ALLEN CAREER INSTITUTE KOTA (RAJASTHAN)

CLASSROOM CONTACT PROGRAMME
(Academic Session : 2021 - 2022)

JEE (Main)
Sample Test Paper # 05

JEE(Main) : Leader Course

ANSWER KEY

PART-1 : PHYSICS

SECTION-I	Q.	1	2	3	4	5	6	7	8	9	10
	A.	D	D	A	B	A	C	C	D	D	D
	Q.	11	12	13	14	15	16	17	18	19	20
	A.	A	A	B	B	A	A	A	A	A	D
SECTION-II	Q.	1	2	3	4	5	6	7	8	9	10
	A.	0.50	7.00	75.00	3.00	8.00	16.00	8.00	1771.43	21.00	675.00

PART-2 : CHEMISTRY

SECTION-I	Q.	1	2	3	4	5	6	7	8	9	10
	A.	D	C	D	C	C	D	C	C	A	B
	Q.	11	12	13	14	15	16	17	18	19	20
	A.	A	B	A	D	B	C	A	A	A	D
SECTION-II	Q.	1	2	3	4	5	6	7	8	9	10
	A.	4.00	1.00	3.00	40.00	5.00	0.34	14.10	99.00	5.00	5.00

PART-3 : MATHEMATICS

SECTION-I	Q.	1	2	3	4	5	6	7	8	9	10
	A.	B	D	A	C	A	D	D	A	A	D
	Q.	11	12	13	14	15	16	17	18	19	20
	A.	B	B	A	C	C	C	C	C	B	D
SECTION-II	Q.	1	2	3	4	5	6	7	8	9	10
	A.	1.00	5.00	1.00	9.00	17.00	-81.00	8.00	1.00	2.00	32.50

HINT – SHEET

PART-1 : PHYSICS

SECTION-I

1. Ans (D)

Let R be their individual resistance at 0ºC.
Their resistance at any other temperature t is $R_1 = R(1 + \alpha_1 t)$ and $R_2 = R(1 + \alpha_2 t)$
In series

$R_{series} = R_1 + R_2 = R[2 + (\alpha_1 + \alpha_2).t] = 2R\left[1 + \frac{\alpha_1 + \alpha_2}{2} t\right]$

$a_{series} = \frac{\alpha_1 + \alpha_2}{2}$

In parallel

$R_{Parallel} = \frac{R_1 + R_2}{R_1 + R_2} = \frac{R(1+\alpha_1 t)\, R(1+\alpha_2 t)}{R(2+\alpha_1+\alpha_2)t}$

$= \frac{R^2(1+\alpha_1+\alpha_2)t}{2R\left(1 + \frac{\alpha_1+\alpha_2}{2} t\right)} = \frac{R}{2}\left(1 + \frac{\alpha_1+\alpha_2}{2}\right)$

$\alpha_{Parallel} = \frac{\alpha_1 + \alpha_2}{2}$

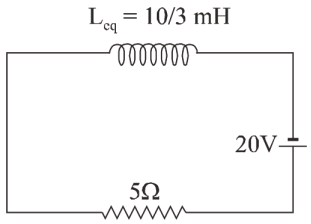
2. Ans (D)

The energy of a charged particle moving in magnetic field remains constant because the magnetic field does not do any work. Therefore kinetic energy is constant i.e. u = v.
The force on electron will act along negative y-axis initially. The electron will undergo circular motion in clockwise direction and emerge out the field. So y < 0.

3. Ans (A)

$V_{rms} = \sqrt{\frac{10^2 + 10^2}{2}} = 10V$

4. **Ans (B)**



$$\text{Leq.} = \frac{5\times 10}{5\times 10} = \frac{10}{3}\text{mH}$$

Current in steady start,

$$I = \frac{20}{5} = 4A$$

As L_1 & L_2 are in parallel

$$I_1 = I\left(\frac{I_2}{L_1+L_2}\right) = 4\times\frac{10}{10+5}$$

$$I_1 = \frac{4\times 10}{15} = \frac{8}{3}A$$

5. **Ans (A)**

Initial velocity of each point onthe rod is zero so angular velocity of rod is zero.

