 0$

$(\alpha - 3)(\alpha - 7) \ge 0 \Rightarrow \alpha \in (-\infty, 3] \cup [7, \infty)$

Ans:- $\alpha \in [7, \infty)$

Sol. 42 [B] $\alpha^4 - 3\alpha + 1 = 0$

$\alpha(\alpha^3 - 3) + 1 = 0$

$\alpha^3 = 3 - \frac{1}{\alpha}$

$\therefore \alpha^3 + \beta^3 + \gamma^3 + \delta^3$

$\Rightarrow 3 - \frac{1}{\alpha} + 3 - \frac{1}{\beta} + 3 - \frac{1}{\alpha} + 3 - \frac{1}{\delta}$

$= 12 - \left[\frac{1}{\alpha} + \frac{1}{\beta} + \frac{1}{\gamma} + \frac{1}{\delta}\right]$

$= 12 - \left(\frac{\sum \alpha\beta\gamma}{\alpha\beta\gamma\delta}\right)$

$= 12 - \frac{3}{1} = 9$

Sol.43 [B] $\dfrac{2^2(1^2 + 2^2 + ... + n^2)}{1^2 + 2^2 + ... + (2n)^2 - 2^2(1^2 + 2^2 + ... + n^2)}$

$$\Rightarrow \frac{\frac{4n(n+1)(2n+1)}{6}}{\frac{(2n)(2n+1)(4n+1)}{6} - \frac{4n(n+1)(2n+1)}{6}}$$

$$\Rightarrow \frac{4(n+1)}{2(4n+1) - 4(n+1)}$$

$$\Rightarrow \frac{2n+2}{(4n+1) - (2n+2)} = \frac{2n+2}{2n-1} > \frac{101}{100}$$

$\Rightarrow 200n + 200 > 202n - 101$

$\Rightarrow 301 > 2n$

$\Rightarrow 150.5 > n$

Sol.44 [D] $x = 2^{\left(2\log_2 (9^{k-1} + 7)^{\frac{1}{2}}\right)}$

$= 9^{k-1} + 7$

$y = 2^{\left(-5\log_2 (3^{k-1} + 1)^{\frac{1}{5}}\right)}$

$= (3^{k-1}+1)^{-1}$

$= \dfrac{1}{(3^{k-1}+1)}$

Now, xy = 4

$\dfrac{9^{k-1}+7}{3^{k-1}+1} = 4$

$(3^{k-1})^2 + 7 = 4(3^{k-1}) + 4$

Let $3^{k-1} = t$

$\Rightarrow t^2 - 4t + 3 = 0$

$\Rightarrow (t-1)(t-3) = 0$

$\Rightarrow t = 1 \text{ or } t = 3$

$\Rightarrow 3^{k-1} = 1 \text{ or } 3^{k-1} = 3$

$\Rightarrow k-1 = 0 \text{ or } k-1 = 1$

$\Rightarrow k = 1 \text{ or } k = 2$

Sol.45 [A] $\dfrac{(1-\cos\frac{2\pi}{5})+\sin\frac{\pi}{5}}{\cos\frac{\pi}{5}+\sin 2\left(\frac{\pi}{5}\right)}$

$\Rightarrow \dfrac{2\sin^2\frac{\pi}{5}+\sin\frac{\pi}{5}}{\cos\frac{\pi}{5}+2\sin\frac{\pi}{5}\cos\frac{\pi}{5}}$

$\Rightarrow \dfrac{\sin\frac{\pi}{5}(2\sin\frac{\pi}{5}+1)}{\cos\frac{\pi}{5}(1+2\sin\frac{\pi}{5})}$

$\Rightarrow \tan x = \tan\frac{\pi}{5}$

$\Rightarrow x = n\pi + \frac{\pi}{5}, n \in I$

Sol.46 [D] $7^{100} = (49)^{50}$

$= (50-1)^{50}$

$= \underbrace{{}^{50}C_o\, 50^{50} - {}^{50}C_1\, 50^{49} + \ldots\ldots - {}^{50}C_{47}\, 50^3}_{1000\lambda} + \underbrace{{}^{50}C_{48}\, 50^2 - {}^{50}C_{49}\, 50 + {}^{50}C_{50}}_{\text{last three digit of this no. are 001}}$

Similarly $3^{100} = (10-1)^{50}$ also have last three digit 001

So, $7^{100} - 3^{100}$ have last three digit 000.

