01/03/2026

SET-1_ONLINE

Corporate Office : AESL, 3rd Floor, Incuspaze Campus-2, Plot No. 13, Sector-18, Udyog Vihar, Gurugram, Haryana - 122015, ***Ph.***+91-1244168300

MM : 300 AIATS For Two Year JEE(Main)-2027 (XI Studying-P1)_Test-03_ONLINE **Time : 180 Min.**

MATHEMATICS

Section-I

1. (2)

2. (2)

3. (4)

4. (2)

5. (1)

6. (1)

7. (3)

8. (4)

9. (3)

10. (4)

11. (3)

12. (2)

13. (4)

14. (3)

15. (4)

16. (3)

17. (2)

18. (1)

19. (3)

20. (3)

Section-II

21. (3)

22. (0)

23. (729)

24. (8)

25. (4)

PHYSICS

Section-I

26. (2)

27. (4)

28. (3)

29. (2)

30. (2)

31. (1)

32. (4)

33. (2)

34. (4)

35. (1)

36. (1)

37. (3)

38. (1)

39. (2)

40. (1)

41. (4)

42. (1)

43. (3)

44. (1)

45. (1)

Section-II

46. (8)

47. (3)

48. (13)

49. (50)

50. (70)

CHEMISTRY

Section-I

51. (4)

52. (2)

53. (4)

54. (3)

55. (4)

56. (4)

57. (3)

58. (2)

59. (3)

60. (1)

61. (1)

62. (2)

63. (3)

64. (3)

65. (2)

66. (1)

67. (2)

68. (1)

69. (4)

70. (3)

Section-II

71. (4)

72. (116)

73. (13)

74. (5)

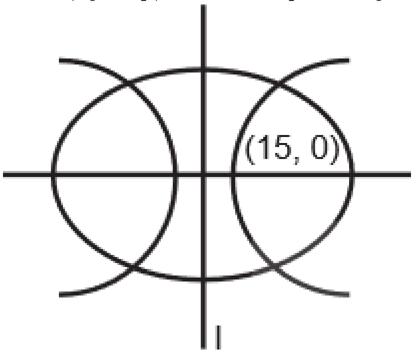
75. (6)

Hints and Solutions

MATHEMATICS

Section-I

(1) **Answer :** (2)
Hint:
$a_1e_1 = a_2e_2 = 15$
Solution:
we have to find $\left|(2a_1)^2 - (2a_2)^2\right|$
$a_1e_1 = a_2e_2 = 15$ and $e_1 = \frac{15}{a_1};\ e_2 = \frac{15}{a_2}$
Also, $\left|\frac{a_1}{e_1} - \frac{a_2}{e_2}\right| = 15;\ x = \frac{a_2}{e_2};\ x = \frac{a_1}{e_1}$



$\left|\frac{a_1^2}{15} - \frac{a_2^2}{15}\right| = 15;\ \left|a_1^2 - a_2^2\right| = 225$
$\therefore \left|4a_1^2 - 4a_2^2\right| = 225 \times 4 = 900$

(2) **Answer :** (2)
Hint:
$z^2 + z + 1 = 0 \Rightarrow z = \omega, \omega^2$
Solution:
$\left|\sum_{n=1}^{9} \left(z^n + (-1)^n \frac{1}{z^n}\right)^2\right|$
on squaring, we get
$= \left|\sum_{n=1}^{9} \left(z^{2n} + \frac{1}{z^{2n}} + 2(-1)^n\right)\right|$
$= \left|\sum_{n=1}^{9} \omega^{2n} + \frac{1}{\omega^{2n}} + 2(-1)^n\right|$
Using hp, we get
$= \left|\frac{\omega^2(1-\omega^{18})}{1-\omega^2} + \frac{\frac{1}{\omega^2}\left(1-\frac{1}{\omega^{18}}\right)}{1-\frac{1}{\omega^2}} + 2(-1)\right|$
$= \left|\frac{\omega^2(1-1)}{1-\omega^2} + \frac{\frac{1}{\omega^2}(1-1)}{1-\frac{1}{\omega^2}} + 2(-1)\right|$
|0 + 0 – 2|
= 2

(3) **Answer :** (4)
Hint:
$\sin^2 x = \frac{\tan^2 x}{1+\tan^2 x}$
Solution:
$\sin^4 x - (\lambda+2)\sin^2 x - (\lambda+3) = 0$
λ + 2 = λ + 3 – 1
$(\sin^2 x - (\lambda + 3))(\sin^2 x + 1) = 0 \quad \left(\because x \neq n\pi + \frac{\pi}{2}\right)$
$\Rightarrow 0 \leq \lambda + 3 < 1 \quad (\sin^2 x \neq 1)$
$\Rightarrow -3 \leq \lambda < -2$

(4) **Answer :** (2)

Hint:
Concept of Limits
Solution:
we have,

$$\lim_{x\to 0}\left(\frac{\alpha \sin 2x - x^{x+1}}{\ln(2x+1)}\right)^{\frac{2x}{x^2+x}} = \frac{9}{4}, \alpha \in R$$

$$\Rightarrow \lim_{x\to 0}\left(\frac{\alpha\frac{\sin 2x}{2x} - x^x \cdot \frac{x}{2x}}{\frac{\ln(1+2x)}{2x}}\right)^{\frac{2}{x+1}} = \frac{9}{4}$$

We know,

$$\lim_{x\to 0}\frac{\sin x}{x} = 1, \lim_{x\to 0}\frac{\ln(1+x)}{x} = 1, \lim_{x\to 0} x^x = 1$$

$$\Rightarrow \left(\frac{\alpha - \frac{1}{2}}{1}\right)^2 = \frac{9}{4}$$

$\Rightarrow \alpha = \frac{1}{2} \pm \frac{3}{2}$
⇒ α = 2 and α = –1
Then, the sum of all possible value of $\alpha = 2 + (-1)$ = 1