Torque about O

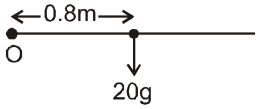
$\tau = I\,\alpha$

$$20g\,(0.8) = \frac{m\ell^2}{3}\alpha$$

$$\Rightarrow 20g\,(0.8) = \frac{20\,(1.6)^2}{3}\alpha$$

$$\Rightarrow \frac{3\,g}{3.2} = \alpha = \text{angular acceleration}$$

$$\Rightarrow \alpha = \frac{15\ g}{16}$$



8. **Ans (D)**

$$\frac{r_1}{r_2} = \frac{1}{2}$$

$$\text{PE (per unit volume)} = \frac{1}{2y}\left(\frac{F}{A}\right)^2$$

$PE \propto 1/A^2$

$$\frac{PE_1}{PE_2} = \frac{A_2^2}{A_1^2} = 16:1$$

11. **Ans (A)**

$$\phi = BA = (B_0+\alpha t)\pi r^2$$

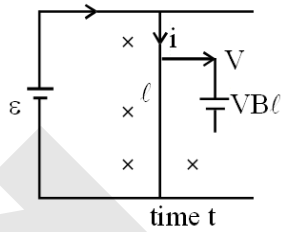
$$\varepsilon = -\frac{d\phi}{dt} = -\frac{d}{dt}[(B_0+\alpha t)\pi r^2]$$

$$\varepsilon = -\pi r^2\alpha$$

12. **Ans (A)**

$$i = \frac{\varepsilon - V B\ell}{R}$$

$$F = iB\ell = \left(\frac{\varepsilon - V B\ell}{R}\right)B\ell$$



$$m\frac{dv}{dt} = \frac{(\varepsilon - V B\ell)B\ell}{R}$$

$$\int_0^v \frac{dv}{\varepsilon - V B\ell} = \frac{B\ell}{mR}\int_{t=0}^{t} dt$$

$$-\frac{1}{B\ell}\ln\left(\frac{\varepsilon - V B\ell}{\varepsilon}\right) = \frac{B\ell}{mR}t$$

$$v = \frac{\varepsilon}{B\ell}\left(1 - e^{-\frac{B^2\ell^2}{mR}t}\right)$$

$$v = 100\left(1 - e^{-t/200}\right)$$

13. **Ans (B)**

$$V^2 = V_R^2 + V_C^2$$

14. **Ans (B)**

$$n_e = \frac{n_i^2}{n_h} = \frac{(10^{13})^2}{10^{11}} = 10^{15}\text{cm}^{-3}$$

15. **Ans (A)**

Given

$$\frac{N_2 - N_3}{N_1 - N_2} = 0.3$$

$$\Rightarrow \frac{N_0e^{-2\lambda} - N_0e^{-3\lambda}}{N_0e^{-\lambda} - N_0e^{-2\lambda}} = 0.3$$

$$\Rightarrow e^{-\lambda} = 0.3$$

Number of a – particle emitted

Per second = $N_0 - N_1$

$= N_0(1 - e^{-\lambda})$

$= 10^{20}\,(1–0.3)$

$= 7\times 10^{19}$

19. **Ans (A)**

In an isothermal process, temperature remains constant and since internal energy is a function of temperature only, therefore there will be no change in the internal energy $\Delta U = 0$

Using the first law of thermodynamics

$\Delta U = Q - W = 0$

or $Q = W = +600$ J Thus, the gas absorbs 600 J of heat from the surroundings.

20. **Ans (D)**

$PV = \frac{m}{M}RT$

$P \alpha m.T$

$\frac{P}{P/2} = \frac{28}{m} \times \frac{330}{300}$

$m = \frac{28}{2} \times \frac{33}{30} = \frac{154}{10}$

Leaked mass $= 28 - \frac{154}{10} = \frac{126}{10} = \frac{63}{5}$ gm

PART-1 : PHYSICS

SECTION-II

1. **Ans (0.50)**

Field due to +2e charge sphere at distance d from the centre $E = \frac{2ked}{R^3}$

Force on electron $F = eE = \frac{2ke^2d}{R^3}$

$F_c = \frac{ke^2}{4d^2}$

$\frac{2ke^2d}{R^3} = \frac{ke^2}{4d^2} = \Rightarrow R^3 = 8d^3 \Rightarrow R = 2d$