Sol.47 [A] $\sum_{r=0}^{20} 3^{r+1}\dfrac{{}^{20}C_r}{r+1}$

$\sum_{r=0}^{20} \dfrac{{}^{21}C_{r+1}3^{r+1}}{21}$

$\Rightarrow \dfrac{1}{21}\left[(1+3)^{21} - {}^{21}C_o\right]$

$\Rightarrow \dfrac{4^{21}-1}{21} = \dfrac{2^{42}-1}{21}$

Sol.48 [B] $4\sin\cos\alpha\left[1-2\sin^2\alpha\right]=\frac{\sqrt{3}}{2}$ & $8\cos^4_\alpha-8\cos^2_\alpha+1=\frac{-1}{2}$

$2\sin 2\alpha\cos 2\alpha=\frac{\sqrt{3}}{2}$

$\sin 4\alpha=\frac{\sqrt{3}}{2}$

$\because 4\alpha\in(0,2\pi)$

$4\alpha=\frac{\pi}{3}$ or $\frac{2\pi}{3}$

$\alpha=\frac{\pi}{12}$ or $\frac{\pi}{6}$

$8\cos^2\alpha(\cos^2\alpha-1)=\frac{-3}{2}$

$-8\cos^2\alpha\sin^2\alpha=-\frac{3}{2}$

$4\cos^2\alpha\sin^2\alpha=\frac{3}{4}$

$\sin^2 2\alpha=\frac{3}{4}$

$\sin 2\alpha=\frac{\sqrt{3}}{2}$ or $-\frac{\sqrt{3}}{2}$

$2\alpha=\frac{\pi}{3},\frac{2\pi}{3}$ $(\because 2\alpha\in(0,\pi))$

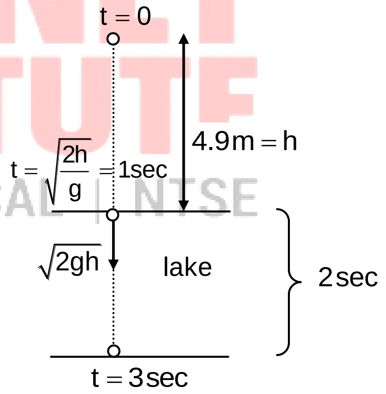
$\alpha=\frac{\pi}{6},\frac{\pi}{3}$

$\alpha=\frac{\pi}{6}$ only

DIFFICULT LEVEL

PHYSICS

Sol.49 [A] depth of lake



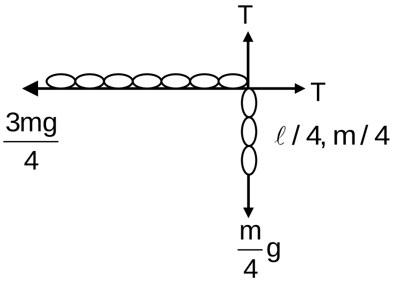
$=\sqrt{2gh}\times 2$

$=\sqrt{2\times 9.8\times 4.9}\times 2$

$=9.8\times 2\text{m}$

Average velocity $=\frac{\text{displacement}}{\text{time taken}}=\frac{(4.9+9.8\times 2)\text{m}}{3\text{ sec}}$

Sol.50 [A] $f_{s_{max}}=f_\ell=\mu\frac{3mg}{4}$



$T=\frac{mg}{4}=F_\ell=\mu\times\frac{3mg}{4}$

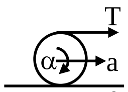
Sol.51 [A] $\vec{v}=2\hat{i}\text{ m/s}$

$\vec{a}=(2\hat{i}+4\hat{j})\text{ m/s}^2$

$=(a_T\hat{i}+a_c\hat{j})$

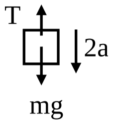
$a_c=4\text{m/s}^2=\frac{v^2}{R}$

Sol.52 [D]



$T \times 2R = 2mR^2\alpha$

$T = mR\alpha$ ....(1)



$mg - T = m \times 2a$ ....(2)

$a = R\,\alpha$ ....(3)

$mg = 3\,ma$

$\boxed{a = \frac{g}{3}}$ = Acceleration of ring .

Acceleration of block = $\frac{2g}{3}$

$T - f_r = ma$

$m\,R\alpha - f_r = ma$

$\boxed{f_r = 0}$

CHEMISTRY

Sol. 53 [C] Fact

Sol. 54 [B] Fact

Sol. 55 [A] $P_{N_2} = 700$ mm $\because n = \frac{PV}{RT}$

$nN_2 = \frac{700}{760} \times \frac{40}{1000} \times \frac{12}{1} \times \frac{}{300}$

Then mass of N can be calculated.