(5) **Answer :** (1)
Hint:
$e = \sqrt{1 - \frac{b^2}{a^2}}$
Solution:
Put y = 0 in $\frac{x}{7} + \frac{y}{2\sqrt{6}} = 1$, we get x = 7;
So, ellipse intersect x -axis at 7, *i.e.* α = 7 put x = 0, in $\frac{x}{7} - \frac{y}{2\sqrt{6}} = 1$, we get
$y = -2\sqrt{6}$
So, ellipse intersect y-axis at $-2\sqrt{6}$
i.e. $\beta = -2\sqrt{6}$

$\therefore\ e = \sqrt{1 - \frac{\beta^2}{\alpha^2}}$

$= \sqrt{1 - \frac{24}{49}}$

$= \frac{5}{7}$
∴ foci = (±*ae*, 0)
= (±5, 0)

(6) **Answer :** (1)
Hint:
Put $z = a - \frac{13}{11}i$
Solution:

$= \left(\frac{z^2 + 8iz - 15}{z^2 - 3iz - 2}\right) \in R$

$\Rightarrow 1 + \frac{(11iz - 13)}{(z^2 - 3iz - 2)} \in R$

Put $z = a - \frac{13}{11}i$ [∵ Given]
$\Rightarrow (z^2 - 3iz - 2)$ is imaginary
Put $z = x + iy$
$\Rightarrow (x^2 - y^2 + 2xyi - 3ix + 3y - 2) \in$ Imaginary
$\Rightarrow \text{Re}\left(x^2 - y^2 + 3y - 2 + (2xy - 3x)i\right) = 0$
$\Rightarrow x^2 - y^2 + 3y - 2 = 0$
$\Rightarrow x^2 = y^2 - 3y + 2$
$\Rightarrow x^2 = (y-1)(y-2)$
$\therefore z = \alpha - \frac{13i}{11}$
Put $x = a, y = -\frac{13}{11}$

$a^2 = \left(\frac{-13}{11} - 1\right)\left(\frac{-13}{11} - 2\right)$

$\Rightarrow a^2 = \left(\frac{24 \times 35}{121}\right)$

$\Rightarrow 363a^2 = 2520$

(7) **Answer :** (3)
Hint:
Properties of Ellipse
Solution:
we have
$x^2 + 4y^2 + 2x + 8y - \lambda = 0$
$\Rightarrow \frac{(x+1)^2}{\lambda+5} + \frac{(y+1)^2}{\frac{\lambda+5}{4}} = 1$
$\because \frac{2b^2}{a} = 2$
$\frac{2(\lambda+5)}{4} = 2(\sqrt{\lambda+5})$
On Solving
$\Rightarrow \lambda = 11$ $\{\because \lambda > 5\}$
$l = 2a = 2\sqrt{\lambda+5}$
$= 2\sqrt{11+5} = 8$
$\Rightarrow \lambda + l = 11 + 8$
= 19

(8) **Answer :** (4)
Hint:
$\sigma^2 = \frac{\sum_{n=1}^{15} x_n^2}{15} - (\bar{x})^2$
Solution:
Put $\bar{x} = 9$ and $\sigma^2 = 4$
$\sigma^2 = \frac{\sum_{n=1}^{15} x_n^2}{15} - (\bar{x})^2 = \frac{\sum_{n=1}^{15} x_n^2}{15} - 9^2 = 4^2$
$\Rightarrow \sum x_n^2 = (16+81)15 = 1455$
New $\sum x_n^2 = 1455 - 6^2 + 18^2 = 1743$
New $\sum x_n = 15 \times 9 - 6 + 18 = 147$
$\therefore$ variance $= \frac{1743}{15} - \left(\frac{147}{15}\right)^2$
= 20.16

(9) **Answer :** (3)
Hint:
$M \cdot D = \frac{1}{n} \sum |x_i - \bar{x}| = 255$
Solution:
$\bar{x} = \frac{\text{Sum of quantities}}{n} = \frac{\frac{n}{2}(a+l)}{n}$
$= \frac{1}{2}[1 + 1 + ...100a] = 1 + 50a$
$\therefore MD = \frac{1}{n} \sum |x_i - \bar{x}| = 255$
$= \frac{2a}{101}\left(\frac{50 \times 51}{2}\right)$
$\therefore a = \frac{255 \times 101}{50 \times 51} = 10.1$

(10) **Answer :** (4)
Hint:
Divide by $x - 1$ in Numerator & Denominator**.**
Solution:
$\lim_{x \to 1} \left\{\frac{\sin(x-1) + t(1-x)}{(x-1) + \sin(x-1)}\right\}^{\frac{(1+\sqrt{x})(1-\sqrt{x})}{(1-\sqrt{x})}} = 1$
$\lim_{x \to 1} \left\{\frac{\frac{\sin(x-1)}{(x-1)} - t}{1 + \frac{\sin(x-1)}{(x-1)}}\right\}^{1+\sqrt{x}} = 1$
$\Rightarrow \left(\frac{1-t}{2}\right)^2 = 1$
$\Rightarrow (t-1)^2 = 4$
$\Rightarrow t = -1, 3$

(11) **Answer :** (3)
Hint:
$\sum \tan P = \prod \tan P$
Solution:
$\prod \tan P = \frac{\sin P.\ \sin Q\ \sin R}{\cos P.\cos Q \cos R}$

⇒ $\sum \tan P = \frac{\frac{3+\sqrt{3}}{8}}{\frac{\sqrt{3}-1}{8}} = \frac{\left(3+\sqrt{3}\right)}{\left(\sqrt{3}-1\right)} \frac{\left(\sqrt{3}+1\right)}{\left(\sqrt{3}+1\right)}$

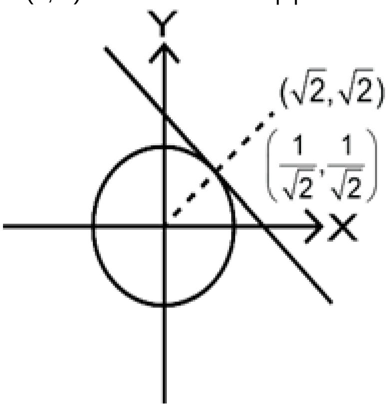
$= \frac{6+4\sqrt{3}}{2}$
$= 3+2\sqrt{3}$