2. **Ans (7.00)**

p.d. across 3 ohm or 1 microfarad

$= 9\left(\frac{3}{3+6}\right) = 3V$

Its charge = 3 micro coulomb

p.d. across 7 ohm or 3 microfarad

$= 9\left(\frac{7}{7+2}\right) = 7V$

Its charge = 21 μC

4. **Ans (3.00)**

In Class notes

5. **Ans (8.00)**

$600 - (30g \sin\theta + \mu\, 30g \cos\theta) = (60+30) \times a$

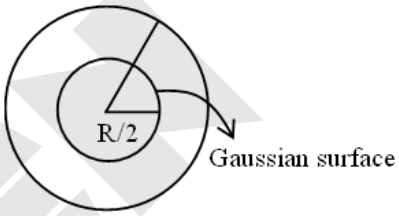
$\Rightarrow a = \frac{10}{3}$

$v = \sqrt{2\left(\frac{10}{3}\right)6} = \sqrt{40}$

$\therefore \quad 0 = 40 - 2 \times g(\sin\theta + \mu\cos\theta) \times (\ell - 6)$

$\therefore \quad \ell = 8$

6. **Ans (16.00)**



$\oint \vec{E} . d\vec{s} = \frac{q_{in}}{\varepsilon_0}$

$E4\pi\left(\frac{R}{2}\right)^2 = \frac{\int_0^{R/2} \rho 4\pi r^2 dr}{\varepsilon_0}$

$\Rightarrow E\pi R^2 = \frac{\int_0^{R/2} Kr4\pi r^2 dr}{\varepsilon_0}$

$E\pi R^2 = \frac{K4\pi}{\varepsilon_0}\left(\frac{r^4}{4}\right)_0^{R/2}$

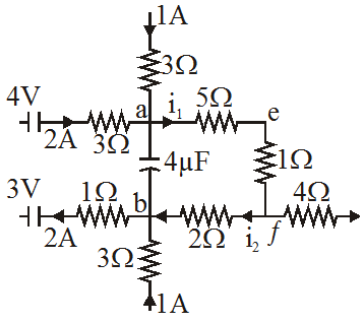
$ER^2 = \frac{4K}{\varepsilon_0}\left[\left(\frac{R}{2}\right)^4 - 0^4\right]$

$ER^2 = \frac{4K}{\varepsilon_0}\left[\frac{R^4}{16 \times 4}\right]$

$E = \frac{KR^2}{16\varepsilon_0}$

7. **Ans (8.00)**

When the capacitor plates get fully charged, there will be no current in branch ab. Remember capacitance acts as the open circuit since capacitance offers infinite resistance to d.c. The capacitance simply collects the charge



Applying Kirchhoff's first law to the junctions a and b, we find $i_1 = 3A$ and $i_2 = 1A$

Now applying Kirchhoff's second law to the closed mash aefba, we get

$3 \times 5 + 3 \times 1 + 1 \times 2 = V_a - V_b$

or $V_a - V_b = 20$ V

$U = \frac{1}{2} C(V_a - V_b)^2 = \frac{1}{2} \times 4 \times 10^{-6} \times (20)^2$

$= 0.8$ mJ

8. **Ans (1771.43)**

$$\lambda_{max} = \frac{12400 eV - Å}{Eg} = \frac{12400}{0.7} Å$$

9. **Ans (21.00)**

$$A = A_0 \left(\frac{1}{2}\right)^{\frac{t}{T_{\frac{1}{2}}}}$$

$$\Rightarrow 5 \times 10^{-6} = 64 \times 10^{-5} \left(\frac{1}{2}\right)^{\frac{t}{3}}$$

$$\Rightarrow \frac{1}{128} = \left(\frac{1}{2}\right)^{\frac{t}{3}}$$

$\Rightarrow t = 21$ days

PART-2 : CHEMISTRY

SECTION-I

3. **Ans (D)**

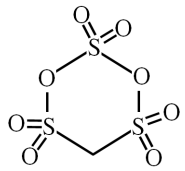
In. SiO_2, B_2H_6, B_2H_6, Al_2Cl_6, Diamond, $HClO_4$, and $H_2S_2O_5$ hybridisation of central atom is sp^3.

4. **Ans (C)**

Van-Arkel process is used for Zr and Ti.

7. **Ans (C)**

$(SO_3)_3$ or S_3O_9



S–S bonds = 0

S–O–S linkages = 3

σ – bonds = 12

π – bonds = 3

8. **Ans (C)**

$NH_4HS\ (s) \rightleftharpoons NH_3(g) + H_2S(g)$

$0.9 \quad 0.9$

$K_P = 0.9 \times 0.9 = 0.81$

9. **Ans (A)**

$\pi_1 = \pi_2$

$i_1 c_1 = i_2 c_2$

$$(1 + 2\alpha_1) \times \frac{17.4 \times 1000}{174 \times 100} = (1 + \alpha_1) \times \frac{5.85 \times 1000}{58.5 \times 100}$$

$\alpha_1 = 0.5 \quad \therefore \alpha$ in % = 50%

10. **Ans (B)**

From the given formula it is clear that for every 100 oxide ions there are only 98 nickel ions. Suppose, out of 98 nickel ions x exist as Ni^{+2} and the remaining (98 – x) exist as Ni^{+3}.

