ALLEN CAREER INSTITUTE KOTA (RAJASTHAN)

DISTANCE LEARNING PROGRAMME
(Academic Session : 2024 - 2025)

JEE (Main)
MAJOR
02-03-2025

JEE(Main) : LEADER TEST SERIES / JOINT PACKAGE COURSE

ANSWER KEY

PART-1 : PHYSICS

SECTION-I	Q.	1	2	3	4	5	6	7	8	9	10
	A.	B	C	B	B	B	A	C	D	B	A
	Q.	11	12	13	14	15	16	17	18	19	20
	A.	B	C	A	D	D	A	B	B	D	D
SECTION-II	Q.	1	2	3	4	5					
	A.	36	5	8	2	25					

PART-2 : CHEMISTRY

SECTION-I	Q.	1	2	3	4	5	6	7	8	9	10
	A.	D	D	A	A	D	C	C	D	C	A
	Q.	11	12	13	14	15	16	17	18	19	20
	A.	C	B	D	B	C	C	B	C	B	D
SECTION-II	Q.	1	2	3	4	5					
	A.	0	2	15	75	0					

PART-3 : MATHEMATICS

SECTION-I	Q.	1	2	3	4	5	6	7	8	9	10
	A.	A	D	C	C	C	A	A	A	A	B
	Q.	11	12	13	14	15	16	17	18	19	20
	A.	C	B	A	A	B	A	B	C	B	D
SECTION-II	Q.	1	2	3	4	5					
	A.	40	39	120	2	7					

HINT – SHEET

PART-1 : PHYSICS

SECTION-I

1. Ans (B)

$\vec{P}_i = 0.15 \times 12 \left(\hat{i}\right)$

$\vec{P}_f = 0.15 \times 12 \left(-\hat{i}\right)$

$\left|\overrightarrow{\Delta P}\right| = 3.6 \text{ kg} - \text{m/s}$

$3.6 = F\ \Delta t$

$3.6 = 100\ \Delta t$

$\Delta t = 0.036 \text{ sec}$

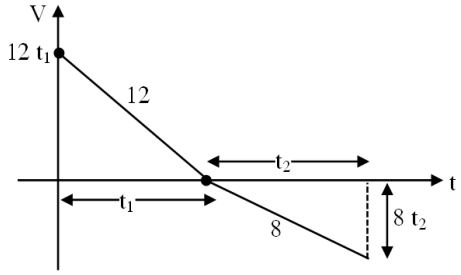
2. Ans (C)

$F = \frac{Gm^2}{r^2}$

$F' = \frac{G\left(\frac{4m}{3}\right) \times \left(\frac{2m}{3}\right)}{r^2}$

$F' = \frac{8}{9}F$

3. Ans (B)



$6t_1^2 = 4t_2^2$

4. Ans (B)

$a = -\mu g = -0.5 \times 9.8 = -4.9\ m/s^2$

$d = \frac{v^2}{2a} = \frac{9.8 \times 9.8}{2(4.9)} = 9.8\ m$

5. Ans (B)

$K_{total} = K_{rotational} + K_{Translational}$

$K_{total} = \frac{1}{2} I_{cm} \omega^2 + \frac{1}{2} m v_{cm}^2$

$v_{cm} = R\omega$ for pure rolling

$I_{cm} = \frac{2}{5} mR^2$

$K_{Rot} = \frac{1}{2} I_{cm} \omega^2 = \frac{1}{2} \times \frac{2}{5} mR^2 \times \frac{v_{cm}^2}{R^2} = \frac{1}{5} m v_{cm}^2$

$K_{Total} = \frac{1}{5} m v_{cm}^2 + \frac{1}{2} m v_{cm}^2 = \frac{7}{10} m v_{cm}^2$

$\frac{K_{Rot}}{K_{Total}} \frac{\frac{1}{5} m v_{cm}^2}{\frac{7}{10} m v_{cm}^2} = \frac{2}{7}$

6. Ans (A)

$K = \frac{hc}{\lambda} - \phi$ ...(1)