(12) **Answer :** (2)
Hint:
Let $z = x + iy$
Solution:
$z - z_1 = (x - 10) + (y - 6)i$
$z - z_2 = (x - 4) + (y - 6)i$
$\arg\left(\frac{z-z_1}{z-z_2}\right) = \frac{\pi}{4}$
$\Rightarrow \tan^{-1}\left[\frac{6(y-6)}{(x-10)(x-4)+(y-6)^2}\right] = \frac{\pi}{4}$
$\Rightarrow x^2+y^2-14x-18y+112=0$
$\left|z-7-9i\right|^2 = (x-7)^2+(y-9)^2$
$\Rightarrow x^2-14x+y^2-18y+130$
⇒ –112 + 130
= 18

(13) **Answer :** (4)
Hint:
Centroid: $\left(\frac{x_1+x_2+x_3}{3}, \frac{y_1+y_2+y_3}{3}\right)$
Solution:
Centroid is $\overline{M}\left(\frac{1+\lambda}{3}, \frac{11}{3}, \frac{7+\mu}{3}\right)$
$A(2, 3, 5)$

$DR's$ of $\overline{AM}\left(\frac{\lambda-5}{3}, \frac{2}{3}, \frac{\mu-8}{3}\right)$
For $\overline{AM}$ to be equally inclined
$\lambda = 7, \mu = 10$

(14) **Answer :** (3)
Hint:
∴ z is on perpendicular bisector of line joining $\left(\sqrt{2}, \sqrt{2}\right)$ and (0, 0)
Solution:
$\because \left|\frac{z-\sqrt{2}(1+i)}{z}\right| = 1$
$\Rightarrow |z-\sqrt{2}\left(1+i\right)| = |z-0|$
∴ z is on perpendicular bisector of line joining $\left(\sqrt{2}, \sqrt{2}\right)$ and $(0, 0)$
∴ (0, 0) is centre of circle $|z| = 1$



$\therefore$ Point z will be $\left(\frac{1}{\sqrt{2}}, \frac{1}{\sqrt{2}}\right)$

$\therefore\ z = \frac{1+i}{\sqrt{2}}$

(15) **Answer :** (4)

Hint:

$\bar{x} = \frac{\sum f_i x_i}{\sum f_i}$

Solution:

x_i	0	2	2^2	...	2^n
f_i	${}^nC_0$	${}^nC_1$	${}^nC_2$		${}^nC_n$

$\frac{0\times {}^nC_0+2\times {}^nC_1+2^2\times {}^nC_2\ldots 2^n\times {}^nC_n}{{}^nC_0+{}^nC_1+{}^nC_2\ldots {}^nC_n}$

$= \frac{3^n-1}{2^n} = \frac{242}{2^n}$

$\Rightarrow 3^n = 3^5$

$\Rightarrow n = 5$

(16) **Answer :** (3)

Hint:

$\cos^2\alpha + \cos^2\beta + \cos^2\gamma = 1$

Solution:

$\left(\cos^4\alpha + \cos^4\beta + \cos^4\gamma\right) - \left(\sin^4\alpha + \sin^4\beta + \sin^4\gamma\right)$

$= \left(\cos^4\alpha - \sin^4\alpha\right) + \left(\cos^4\beta - \sin^4\beta\right) + \left(\cos^4\gamma - \sin^4\gamma\right)$

$= \left(\cos^2\alpha - \sin^2\alpha\right)\left(\cos^2\alpha + \sin^2\alpha\right) + \left(\cos^2\beta - \sin^2\beta\right)$

$\left(\cos^2\beta + \sin^2\beta\right) + \left(\cos^2\gamma - \sin^2\gamma\right)\left(\cos^2\gamma + \sin^2\gamma\right)$

$= 2\cos^2\alpha - 1 + 2\cos^2\beta - 1 + 2\cos^2\gamma - 1$

= 2 – 3

= –1

(17) **Answer :** (2)

Hint:

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

Solution:

x_i	x_i^2
1	1
2	4
2	4
3	9

$\because \sum x_i = 8\ ;\ \sum x_i^2 = 18$

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

$= \frac{18}{4} - \left(\frac{8}{4}\right)^2 = \frac{9}{2} - 4 = \frac{1}{2}$

$\Rightarrow \log_{\frac{1}{2}} \frac{1}{2} = 1$

(18) **Answer :** (1)

Hint:

Vertex of parabola is $P\left(-\frac{B}{2A}, -\frac{D}{4A}\right)$

Solution:

The family of parabola is

$y = \frac{a^3x^2}{3} + \frac{a^2x}{2} - 2a = Ax^2 + Bx + C$

and vertex is $P\left(\frac{-B}{2A}, \frac{-D}{4A}\right) \equiv (h, k)$

$\therefore h=-\frac{a^2/2}{2(a^3/3)}=-\frac{3}{4a}$

and $k=-\frac{(a^2/2)^2-\{4a^3(-2a)/3\}}{4(a^3/3)}$

or $h=-\frac{3}{4a}$ and $k=-\frac{35a}{16}$

Eliminating *a*, we have $hk=\frac{105}{64}$.

Hence, the required locus is $xy=\frac{105}{64}$

∴ eccentricity = $\sqrt{2}$

(19) **Answer :** (3)
Hint:
Sum of Trigonometric Series
Solution:
Clearly

$\lambda=\frac{\cos 22\frac{1}{2}^\circ}{\sin 22\frac{1}{2}^\circ}$

$=\cot 22\frac{1}{2}^\circ$

$=\sqrt{2}+1$

Hence, $[100(\lambda-2)]=41$

(20) **Answer :** (3)
Hint:
Transformation Formulae
Solution:

$S=\frac{\sin^2\frac{2\pi}{7}}{\sin^2\frac{\pi}{7}}+\frac{\sin^2\frac{4\pi}{7}}{\sin^2\frac{2\pi}{7}}+\frac{\sin^2\frac{\pi}{7}}{\sin^2\frac{4\pi}{7}}$