Total positive charge on 98 nickel ions

$= x \times 2 + (98 - x) \times 3 = 2x + 3\ (98 - x)$

Total negative charge on 100 oxide ions

$= 100 \times 2 = 200$

Due to electrical neutrality $2x + 3\ (98 - x) = 200$

$x = 94$

$\therefore$ Fraction of nickel as Ni^{+2} =

and Fraction of nickel as Ni+3 = 100 – 96 = 4%

11. **Ans (A)**

$NaCl + 4H_2O \longrightarrow NaClO_4 + 4H_2$

$-1 \qquad +7$

Change in oxidation no. of $NaClO_4$ (V.F.) = 8

Molecular wt. of $NaClO_4$ = 122.5 g/mole

Moles of $NaClO_4 = \frac{1000}{122.5} = 8.16$

No. of Faradays = $8.16 \times 8 \Rightarrow 65.3$

12. Ans (B)

Dalton law

$p_1v_1 + p_2v_2 = p_fv_f$

$20 \times 20 + 1(v - 20) = 5\ (v)$

$400 + v - 20 = 5v$

$\frac{380}{4} = v = 95\ L$

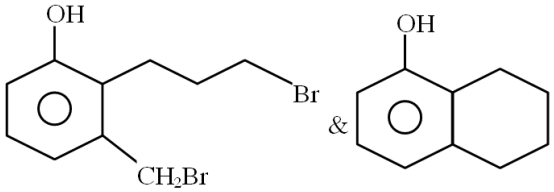
13. Ans (A)

$C + 2H_2 \longrightarrow CH_4 \qquad \Delta H_f^\circ = -74.81\ KJ$

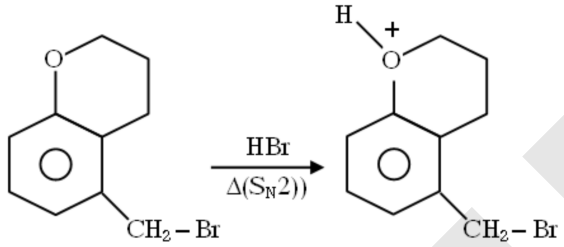
$\Delta S^\circ = S^\circ_{CH_4} - S^\circ_C - 2S^\circ_{H_2}$

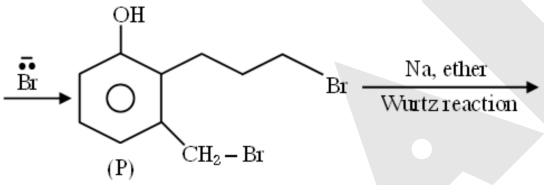
$= 186.3 - 5.70 - 2 \times 130.7 \quad = -80.8$

14. Ans (D)

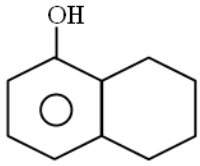


Here the reaction is as follows





(P)



(Q)

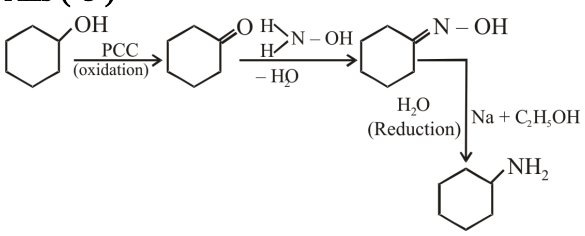
15. Ans (B)

r ⇒ localised eqe

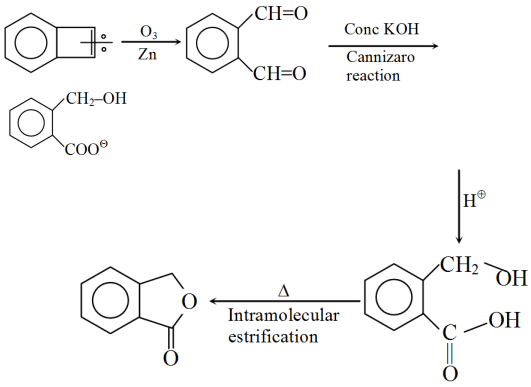
P ⇒ Delocalised eqe

q ⇒ More delocalised epe

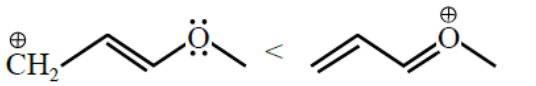
16. Ans (C)