$K' = \frac{hc}{\lambda'} - \phi$

here k' = nk & $\lambda' = \lambda - \frac{2\lambda}{3} = \frac{\lambda}{3}$

$\therefore nk = \frac{3hc}{\lambda} - \phi$ ....(2)

$\frac{nhc}{\lambda} - n\phi = \frac{3hc}{\lambda} - \phi$

$(n-3)\frac{hc}{\lambda} = (n-1)\phi$

$(n-3)\frac{hc}{\lambda} = (n-1)\frac{hc}{\lambda_0}$

$\lambda_0 = \frac{(n-1)\lambda}{(n-3)}$

7. Ans (C)

$\frac{(K.E.)_{photon}}{(K.E.)_{electron}} = \frac{h\nu}{\frac{1}{2}mv^2} = \frac{hc/\lambda}{\frac{1}{2m}(m^2v^2)}$ ...(i)

But the de-Broglie wavelength of electron is given

by $\lambda = \frac{h}{P} = \frac{h}{mv}$

$\therefore m^2v^2 = \left(\frac{h}{\lambda}\right)^2$ ...(ii)

On substituting in eq. (i), we get

$\frac{E_P}{E_e} = \frac{2mhc/\lambda}{(h/\lambda)^2} = \frac{2m\lambda c}{h} = \frac{2m(h/mv)c}{h} = \frac{2c}{v}$

8. Ans (D)

$p = \bar{x} + y$

$Q = \overline{\bar{y}.x} = y + \bar{x}$

$O/P = \overline{P + Q}$

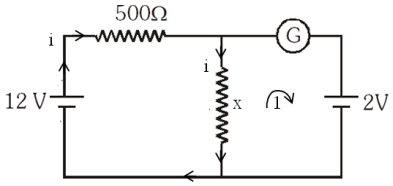
To make O/P

P + Q must be 'O'

SO, $y = 0$

$x = 1$

9. Ans (B)



In loop (1)

$i\,x = 2$

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

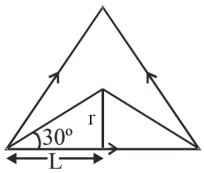
Also $i = \frac{12}{500 + x}$

$\frac{2}{x} = \frac{12}{500 + x}$

$x = 100\Omega$

10. Ans (A)

$\frac{r}{L} = \tan 30°$

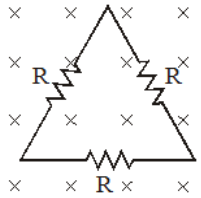


$r = \frac{L}{\sqrt{3}}$

$B = 3\left[\frac{\mu_0 i}{4\pi r}(\sin 60° + \sin 60°)\right]$

$= \frac{3\mu_0 i}{4\pi \frac{L}{\sqrt{3}}}\left[\sqrt{3}\right] = \frac{9}{4}\frac{\mu_0 i}{\pi L}$

11. Ans (B)



$\phi = BA = B_0 e^{-\lambda t}\frac{\sqrt{3}}{4}a^2$

$e = -\frac{d\phi}{dt} = +\frac{\sqrt{3}}{4}a^2 B_0 \lambda e^{-\lambda t}$

induced current

$i = \frac{e}{3R} = \frac{\sqrt{3}}{12}a^2 B_0 \lambda e^{-\lambda t} = \frac{a^2 \lambda B_0 e^{-\lambda t}}{4\sqrt{3}R}$

12. Ans (C)

$z = \sqrt{R^2 + (X_L - X_C)^2}, R = R_1 + R_2$

$i = \frac{v}{z}$, In coil, $P = i^2 R_2$

14. Ans (D)

$\frac{1}{f_{lens}} = (\mu - 1)\left[\frac{1}{R_1} - \frac{1}{R_2}\right]$

$= 0.5\left[\frac{1}{10} - \frac{1}{20}\right] = \frac{1}{40}$

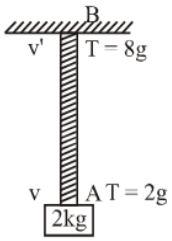
$\therefore f_{lens} = 40$ cm

Thus image will be formed at +2f

The ray will retrace if d = 2f or d = 2f + 30

= 80 cm OR 110 cm

15. Ans (D)



$v = \sqrt{\frac{T}{m}}$ m = const.