$\Rightarrow S=\frac{\sin^2\frac{2\pi}{7}}{\sin^2\frac{\pi}{7}}+\frac{\sin^2\frac{4\pi}{7}}{\sin^2\frac{2\pi}{7}}+\frac{\sin^2\frac{8\pi}{7}}{\sin^2\frac{4\pi}{7}}$

$\Rightarrow S=4\left(\cos^2\frac{\pi}{7}+\cos^2\frac{2\pi}{7}+\cos^2\frac{4\pi}{7}\right)$

$=4\left(1-2\cos\frac{\pi}{7}\times\cos\frac{2\pi}{7}\times\cos\frac{4\pi}{7}\right)$

$=4\left(1+2\times\frac{1}{8}\right)=5$

Section-II

(21) **Answer :** 3
Hint:
Family of curves $C_1+\lambda C_2=0$
Solution:
Required circle

$\frac{x^2}{16}+\frac{y^2}{9}-1+\lambda\left(x^2-y^2\right)=0$

Using x^2 coefficient = y^2 coefficient

$\frac{1}{16}+\lambda=\frac{1}{9}-\lambda$

$\Rightarrow \lambda=\frac{7}{288}$

∴ Required circle is $x^2+y^2=\frac{288}{25}$

(22) **Answer :** 0
Hint:
$(z-1)(z^2-z+1)=0$
Solution:
$z^3-2z^2+2z-1=0$
$(z-1)(z^2-z+1)=0$
$z=1, -\omega, -\omega^2$
No root satisfies the second equation.

(23) **Answer :** 729
Hint:
Probability using *P* & *C*
Solution:
$n(s)=100$

$n(E) = 36$

$\therefore P(E) = \frac{36}{100} = \frac{P}{25} \Rightarrow P = 9$

(24) Answer : 8

Hint:

$\lim_{x\to 0}\left(f(x)^{g(x)}\right) = e^{\lim_{x\to 0}(f(x)-1)g(x)}$

Solution:

$= e^{\lim_{x\to 0}\left(\frac{p^x-1+q^x-1}{2}\right)} = e^{\ln pq} = pq = 12$

(p, q) = (2, 6), (3, 4), (4, 3), (6, 2)

Probability = $\frac{4}{36} = \frac{1}{9}$

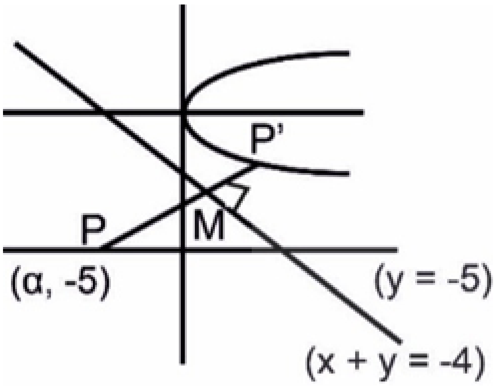
$\therefore |a - b| = 8$

(25) Answer : 4

Hint:

Equation of PP' is $y - x = -\alpha - 5$

Solution:



Equation of PP'

$y + 5 = 1(x - \alpha)$

$\Rightarrow y = x - \alpha - 5$

$y - x = -\alpha - 5$ …. (i)

Also,

$x + y = -4$

$y = -\frac{\alpha-9}{2}$, $2x = \alpha + 1$

$\Rightarrow x = \frac{\alpha+1}{2}$

$M = \left(\frac{\alpha+1}{2}, \frac{-\alpha-9}{2}\right)$

$P' = (1, -\alpha - 4)$

P' lies on parabola.

Now,

$\alpha^2 + 16 + 8\alpha = 4$

$\Rightarrow \alpha^2 + 8\alpha + 12 = 0$

$\Rightarrow \alpha = -2, -6$

AB = distance = 4 units

PHYSICS

Section-I

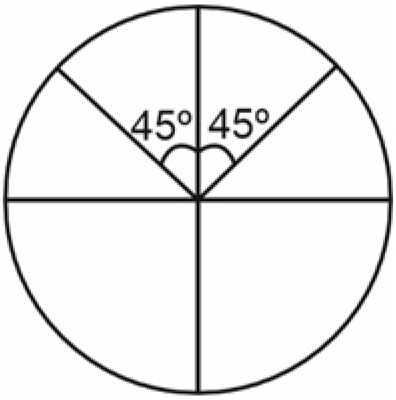
(26) Answer : (2)

Hint:

$T = 2\pi\sqrt{\frac{0.1}{10\pi^2}}$

Solution:

$T = 2\pi\sqrt{\frac{0.1}{10\pi^2}} = \frac{2}{10} = 0.2$



$(V_{avg})_{max} = \frac{\sqrt{2}A}{0.05} = \sqrt{2} \times 4 \times 20$

$= 80\sqrt{2}$ cm/s

(27) **Answer :** (4)

Hint:

$F = -\frac{dU}{dx}$

Solution:

$F = -\frac{dU}{dx} = -3kx^2$

$ma = -3kx^2$

$mv\frac{dv}{dx} + 3kx^2 = 0$

(28) **Answer :** (3)

Hint:

$a_m = A\omega^2$

Solution:

$a = A\omega^2$ $\omega = \sqrt{\frac{3\delta_0 Ag}{\delta_0 Al}}$

$= x \cdot \frac{3g}{l}$

$a = \frac{3xg}{l}$

(29) **Answer :** (2)

Hint:

In equilibrium $1 \cdot g \cdot R \sin 60° = m_0$

Solution:

In equilibrium $1 \cdot g \cdot R \sin 60° = m_0$

$\tau = m_0 gR - 1 \cdot g \cdot R \sin(60° - \theta)$

$\omega = \sqrt{\frac{2\times1\times10\cos60^\circ}{2R+2\times1\times R(1+\sin60^\circ)}}$

$T = 2\pi\sqrt{\frac{2R(2+\sqrt{3})}{g}}$

(30) **Answer :** (2)

Hint:

$V_P = -\left(\frac{dy}{dx}\right)V_\omega$

Solution:

$V_P = -\left(\frac{dy}{dx}\right)V_\omega$

At $t = 0$

$\frac{dy}{dx} = -2$

$V_\omega = 3$

Speed = 6 m/s

(31) **Answer :** (1)