Sol. 56 [A] $E_1\,\text{photon} = \frac{hc}{\lambda} = \frac{6.6 \times 10^{-34} \times 3 \times 10^{8}}{4500 \times 10^{-10}}$ J

$\text{Erequired for } 1\,I_2 \text{ molecule} = \frac{240 \times 10^3}{N_A}$

<u>MATHS</u>

Sol. 57 [C] After taking LCM

$y = \frac{x^3}{(x-\alpha)\,(x-\beta)\,(x-\gamma)}$

$\Rightarrow y(2) = \frac{8}{(2-\alpha)\,(2-\beta)\,(2-\gamma)}$

$\because x^3 - 3x^2 + 2x + 4 = (x-\alpha)\,(x-\beta)\,(x-\gamma)$ put x = 2

$\Rightarrow 8 - 12 + 4 + 4 = (2-\alpha)\,(2-\beta)\,(2-\gamma)$

$\Rightarrow 4 = (2-\alpha)\,(2-\beta)\,(2-\gamma)$

Now $y(2) = \frac{8}{4} = 2$

Sol.58 [A] $S = 1 + \left(1+\frac{1}{5}\right)\left(\frac{1}{2}\right) + \left(1+\frac{1}{5}+\frac{1}{5^2}\right)\left(\frac{1}{2^2}\right) + \ldots\ldots\ldots$

$\frac{1}{2}S = \qquad \left(\frac{1}{2}\right) + \left(1+\frac{1}{5}\right)\left(\frac{1}{2^2}\right) + \ldots\ldots\ldots\ldots$

substracting

$$\frac{S}{2}=1+\left(\frac{1}{5}\right)\left(\frac{1}{2}\right)+\left(\frac{1}{5^2}\right)\left(\frac{1}{2^2}\right)+.......$$

$$\frac{S}{2}=\frac{1}{1-\frac{1}{5}\cdot\frac{1}{2}}$$

$$\frac{S}{2}=\frac{10}{9}\Rightarrow S=\frac{20}{9}$$

Sol.59 [C] $\frac{a}{6-a}+\frac{b}{6-b}+\frac{c}{6-c}\Rightarrow\frac{6}{6-a}-1+\frac{6}{6-b}-1+\frac{6}{6-c}-1\Rightarrow 6\left[\frac{1}{6-a}+\frac{1}{6-b}+\frac{1}{6-c}\right]-3$

Now $AM\geq HM$ on $\frac{1}{6-a},\frac{1}{6-b},\frac{1}{b-c}$

$$\frac{\frac{1}{6-a}+\frac{1}{6-b}+\frac{1}{b-c}}{3}\geq\frac{3}{6-a+6-b+6-c}$$

$$\frac{1}{6-a}+\frac{1}{6-b}+\frac{1}{b-c}\geq\frac{9}{18-[a+b+c]}$$

$$\geq\frac{9}{18-3}$$

$$\geq\frac{9}{15}$$

$$\geq\frac{3}{5}$$

$$\because\left(\frac{1}{6-a}+\frac{1}{6-b}+\frac{1}{b-c}\right)\min=\frac{3}{5}$$

$$\therefore\left(\frac{a}{6-a}+\frac{b}{6-b}+\frac{c}{6-c}\right)\min$$

$$\Rightarrow 6\times\frac{3}{5}-3$$

$$\Rightarrow\frac{3}{5}$$ **Ans.**

Sol.60 [A] $Q=\sum_{r=0}^{n}\frac{\sin 3^r\theta\cos 3^r\theta}{\cos 3^{r+1}\theta\cos 3^r\theta}$

$$=\frac{1}{2}\sum_{r=0}^{n}\frac{\sin(2.3^r\theta)}{\cos 3^{r+1}\cos 3^r\theta}$$

$$=\frac{1}{2}\sum_{r=0}^{n}\frac{\sin(3^{r+1}\theta-3^r\theta)}{\cos 3^{r+1}\theta\cos 3^r\theta}$$

$$=\frac{1}{2}\sum_{r=0}^{n}\frac{\sin 3^{r+1}\theta\cos 3^r\theta-\cos 3^{r+1}\theta\sin 3^r\theta}{\cos 3^{r+1}\theta\cos 3^r\theta}$$

$$=\frac{1}{2}\sum_{r=0}^{n}\tan 3^{r+1}\theta-\tan 3^r\theta$$

$$=\frac{1}{2}\begin{pmatrix}\tan 3\theta-\tan\theta\\ \tan 3^2\theta-\tan 3\theta\\ \vdots\\ \tan 3^{n+1}\theta-\tan 3^n\theta\end{pmatrix}$$

$$Q=\frac{1}{2}(\tan 3^{n+1}\theta-\tan\theta)$$

$2Q=P$ **Ans.**