$v \propto \sqrt{T}$

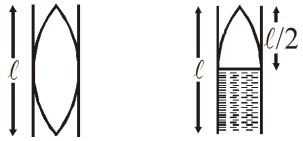
$\frac{v'}{v} = \sqrt{\frac{8g}{2g}}$

v' = v × 2 , (frequency n remain constant)

$n\lambda' = n\lambda \times 2$

$\lambda' = 0.06 \times 2 = 0.12$ m

16. Ans (A)



$\frac{\lambda}{2} = \ell$ $\qquad$ $\frac{\lambda}{4} = \frac{\ell}{2}$

$\boxed{\lambda = 2\ell}$ $\qquad$ $\boxed{\lambda = 2\ell}$

$v = f\lambda$ $\qquad$ $v = f'\lambda$

$\boxed{f = \frac{v}{\lambda} = \frac{v}{2\ell}}$ $\qquad$ $\boxed{f' = \frac{v}{\lambda} = \frac{v}{2\ell} = f}$

17. Ans (B)

Let the initial pressure of the three samples be P_A, P_B and P_C, then $P_A(V)^{3/2} = (2V)^{3/2}P$, $P_B = P$ and $P_C(V) = P(2V)$

$\Rightarrow P_A : P_B : P_C = (2)^{3/2} : 1 : 2 = 2\sqrt{2} : 1 : 2$

18. Ans (B)

$\Delta L = L\alpha.\Delta t$

$\therefore \Delta L \propto L$

$\frac{(\Delta L)_P}{(\Delta L)_Q} = \frac{L_P}{L_Q} = \frac{l}{2l} = \frac{1}{2}$

19. Ans (D)

$A \propto T^4$ by Stefan's Boltzman law not by Wien's displacement law.

$\lambda_{max} \times T$ = constant by Wien's displacement law.

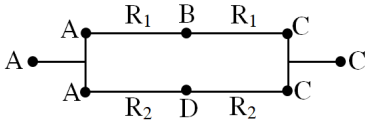
20. Ans (D)

Let R_1 and R_2 be the thermal resistance of copper and iron wires. Then

$R_1 = \frac{l}{K_1 A}$ and $R_2 = \frac{l}{K_2 A}$

According to the principle of Wheat stone's bridge, the point B and D must be at same temperature when the bridge is balanced. Therefore, thermal resistance of arm BD becomes ineffective.

Now the equivalent circuit at balance is



The effective resistance between A and C is

$R = \frac{(2R_1)(2R_2)}{2R_1 + 2R_2} = \frac{2R_1R_2}{R_1 + R_2}$

$R = \frac{2\frac{1}{K_1A}.\frac{1}{K_2A}}{\frac{1}{K_1A} + \frac{1}{K_2A}} = \frac{2l}{(K_1 + K_2)A}$

PART-1 : PHYSICS

SECTION-II

1. **Ans (36)**

$X = A \sin \omega t \left(t = 3, X = \frac{A}{2}\right)$

$\Rightarrow \frac{A}{2} = A \sin 3\omega$

$\Rightarrow \sin 3\omega = \frac{1}{2}$

$\Rightarrow 3\omega = \frac{\pi}{6}$

$\Rightarrow \omega = \frac{\pi}{18} = \frac{2\pi}{T}$

$\Rightarrow T = 36 \text{ s}$

2. **Ans (5)**

There will be no effect of first zener diode because of forward bias, so current through 10 kΩ = reading of ammeter

$= \frac{(20 - 15)\,V}{10k\Omega} = 0.5mA$

$= 5 \times 10^{-4} A$

$= x \times 10^{-4} A$

$x = 5$

3. **Ans (8)**

$\Delta U = U_f - U_i$

$= \left(\frac{kq_1q_2}{0.30} + \frac{kq_1q_3}{0.4} + \frac{kq_2q_3}{0.1}\right)$