Hint:

$v = \frac{dy}{dt}$

Solution:

$y_1 = 0.4 \sin(5x - 100t)$

$y_2 = 0.4 \sin(5x - 100t + \pi/3)$

$y = y_1 + y_2 = 0.4\sqrt{3}$ sin (5x – 100t + π/6)

$\frac{dy}{dt} =$ 0.4 × 100 $\sqrt{3}$ cos (5x – 100t + π/6)

$= 40\sqrt{3}\cos(\pi)$

$\frac{dy}{dt} = 40\sqrt{3}$ cm/s

(32) Answer : (4)

Hint:

$f = \frac{n}{2L}\sqrt{\frac{\tau}{\mu}}$

Solution:

$42 = \frac{n}{2L}\sqrt{\frac{\tau}{\mu}}$

$49 = \frac{n+1}{2L}\sqrt{\frac{\tau}{\mu}}$

n = 6

$42 = \frac{6}{2L}\sqrt{\frac{4.5}{5\times10^{-3}}}$

$42 = \frac{90}{L}$

L = 2.1

(33) Answer : (2)

Hint:

$\frac{\lambda}{4} = a + e$

Solution:

$\frac{\lambda}{4} = a + e$

$\frac{3\lambda}{4} = b + e$

$e = \frac{b-3a}{2}$

(34) Answer : (4)

Hint:

ρV = Constant

Solution:

ρV = (V + ΔV)ρ_1

Similarly,

$\rho_n = \left(\frac{V}{V+\Delta V}\right)^n \rho_0$

$\frac{\rho_n}{\rho_0} = \frac{1}{4}$

$n = \frac{\ln(4)}{\ln\left(1+\frac{1}{10}\right)}$

(35) Answer : (1)

Hint:

$C_V = \frac{f}{2}R$

Solution:

1 eq. initial number of moles = 1

Mixture = (1 – x) mole tetratomic + 4x monoatomic

$f = \frac{(1-x)6+3(4x)}{1-x+4x}$

$= \frac{6+6x}{1+3x}$

(36) Answer : (1)

Hint:

Thermometer need contact of a body to measure its temperature.

Solution:

Thermometer need contact of a body to measure its temperature.

(37) Answer : (3)

Hint:

$\lambda = \frac{kBT}{\sqrt{2}\pi d^2 P}$

Solution:

(A) $\lambda = \frac{kBT}{\sqrt{2}\pi d^2 P}$

(B) λ ∝ T

(C) $\lambda \propto \frac{1}{P}$

(D) $P \propto T^{\frac{\lambda}{\lambda-1}}$ $\lambda \propto T^{-\frac{3}{2}}$

(38) **Answer :** (1)
Hint:
dQ = *dU* + *dW*
Solution:
$C = C_V + 2T$
$\frac{dQ}{d\tau} = \frac{dU}{dt} + 2T$
dQ = *du* + 2*Tdt*
PdV = 2*TdT*
$\frac{RT}{V} dv = 2T dt$
$\ln\ V = \frac{2}{R} T$
$V e^{-\frac{2T}{R}}$ = Constant

(39) **Answer :** (2)
Hint:
PV = *nRT*
Solution:
Conceptual

(40) **Answer :** (1)
Hint:
$kA \frac{\Delta T}{n} dt = (\delta A d_n) L$
Solution:
$kA \frac{\Delta T}{n} dt = (\delta A d_n) L$
$t \propto x^2$
where *x* is thickness of ice.
$\frac{t_1}{t_2} = \frac{x_1^2}{x_2^2}$
$t_2 = 16 \times \frac{1}{2} = 8$ hours

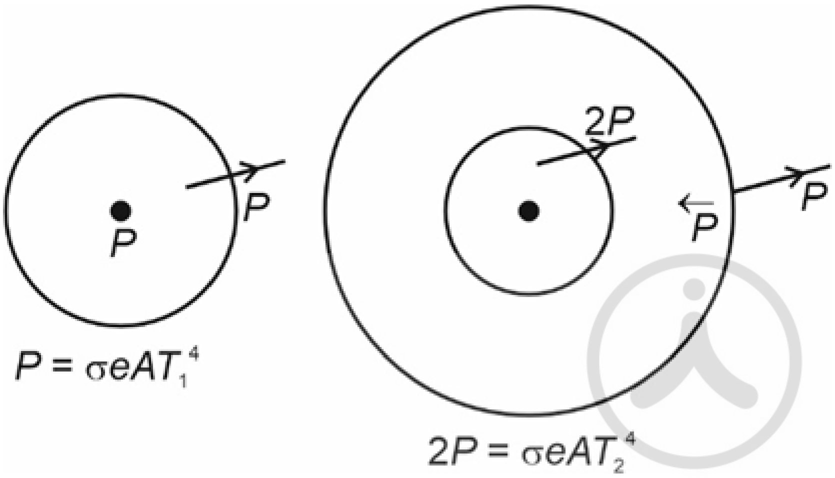
(41) **Answer :** (4)
Hint:
$\frac{dT}{dr} = -\frac{k_1}{4\pi k r^2}$
Solution:
$\frac{dT}{dr} = -\frac{k_1}{4\pi k r^2}$
$T = \frac{k_1}{4\pi k r} + k_2$
$r = R_0$ $T = 3T_0$
$r = 2R_0$ $T = T_0$
$T = \frac{4T_0}{r} R_0 - T_0$
$r = \frac{3}{2} R_0$
$T = \frac{4T_0}{\frac{3}{2} R_0} R_0 - T_0$
$= \frac{8}{3} T_0 - T_0$
$T = \frac{5}{3} T_0$

(42) **Answer :** (1)
Hint:
Black body absorb all wavelengths.
Solution:
Conceptual

(43) **Answer :** (3)
Hint:
$\frac{m_1 + \omega}{t_1} = \frac{m_2 + \omega}{t_2}$
Solution:
$\frac{m_1 + \omega}{t_1} = \frac{m_2 + \omega}{t_2}$
$\frac{60 + \omega}{20} = \frac{85 + \omega}{25}$
ω = 40 g