17. Ans (A)

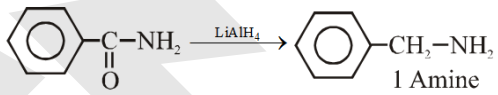


18. Ans (A)



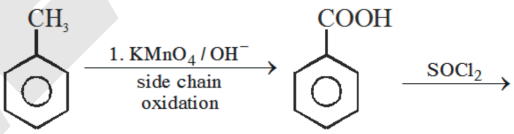
More stable
to complete octel

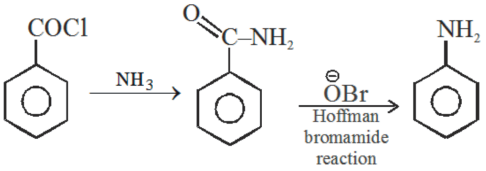
19. Ans (A)



1 Amine

20. Ans (D)





PART-2 : CHEMISTRY

SECTION-II

1. Ans (4.00)

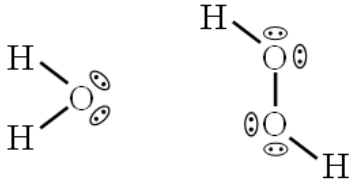
$Cl_2 \rightarrow$ Greenish yellow

$NO_2 \rightarrow$ Brown gas

$CdS \rightarrow$ Yellow

$Cu_2[Fe(CN)_6] \rightarrow$ Chocolate brown

2. Ans (1.00)



p = 6

q = 5

p – q = 6 – 5 = 1

3. Ans (3.00)

CrO_2Cl_2 has d^3S hybridisation and all 3d-orbitals are non-axial which are d_{xy} ; d_{yz} and d_{xz}.

4. Ans (40.00)

In the mixture of $FeSO_4$ and $Fe_2(SO_4)_3$ only $FeSO_4$ is oxidisable

$\therefore$ eq. $(FeSO_4)$ = eq. $(KMnO_4)$

$\Rightarrow \quad n \times x = (M \times x) \times VL$

$\Rightarrow \quad n \times 1 = (0.1 \times 5) \times 0.6$

$\Rightarrow \quad n = 0.3$

$\therefore$ moles of $Fe_2(SO_4)_3 = 0.5 - 0.3$

$= 0.2 = \dfrac{0.2}{0.5} \times 100\% = 40\%$

5. Ans (5.00)

$$A_{(g)} + B_{(g)} \rightarrow 2C_{(g)} + 3D_{(g)}$$

t=0, 2 2

t=t, 2-x 2-x 2x 3x

$4 + 3x = 8.5$

$x = 1.5$

$$t_{1/2} = \frac{\ln 2}{k} = \frac{0.693 \times 10^2}{27.72} = 2.5 \text{ min}$$

$$\text{Time taken} : 2 \xrightarrow[\text{min}]{2.5} 1 \xrightarrow[\text{min}]{2.5} 0.5$$

$= 2.5 + 2.5 = 5$ min

6. Ans (0.34)

Mass of NH_3 gas adsorbed $= \dfrac{\Delta P \,.\, V \,.\, M.}{RT}$

$= \dfrac{0.3 \times 8.21 \times 17}{0.0821 \times 300} = 1.7$ gm

$\therefore$ Mass of NH_3 gas adsorbed per gm of charcoal

$= \dfrac{17}{5} = 0.34$ gm

7. Ans (14.10)

$$k = \frac{\ln 2}{6} = \frac{1}{3}\ln\frac{x}{10}$$

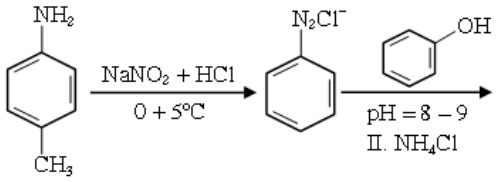
$$\frac{\ln 2}{6} \times 3 = \ln\frac{x}{10}$$