$- \left(\frac{kq_1q_2}{0.3} + \frac{kq_1q_3}{0.4} + \frac{kq_2q_3}{0.50}\right)$

$= 8k\, q_2q_3 = \frac{8q_2q_3}{4\pi\epsilon_0}$

4. **Ans (2)**

$\text{Shift} = \frac{D}{d}(\mu - 1)t = \frac{D\lambda}{d}$

$\mu - 1 = \frac{\lambda}{t} = \frac{12 \times 10^{-7}}{12 \times 10^{-7}} = 1$

$\Rightarrow \mu = 2$

5. **Ans (25)**

Let initial conditions = V, T

and final conditions = V', T'

By Charle's law $V \propto T$ [P remains constant]

$\frac{V}{T} = \frac{V'}{T'} \Rightarrow \frac{V}{T} = \frac{V'}{1.2T'} \Rightarrow V' = 1.2CV$

But as per question, volume is reduced by 10% means V' = 0.9V

So percentage of volume leaked out

$= \frac{(1.2 - 0.9)V}{1.2V} \times 100 = 25\%$

PART-2 : CHEMISTRY

SECTION-I

1. **Ans (D)**

Diamond (sp^3)

Graphite (sp^2)

2. **Ans (D)**

Complex forming tendency $\propto$ polarising power (ϕ)

3. **Ans (A)**

CN^-, NO_2^- are ambidentate

4. Ans (A)

$Mg_3N_2 + 6H_2O \longrightarrow 3Mg(OH)_2 + 2NH_3$

(Both are basic)

$NCl_3 + 3H_2O \longrightarrow NH_3 + 3HOCl$

(One is basic and other is acidic)

$BBr_3 + 3H_2O \longrightarrow H_3BO_3 + 3HBr$

(Both are acidic)

$PCl_5 + 4H_2O \longrightarrow H_3PO_4 + 5HCl$

(Both are acidic)

5. Ans (D)

Due to inert pair effect, the more stable oxidation state for

Tl is +1

Pb is +2

Bi is +3

6. Ans (C)

$\mu_s = 1.73$ BM

No. of unpaired $e^- = 1$

$V(Z = 23) = [Ar]\ 4s^2\ 3d^3$

$V^{+4} = [Ar]\ 4s^0\ 3d^1$

7. Ans (C)

Element, having Z = 48, is Cd

It is member of group 12 or IIB and period 6th

Element having electronic configuration

$[Xe]\ 4f^7\ 5d^1\ 6s^2$ is a lanthanoid. All lanthanoids belong to group no. IIIB and period 6^{th}.

Element having electronic configuration $[Rn]\ 6d^2\ 7s^2$ is an actinoid. All actinoids belong to group no. IIIB and period 7^{th}

Element, having Z = 56, is Ba. It is member of group 2 or IIA and period 6^{th}

8. Ans (D)

Shortest wavelength in the Pfund series

$(\lambda_{\infty \to 5})_{min}$ $n_2 = \infty$

$n_1 = 5$

$$\left(\frac{1}{\lambda_{min}}\right) = RZ^2\left(\frac{1}{n_1^2} - \frac{1}{n_2^2}\right)$$

$$\left(\frac{1}{\lambda_{min}}\right) = R(2)^2\left(\frac{1}{5^2} - \frac{1}{\infty^2}\right)$$

$$\lambda_{min} = \frac{25}{4R}$$

9. Ans (C)

$N_2O_4 \rightleftharpoons 2NO_2$

$\frac{9.2}{92} = 0.1$ mole

0.1 –

0.1 – X 2X

0.1 – 0.05 2X

0.1 – 0.05 2 × 0.05

.05 0.1

$K_C = \frac{[0.1]^2}{[0.05]} = .2$

10. Ans (A)

Total volume = 500 + 1500 = 2000 ml = 2L

Moles of $[Na^+]$ ions = 0.2 × 0.5 = 0.1

Concentration of $[Na^+]$ ions $= \frac{0.1}{2} = 0.05M$

Moles of $[Mg^{2+}]$ ions = 0.4 × 1.5 = 0.6

Concentration of $[Mg^{2+}]$ ions

$= \frac{0.6}{2} = 0.3M = 7.2gm/L$

Moles of $[Cl^-]$ ions = 0.2 × 0.5 + 2 × 0.4 × 1.5 = 1.3

Concentration of $[Cl^-]$ ions $= \frac{1.3}{2} = 0.65$ M

13. **Ans (D)**

(A) ΔH_C = –ive (correct)