(44) **Answer :** (1)
Hint:
$T_2V_2^{\gamma-1} = T_3V_3^{\gamma-1}$
Solution:
$T_2V_2^{\gamma-1} = T_3V_3^{\gamma-1}$
$T_1V_1^{\gamma-1} = T_4V_4^{\gamma-1}$
$\frac{V_2}{V_1} = \frac{V_3}{V_4}$
$\frac{V_2}{V_3} = \frac{V_1}{V_4}$
$\frac{V_3}{V_2} = 3$

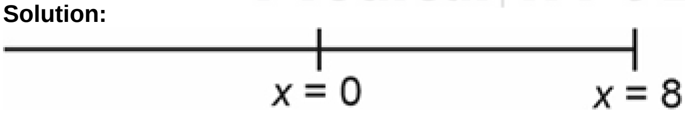
(45) **Answer :** (1)
Hint:
$P = \sigma eAT^4$
Solution:



$2T_1^4 = T_2^4$
$2^{\frac{1}{4}} \cdot T_1 = T_2$

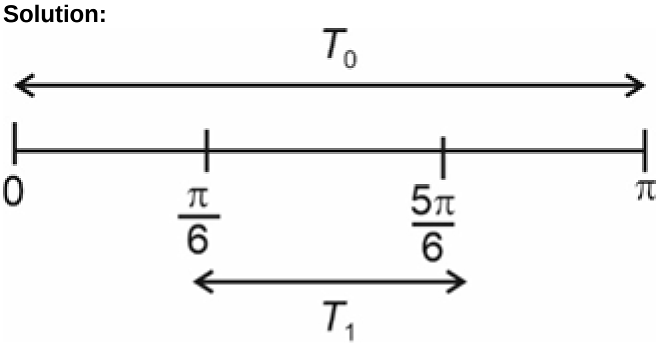
Section-II

(46) **Answer :** 8
Hint:
$S = 4t + \frac{1}{2} + at^2$
Solution:



$8 = \frac{1}{2} \times 4 \times t_0^2$
$t_0 = 2$
$T = 4t_0$
$T = 8$ sec

(47) **Answer :** 3
Hint:
$y = y_1 + y_2$
Solution:



$\frac{T_1}{T_0} = \frac{2}{3}$

$\frac{2T_0}{T_1} = 3$

(48) **Answer :** 13

Hint:

dQ = *dU* + *dW*

Solution:

$Te^{\frac{2R}{V}}$ = Constant

$C = C_v + \frac{V}{2}$

$C = \frac{3}{2}R + \frac{V}{2}$

$C = \frac{3}{2} \times \frac{25}{3} + \frac{1}{2}$

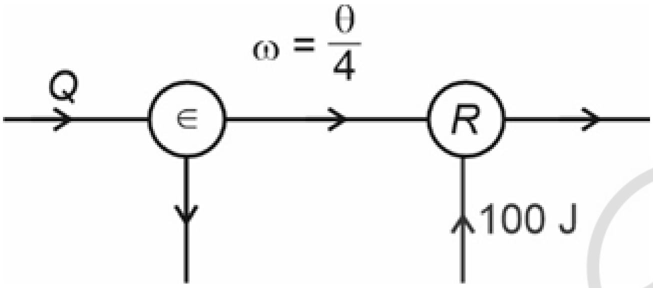
C = 13

(49) **Answer :** 50

Hint:

$\eta_{\text{engine}} = \frac{\text{work}}{\text{heat absorbed}}$

Solution:



Cop $= \frac{100}{\frac{\theta}{4}} = 8$

θ = 50 J

(50) **Answer :** 70

Hint:

$T = \frac{m_1T_1 + m_2T_2}{m_1 + m_2}$

Solution:

$T = \frac{m_1T_1 + m_2T_2}{m_1 + m_2}$

$V_i^0 = \frac{m_1}{\delta_0}\{1 + \gamma T_1\} + \frac{m_2}{\delta_0}\{1 + \gamma T_2\}$

$V_f = \frac{m_1}{\delta_0}\{1 + \gamma T\} + \frac{m_2}{\delta_0}\{1 + \gamma T\}$

$\Delta V = \frac{m_1}{\delta_0}\{\gamma T - \gamma T_1\} + \frac{m_2}{\delta_0}\{\gamma T - \gamma T_2\}$

$= \frac{\gamma}{\delta_0}\{m_1T - m_1T_1 + m_2T - m_2T_2\}$

Δ*V* = 0

CHEMISTRY

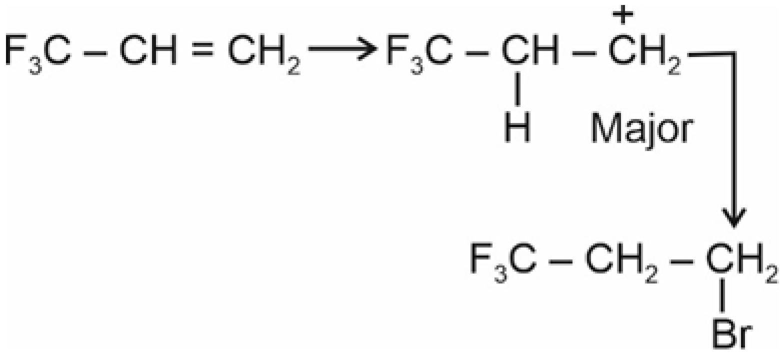
Section-I

(51) **Answer :** (4)

Hint:

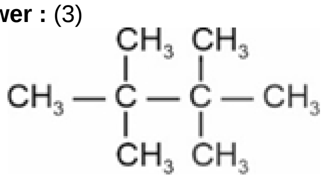
Stable C^+ leads to the major product.

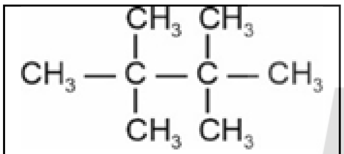
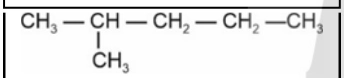
Solution:



(52) **Answer :** (2)
Hint:
Amorphous boron is reactive.
Solution:
Crystalline boron is unreactive. Maximum covalency of boron is 4.