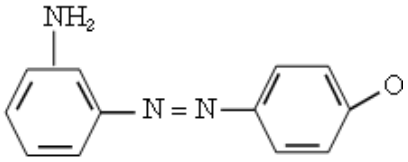
$$\ln\sqrt{2} = \ln\frac{x}{10}$$

$$x = 10\sqrt{2}$$

$= 14.1$ mg

8. Ans (99.00)



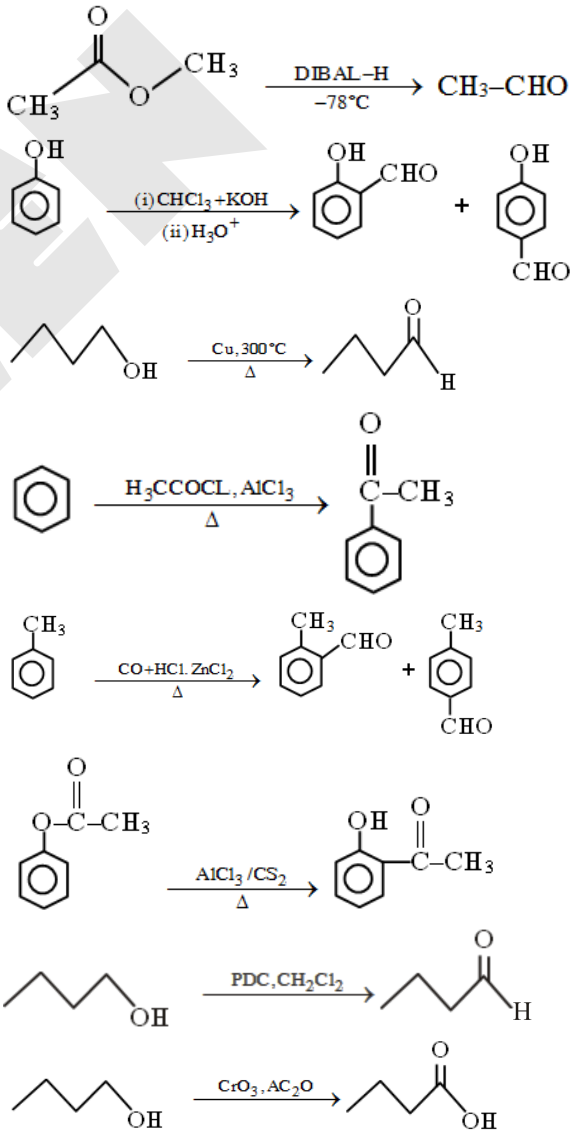


(B)

Molar mass of B = 198 = x

$$\frac{x}{2} = \frac{198}{2} = 99.00$$

9. Ans (5.00)



10. Ans (5.00)

b, c, d, e, f

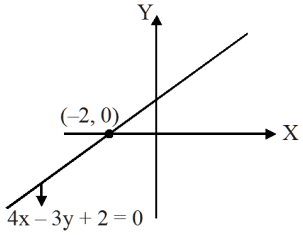
PART-3 : MATHEMATICS

SECTION-I

5. Ans (A)

Required line is $4x - 3y + 1 = 0$

$\left|\frac{\lambda}{5}\right| = \frac{3}{5}$



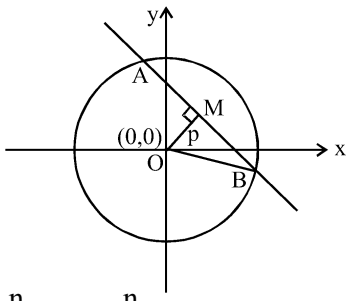
$\Rightarrow 1 = \pm 3.$

So, required equation of line is

$4x - 3y + 3 = 0$ and $4x - 3y - 3 = 0$

(1) 0

6. Ans (D)



$p = \frac{n}{\sqrt{2}}$, but $\frac{n}{\sqrt{2}} < 4 \Rightarrow n = 1, 2, 3, 4, 5.$

Length of chord AB $= 2\sqrt{16 - \frac{n^2}{2}}$

$= \sqrt{64 - 2n^2} = \ell(\text{say})$

For $n = 1, \ell^2 = 62$

$n = 2, \ell^2 = 56$

$n = 3, \ell^2 = 46$

$n = 4, \ell^2 = 32$

$n = 5, \ell^2 = 14$

$\therefore$ Required sum = 62 + 56 + 46 + 32 + 14 = 210

7. Ans (D)

Vertex is $(a^2, 0)$

$y^2 = -(x - a^2)$ and $x = 0 \Rightarrow (0, \pm 2a)$

Area of triangle is $= \frac{1}{2}.\ 4a\ .\ (a^2) = 250$

$\Rightarrow a^3 = 125$ or $a = 5$

8. Ans (A)

Equation of tangents

$y^2 = 12x \Rightarrow y = 2x + \frac{3}{m}$

$\frac{x^2}{1} - \frac{y^2}{8} = 1 \Rightarrow y = mx \pm \sqrt{m^2 - 8}$

Since they are common tangent

$\therefore \frac{3}{m} = \pm\sqrt{m^2 - 8}$ | $\frac{x^2}{1} - \frac{y^2}{8} = 1$