(B) $H^+_{(aq)} + H^-_{(aq)} \longrightarrow H_2O_{(\ell)}$ $\Delta H = -13.7$ Kcal/mole (correct)

(C) $H_{2(g)} \xrightarrow{\Delta H_r} 2H_{(g)}$ $\Delta H_{B.E.} = 436$

$\frac{1}{2}H_2 \longrightarrow H_{(g)}$ $\Delta H_f^\circ = \frac{436}{2} = 218$ kJ/mole (correct)

(D) incorrect

14. **Ans (B)**

$P_T = P_A^0 X_A + P_B^0 X_B = 0.08 \times 300 + 0.92 \times 800$

$= 760$ torr $\Rightarrow$ 1 atm > P_{obs}

Show – ve deviation from raoult law.

16. **Ans (C)**

(I) Sturcture $\longrightarrow$ Non polar (Most stable)

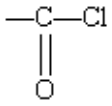
(II) Sturcture $\longrightarrow$ Incomplete octet

(III) Structure $\longrightarrow$ Complete octet

$\therefore$ (I) > (III) > (II)

17. **Ans (B)**

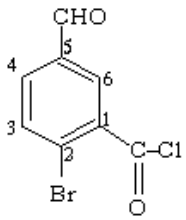
Benzene ring must be selected as parent chain



group is principal functional group.

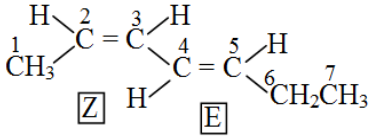
–CH=O, –Br, are side chain.

Numbering of benzene ring according to least locant number rule.



2-bromo-5-formyl benzene carbochloride.

18. **Ans (C)**



(2Z,4E)

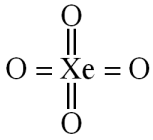
19. **Ans (B)**

Anomers differ in configuration at hemiacetal carbon.

PART-2 : CHEMISTRY

SECTION-II

1. **Ans (0)**



In XeO_4, pπ-dπ bonds = 4

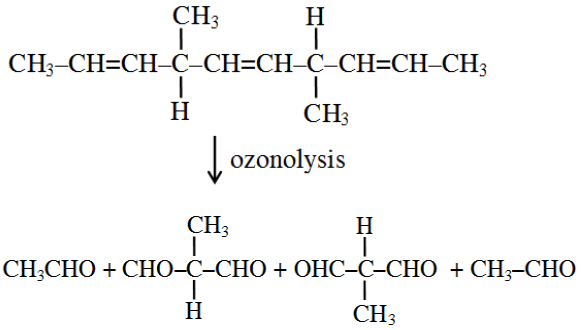
pπ-pπ bonds = 0

2. **Ans (2)**

2.0 Order of ionization energy

Na < Mg > Al < Si < P > S < Cl < Ar

5. **Ans (0)**



None of them is optically active.

PART-3 : MATHEMATICS

SECTION-I

1. Ans (A)

Using A.M. $\geq$ G.M.

$$\frac{\sin\theta+\sin\theta+\sin\theta+\cos\sec^3\theta}{4} \geqslant (\sin^3\theta.\cos ec^3\theta)^{1/4}$$