(53) **Answer :** (4)
Hint:
Chain with odd number of Carbon can’t be prepared with 100% purity.
Solution:
Straight chain alkanes having even number of alkanes can be easily prepared by Wurtz reaction.

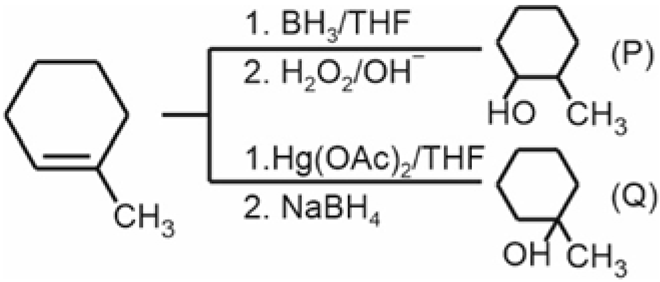
(54) **Answer :** (3)
Hint:  **-**1 monochloro product
Solution:

	-	1 monochloro product
	-	5 monochloro product
$CH_3 — CH_2 — CH_2 — CH_2 — CH_3$	-	3 monochloro product
$CH_3 — CH_2 — CH_2 — CH_3$	-	2 monochloro product

(55) **Answer :** (4)
Hint:
Flerovium is a member of carbon family.
Solution:
Flerovium is a member of carbon family. Its electronic configuration is [Rn] $5f^{14}\ 6d^{10}\ 7s^2\ 7p^2$

(56) **Answer :** (4)
Hint:
Small size anion and large size cation have high ionic character in compounds.
Solution:
PbF_4 and SnF_4 are ionic in nature.

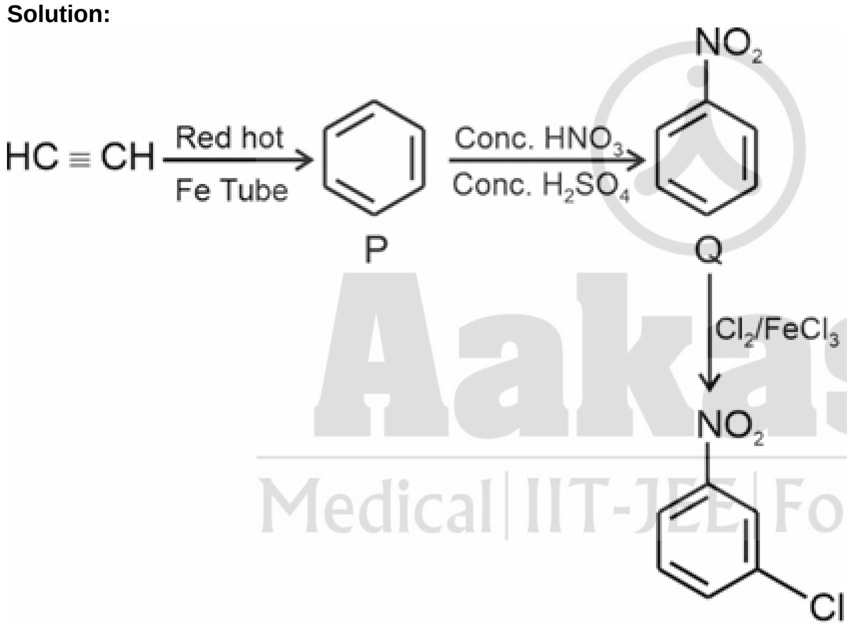
(57) **Answer :** (3)
Hint:
Position of –OH will be different in P and Q.
Solution:



Both are position isomers.

(58) **Answer :** (2)
Hint:
13th group element don't follow regular trend of IE.
Solution:
B - 801 kJ mol^{-1}
Ga - 579 kJ mol^{-1}
Al - 577 kJ mol^{-1}
In - 558 kJ mol^{-1}

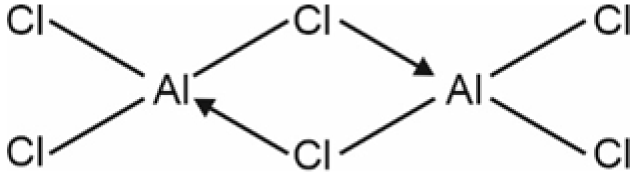
(59) **Answer :** (3)
Hint:
$-NO_2$ is meta directing.
Solution:



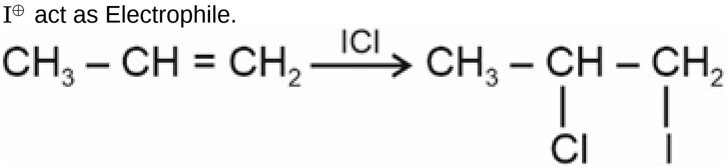
(60) **Answer :** (1)
Hint:
$p\pi$–$p\pi$ bond is possible in lighter member.
Solution:
Heavier members cannot form $p\pi$ – $p\pi$ bonds due to large size and diffused orbitals.

(61) **Answer :** (1)
Hint:
Polynuclear hydrocarbon containing more than two benzene ring fused together are carcinogenic.
Solution:
The compound causes cancer.

(62) **Answer :** (2)
Hint:
2 Al – Cl bond are coordinate bond.
Solution:

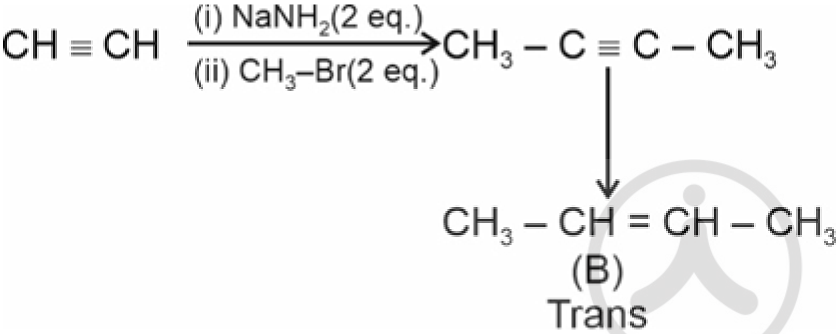


(63) **Answer :** (3)
Hint:
HBr/H_2O_2 gives Anti-Markovnikov addition.
Solution:
$I^{\oplus}$ act as Electrophile.