$m^4 - 8m^2 - 9 = 0$ | $e = 3$

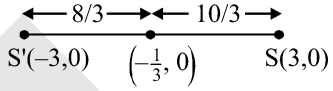
$m = \pm 3$ | $ae = 3$

$\therefore y = 3x + 1 \quad > \quad P\left(-\frac{1}{3}, 0\right)$,

$y = -3x + 1$

$S = (3, 0)$

$S' = (-3, 0)$



9. Ans (A)

$({}^{10}C_0)^2 + ({}^{10}C_1)^2 + \ldots\ldots + ({}^{10}C_{10})^2 = {}^{20}C_{10}$ .....(1)

$({}^{10}C_0)^2 - ({}^{10}C_1)^2 + ({}^{10}C_2)^2 - ({}^{10}C_3)^2 + \ldots\ldots$

$\ldots\ldots + ({}^{10}C_{10})^2 = {}^{10}C_5(-1)^5$ .....(2)

from equation (1) & equation (2)

$({}^{10}C_1)^2 + ({}^{10}C_3)^2 + \ldots\ldots + ({}^{10}C_9)^2 = \frac{{}^{20}C_{10} + {}^{10}C_5}{2}$

10. Ans (D)

$\Delta = 0$

11. Ans (B)

The given equation is

$|z|^n = (z^2 + z)|z|^{n-2} + 1$

$\Rightarrow z^2 + z$ is real

$\Rightarrow z^2 + z = \bar{z}^2 + \bar{z}$

$\Rightarrow (z - \bar{z})(z + \bar{z} + 1) = 0$

$\Rightarrow z = \bar{z} = x$ as $z + \bar{z} + 1 \neq 0 \quad (x \neq -1/2)$

Hence, the given equation reduces to

$x^n = x^n + x|x|^{n-2} + 1$

$\Rightarrow x|x|^{n-2} = -1$

$\Rightarrow x = -1$

So number of solution is 1.

12. Ans (B)

$k = \sqrt{1\frac{10^{10} - 1}{10 - 1} - 2\frac{10^5 - 1}{10 - 1}}$

$= \frac{1}{3}\sqrt{(10^5 - 1)^2} = 3\frac{10^5 - 1}{10 - 1}$

$= 33333$

14. Ans (C)

Total ways = $\frac{16!}{(2!)^8 8!}$

Number of ways in which P_4 and P_9 are in same groups = $\frac{14!}{(2!)^7 7!}$

Number of ways in which they are in different groups = $\frac{16!}{(2!)^8 8!} - \frac{14!}{(2!)^7 7!}$

$= \frac{14!}{(2)^7 7!}\left(\frac{15 \cdot 16}{2 \cdot (8)} - 1\right)$

$= \frac{14 \cdot 14!}{(2)^7 7!}$

Probability $= \frac{\frac{14 \cdot 14!}{(2)^7 \cdot 7!}}{\frac{16!}{(2)^8 \cdot 8!}}$

$= \frac{14.8.2}{15.16} = \frac{14}{15}$

17. Ans (C)

$f''(x) > 0;\ \forall x \in R$

$\Rightarrow f'(x)$ is increasing $\forall x \in R$

$g'(x) = -f'(2-x) + f'(4+x)$

If $g'(x) > 0$

$\Rightarrow f'(4+x) > f'(2-x)$

$\Rightarrow (4+x) > (2-x)$

$\Rightarrow 2x > -2$

$\Rightarrow x > -1$

$\Rightarrow x \in (-1, \infty)$

19. Ans (B)

$\frac{1}{\sin 1^\circ}\left[\frac{\sin 1^\circ}{\sin 1^\circ \sin 2^\circ} + \frac{\sin 1^\circ}{\sin 2^\circ \sin 3^\circ} + \ldots + \frac{\sin 1^\circ}{\sin 89^\circ \sin 90^\circ}\right]$

$\frac{1}{\sin 1^\circ}\left[\frac{\sin(2^\circ - 1^\circ)}{\sin 1^\circ \sin 2^\circ} + \ldots + \frac{\sin(90^\circ - 89^\circ)}{\sin 89^\circ \sin 90^\circ}\right]$