Hence, minimum value of $3\sin\theta + \text{cosec}^3\theta$ is 4

2. Ans (D)

$$\sin\frac{\pi}{14}\sin\frac{3\pi}{14}$$

$$\sin\frac{5\pi}{14}\sin\frac{7\pi}{14}\sin\frac{9\pi}{14}\sin\frac{11\pi}{14}\sin\frac{13\pi}{14}$$

$$= \sin\frac{\pi}{14}\sin\frac{3\pi}{14}\sin\frac{5\pi}{14}\times 1$$

$$\times \sin\left(\pi-\frac{5\pi}{14}\right)\sin\left(\pi-\frac{3\pi}{14}\right)\sin\left(\pi-\frac{\pi}{14}\right)$$

$$= \left[\sin\frac{\pi}{14}\sin\frac{3\pi}{14}\sin\frac{5\pi}{14}\right]^2 = \frac{1}{64}$$

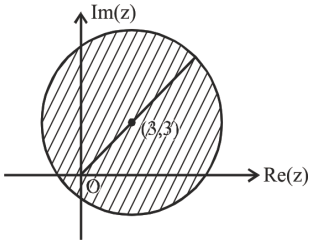
3. Ans (C)

$$s=\sqrt{\frac{1}{n}\Sigma d^2-\left(\frac{\Sigma d}{n}\right)^2}$$

$$\sqrt{\frac{1}{5}(25)-\left(\frac{5}{5}\right)^2}=2$$

S.D. if affected with change in scale so S.D. of $2x; +7$ if 4

4. Ans (C)



$|z-3|<5$

$\Rightarrow |(z+3i)-(3+3i)|<5$

$\Rightarrow |z'-(3+3i)|<5$ [Let $z+3i=z'$]

In argand plane z' represents the shaded area, from figure $0<|z'|<5+3\sqrt{2}$

5. Ans (C)

$1\times 15\times 15\times 15 = 3375$

6. Ans (A)

1 2 3 4 5 6 7 8 9 10

I^{st} drawn is 5, then 2^{nd} drawn can be 1 only of I^{st} is 6, then 2^{nd} is 1 or 2 and so on

$$\therefore P(E)=\frac{1}{10}\left[\frac{1}{9}+\frac{2}{9}+\frac{3}{9}+\frac{4}{9}+\frac{5}{9}+\frac{6}{9}\right]=\frac{7}{30}$$

7. Ans (A)

$x_1+x_2+x_3=35$

$4k_1+(4k_2+1)+(4k_3+2)=35$

$4(k_1+k_2+k_3)=32$

$\therefore k_1+k_2+k_3=8$

$k_1\geqslant 0,\ k_2\geqslant 0,\ k_3\geqslant 0$

no of non $-$ve integral solution

$^{8+3-1}C_{3-1} = {}^{10}C_2 = 45$

8. Ans (A)

Combined mean, $\bar{x} = \frac{2 \times 10 + 4 \times 10}{20} = 3$

$d_1 = \bar{x}_1 - \bar{x} = -1$

$d_2 = \bar{x}_2 - \bar{x} = 1$

Combined variance

$$= \frac{n_1\sigma_1^2 + n_2\sigma^2 + n_1d_1^2 + n_2d_2^2}{n_1 + n_2}$$

$$\Rightarrow \frac{11}{2} = \frac{10 \times 4 + 10 \times k + 10 \times 1 + 10 \times 1}{20}$$

$\Rightarrow k = 5$

9. Ans (A)

$\phi'(x) = f'(x) + f'(2a - x)$

given, $f''(x) > 0$, $\Rightarrow$ $f'(x)$ is increasing function, if

$x < 2a - x \Rightarrow x < a$

$f'(x) < f'(2a - x)$

$\Rightarrow \phi(x) < 0$

$\therefore$ $\phi(x)$ decreases in (0, a)

and if $x > 2a - x \Rightarrow x > a$

$f'(x) > f'(2a - x) \Rightarrow f'(x) > 0$

$\therefore$ $\phi(x)$ increases in (a, 2a)

10. Ans (B)

Let $g(x) = 4x^3 - 12x^2 + 11x - 3$

$\therefore g'(x) = 12x^2 - 24x + 11$

$= 12(x - 1)^2 - 1$

> 0 for $x \in [2, 3]$

Thus, g(x) is increasing in [2, 3].