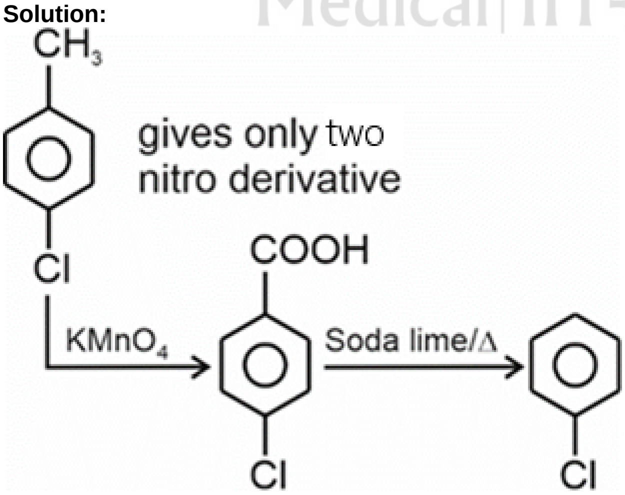
(64) **Answer :** (3)
Hint:
Density of silicon is lowest in 14^{th} group.
Solution:
Si < C < Ge < Sn < Pb

(65) **Answer :** (2)
Hint:
Na/liq. NH_3 gives Trans alkane.
Solution:



(66) **Answer :** (1)
Hint:
$Al^{3+} < Ga^{3+} < In^{3+} < Tl^{3+}$
Solution:
Size of trivalent ions of 13^{th} group increases down the group.

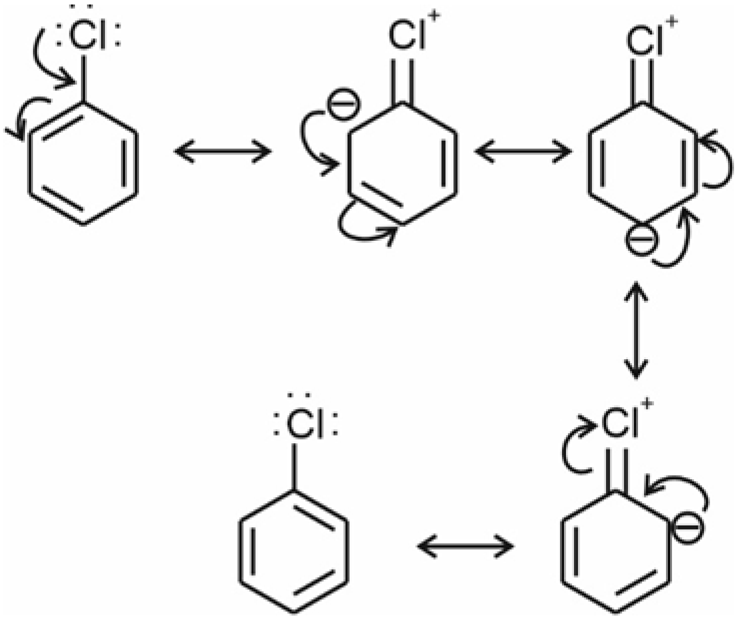
(67) **Answer :** (2)
Hint:
$KMnO_4$ oxidises $–CH_3$ on Benzene.
Solution:



(68) **Answer :** (1)
Hint:
CCl_4 can't be hydrolysed.
Solution:
Due to absence of *d*-orbitals

(69) **Answer :** (4)
Hint:
–Cl shows + M.

Solution:



(70) **Answer :** (3)

Hint:

$O_3/Zn/H_2O$ gives reductive ozonolysis.

Solution:

The three on ozonolysis gives as one of the product.

$$CH_3-\underset{\underset{O}{\|}}{C}-CH_2-CH_2-\underset{\underset{O}{\|}}{C}-CH_3$$

Section-II

(71) **Answer :** 4

Hint:

CO_2, SiO_2 are acidic.

Solution:

SnO_2, PbO_2, SnO and PbO are amphoteric.

(72) **Answer :** 116

Hint:

$$\text{At anode : } \begin{matrix} CH_2-COO^-K^+ \\ | \\ CH_2-COO^-K^+ \end{matrix} \xrightarrow{-2e^-} \begin{matrix} CH_2 \\ \| \\ CH_2 \end{matrix} + 2CO_2$$

Solution:

$$\text{At anode : } \begin{matrix} CH_2-COO^-K^+ \\ | \\ CH_2-COO^-K^+ \end{matrix} \xrightarrow{-2e^-} \begin{matrix} CH_2 \\ \| \\ CH_2 \end{matrix} + 2CO_2$$

Moles of ethene formed = 1

Moles of CO_2 formed = 2

Mass of gas formed = 28 + 88

= 116 gm

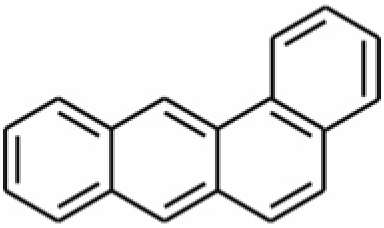
(73) **Answer :** 13

Hint:

D.U. = $C+1-\left(\frac{H}{2}\right)$

Solution:

1, 2-Benzanthracene



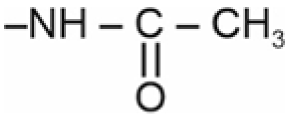
D.U of this is 13.

(74) Answer : 5

Hint:

Group showing +M increases electron density of Benzene.

Solution:

Due to +M of –OH, –OR, $–NH_2$,  electron density is high.

C_2H_5 is activating due to +HC.

(75) Answer : 6

Hint:

Aluminium forms 6 bond with H_2O.

Solution:

Aluminium chloride in acidified aqueous solution forms octahedral $[Al(H_2O)_6]^{3+}$ ion.