$\frac{1}{\sin 1^\circ}[(\cot 1^\circ - \cot 2^\circ) + \ldots + (\cot 89^\circ - \cot 90^\circ)]$

$\frac{\cot 1^\circ}{\sin 1^\circ} = \frac{\cos 1^\circ}{\sin^2 1^\circ}$

20. Ans (D)

Consider $\sim [p \rightarrow (\sim p \vee q)] \equiv p \wedge \sim (\sim p \vee q)]$

$\equiv p \wedge (p \wedge \sim q) \equiv p \wedge p \wedge \sim q \equiv p \wedge \sim q$

PART-3 : MATHEMATICS

SECTION-II

3. Ans (1.00)

Angle bisector is $x - y = 0$

$\Rightarrow \frac{|\beta - (1-\beta)|}{\sqrt{2}} = \frac{3}{\sqrt{2}}$

$\Rightarrow |2\beta - 1| = 3$

$\Rightarrow \beta = 2$ or -1

4. Ans (9.00)

$\vec{r} = \left(\hat{i} + \hat{k}\right) + t\left(\hat{i} + 3\hat{j} - \hat{k}\right)$

point or line (1, 0, 1) also lies on plane

$x + y + cz = d \Rightarrow 1 + 0 + c = d$

$d = c + 1$ ..(1)

normal of plane is perpendicular to line of line $< 1,3,-1 >$, dr of normal $< 1,1,c >$

$1.1 + 3.1 + C.(-1) = 0 \Rightarrow c = 4$

from (1) $d = 4 + 1 = 5 \Rightarrow c + d = 4 + 5 = 9$

5. Ans (17.00)

$\left(\frac{1}{a_1} - \frac{1}{a_2}\right) + \left(\frac{1}{a_2} - \frac{1}{a_3}\right) + \ldots \left(\frac{1}{a_9} - \frac{1}{a_{10}}\right) = \frac{9d}{64}$

$\Rightarrow \frac{a_{10} - a_1}{a_1 a_{10}} = \frac{9d}{64}$

$\Rightarrow a_1 a_{10} = 64$

Also

$(a_1 + a_{10})\left(\frac{1}{a_1 a_{10}} + \ldots \frac{1}{a_{10} a_1}\right) = \frac{a_1 + a_{10}}{10}\left(\frac{1}{a_1} + \ldots \frac{1}{a_{10}}\right)$

$\Rightarrow 2\left(\frac{1}{a_1} + \ldots \frac{1}{a_{10}}\right) = \frac{a_1 + a_{10}}{10}\left(\frac{1}{a_1} + \ldots \frac{1}{a_{10}}\right)$

$\Rightarrow a_1 + a_{10} = 20$

6. Ans (-81.00)

$\because \quad f(x) = \frac{x^2 + 2x + 5}{x^2 + x + 1}$

$= \frac{(x+1)^2 + 4}{\left(x + \frac{1}{2}\right)^2 + \frac{3}{4}} > 0$

$\therefore$ f(x) is into and

$f'(x) = -\frac{x^2 + 8x + 3}{(x^2 + x + 1)^2}$

f'(x) = 0, has real value of x so function is many one

Hence, function is many one and into.

8. **Ans (1.00)**

$y = 3^{x-1} \ln x$ & $y = x^{x-1}$

Point of intersection (1, 0)

$y' = 3^{x-1} \ln 3 \ln x + \frac{3^{x-1}}{x} = 1 = m_1$

$y' = x^x(1 + \ln x) = 1 = m_2$

$\therefore$ Angle = 0

$\therefore \cos 0 = 1$

9. **Ans (2.00)**

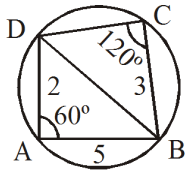
In ΔABD,

$\cos 60^\circ = \frac{2^2 + 5^2 - BD^2}{2(3)(5)}$

$\Rightarrow \quad BD^2 = 19$

Now, in ΔBCD

$\cos 120^\circ = \frac{CD^2 + 9 - 19}{2(3)(CD)}$



$\Rightarrow \quad CD^2 + 3CD - 10 = 0$

$\Rightarrow \quad CD = -5, 2$

$\Rightarrow \quad CD = 2 \qquad (\because CD \neq -5)$

10. **Ans (32.50)**

$\text{Median} = \ell + \frac{\frac{N}{2} - CF}{f} \times h$

$= 30 + \frac{15 - 13}{8} \times 10$

$= 30 + \frac{20}{8} = 32.5$