$f(x)_{max} = f(3) = \log_{10}(4.27 - 12.9 + 11.3 - 3)$

$= 1\log_{10}(30) = 1 + \log_{10}3$

11. Ans (C)

Given $f\left(\frac{x+y}{3}\right) = \frac{f(x) + f(y)}{3}$

Replacing x by 3x and y by zero,

then $f(x) = \frac{f(3x) + f(0)}{3}$

$\Rightarrow f(3x) - 3f(x) = -f(0)$

and $f'(x) = \lim_{h\to0} \frac{f(x+h) - f(x)}{h}$

$= \lim_{h\to0} \frac{f\left(\frac{3x+3h}{3}\right) - f(x)}{h} = \lim_{h\to0} \frac{\frac{f(3x)+f(3h)}{3} - f(x)}{h}$

$= \lim_{h\to0} \frac{f(3x) + f(3h) - 3f(x)}{3h}$

$= \lim_{h\to0} \frac{f(3h) - f(0)}{3h}$ [from Eq. (i)]

$= f'(0) = 3$

$\therefore f(x) = 3x + c \Rightarrow f(0) = 0 + c = 3 \therefore c = 3$

Then, $f(x) = 3x + 3$

Hence, f(x) is continuous and differentiable everywhere

12. Ans (B)

$LHL = \lim_{x\to0} \frac{1 - \cos 4x}{x^2} = \frac{4^2}{2} = 8$

$RHL = \lim_{x\to0} \frac{\sqrt{x}}{\sqrt{16 + \sqrt{x}} - 4}$

$= \lim_{x\to0} \frac{\sqrt{x}\left(\sqrt{16 + \sqrt{x}} + 4\right)}{16 + \sqrt{x} - 16} = 8$

For continuity ; a = 8

13. Ans (A)

$Area = \frac{16}{3}ab = \frac{16}{3} \times 2 \times 3 = 32$

14. Ans (A)

$$\frac{dy}{dx} = \frac{y}{x} + \sec\frac{y}{x}$$

Let $y = vx$

$$\frac{dy}{dx} = v + x\frac{dv}{dx}$$

$$v + \frac{xdv}{dx} = v + \sec v$$

$$\cos v\, dv = \frac{dx}{x}$$

$$\sin v = \ell nx + c$$

$$\sin\left(\frac{y}{x}\right) = \ell nx + c$$

$\because$ passing through $\left(1, \frac{\pi}{6}\right) \Rightarrow \sin\frac{\pi}{6} = c \Rightarrow c = \frac{1}{2}$

$$\therefore \sin\frac{y}{x} = \ell nx + \frac{1}{2}$$

15. Ans (B)

$$\int \frac{x^{-2016}dx}{(1+x^{-2015})^{\frac{2014}{2015}}} = -\left(1+x^{-2015}\right)^{\frac{1}{2015}} + C$$

$$= \frac{a}{b} = 1$$

16. Ans (A)

$$\int \frac{dx}{\left(1+\sqrt{x}\right)^{2010}}$$

Let $x = t^2$

$dx = 2t\, dt$

$$\int \frac{2tdt}{(1+t)^{2010}}$$

$$\int \frac{2[(t+1)-1]}{(1+t)^{2010}}dt$$

$$2\int \frac{dt}{(1+t)^{2009}} - 2\int \frac{dt}{(1+t)^{2010}}$$

$$-\frac{2}{2008}\frac{1}{(1+t)^{2008}} + \frac{2}{2009}\frac{1}{(1+t)^{2009}} + C$$

Put $t = \sqrt{x}$

$\alpha = 2009,\ \beta = 2008$

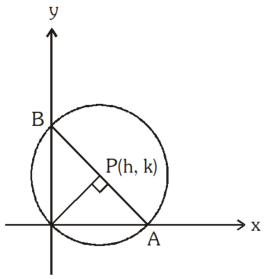
17. Ans (B)

Slope of AB $= \frac{-3}{2}$ which is parallel to

$3x + 2y + 4 = 0$

Area $= \frac{1}{2}AB \times h = \frac{1}{2}\sqrt{208}.\sqrt{13} = 26$

18. Ans (C)



Slope of AB $= \frac{-h}{k}$

Equation of AB is $hx + ky = h^2 + k^2$

$$\left(\frac{h^2+k^2}{h}, 0\right), B\left(0, \frac{h^2+k^2}{k}\right)$$

$AB = 2R$

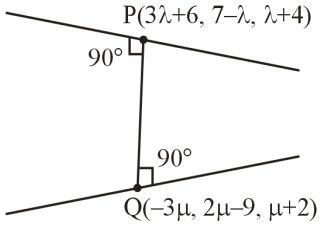
$\Rightarrow (h^2+k^2)3 = 4R^2h^2k^2$

$\Rightarrow (x^2+y^2)3 = 4R^2x^2y^2$

19. Ans (B)

Since each line of family of line passes through the focus of given parabola hence shortest intercept is L.R.

20. Ans (D)



$\overrightarrow{PQ}.\left(3\hat{i}-\hat{j}+\hat{k}\right)=0$ &

$\overrightarrow{PQ}.\left(-3\hat{i}+2\hat{j}+4\hat{k}\right)=0$

$\overrightarrow{PQ}=(3\lambda+3\mu+6)\hat{i}+(16-\lambda-2\mu)\hat{j}+(2+\lambda-4\mu)\hat{k}$

$\Rightarrow 7\mu+11\lambda=-4$ & $29\mu+7\lambda=22$

$\Rightarrow \lambda=-1$ & $\mu=1$

P & Q are (3, 8, 3) & (–3, –7, 6) respectively

Hence equation of PQ is $\frac{x-3}{2}=\frac{y-8}{5}=\frac{z-3}{-1}$

PART-3 : MATHEMATICS

SECTION-II

1. Ans (40)

$\because$ mean = 35

$\frac{a+b+c+d}{4}=35$

$a+b+c+d=140$ ...(1)

and medium of b, a, d, c is 25

$\therefore \frac{a+d}{2}=25$

$a+d=50$ ...(2)

From (1) and (2)

$b+c=90$ ...(3)

$\because$ $b+c-a-d=90-50=40$

2. Ans (39)

$T_{13}={}^{n}C_{12}(x^2)^{n-12}\left(\frac{2}{x}\right)^{12}\cdot\longrightarrow x^0$

power of x $\Rightarrow 2x-36=0 \Rightarrow \boxed{n=18}$

M-I : So sum of division of 18 = 1 + 2 + 3 + 6 + 9 + 18 = 39

M-II : $18=2^1\times3^2$

Sum of divisions of 18

$=(2^0+2^1)(3^0+3^1+3^2)=39$

3. Ans (120)

$\lim\limits_{x\to0}\frac{3f(x)-4f(3x)+f(9x)}{x^2}\left(\frac{0}{0}\text{form}\right)$

$\lim\limits_{x\to0}\frac{3f'(x)-12f'(3x)+9f'(9x)}{2x}\left(\frac{0}{0}\text{form}\right)$

$\lim\limits_{x\to0}\frac{3f''(x)-36f''(3x)+81f''(9x)}{2}$

$\frac{3f''(0)-36f''(0)+81f''(0)}{2}$

$=24f''(0)=24(5)=120$

4. Ans (2)

$\int_{-1}^{2}f(x)\,dx=\int_{-1}^{0}|\{x\}|\,dx+\int_{0}^{1}|\{x\}-2|\,dx+\int_{1}^{2}|\{x\}|\,dx$

$\int_{-1}^{0}(x+1)\,dx+\int_{0}^{1}(2-x)\,dx+\int_{1}^{2}(x-1)\,dx$

$\therefore K=\frac{5}{2}$

5. Ans (7)

$\vec{a}\times\vec{b}=\vec{c}$ and $\vec{b}\times\vec{c}=\vec{a}$

$\Rightarrow \vec{a}.\vec{b}=\vec{b}.\vec{c}=\vec{c}.\vec{a}=0$

$\left|2\vec{a}+3\vec{b}+6\vec{c}\right|=\sqrt{2^2+3^2+6^2}=7$