Aakash
Medical | IIT-JEE | Foundations

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MM : 300 AIATS For Two Year JEE(Main)-2027 (XI Studying-P2)_Test-02_ONLINE **Time : 180 Min.**

Chemistry

Section-I

1. (2)
2. (2)
3. (2)
4. (4)
5. (1)
6. (2)
7. (2)
8. (4)
9. (2)
10. (3)
11. (2)
12. (3)
13. (2)
14. (1)
15. (1)
16. (1)
17. (2)
18. (1)
19. (1)
20. (2)

Section-II

21. (5)
22. (58)
23. (6)
24. (4)
25. (5)

Mathematics

Section-I

26. (2)
27. (4)
28. (4)
29. (1)
30. (1)
31. (2)
32. (2)
36. (1)
37. (4)
38. (3)
39. (2)
40. (3)
41. (1)
42. (4)

33. (4)
34. (3)
35. (2)
43. (2)
44. (4)
45. (3)

Section-II

46. (730)
47. (3)
48. (19)
49. (4)
50. (0)

Physics

Section-I

51. (2)
52. (2)
53. (3)
54. (1)
55. (3)
56. (3)
57. (2)
58. (4)
59. (2)
60. (2)
61. (2)
62. (4)
63. (1)
64. (3)
65. (4)
66. (4)
67. (4)
68. (4)
69. (2)
70. (1)

Section-II

71. (31)
72. (25)
73. (9)
74. (4)
75. (11)

Hints and Solutions

Chemistry

Section-I

(1) **Answer :** (2)
Hint:
Sulphur is in +2 oxidation state in $Na_2S_2O_3$.
Solution:
$\overset{+1}{Na}\overset{+1}{H_2}PO_2 < Na_2\overset{+2}{S_2}O_3 < \overset{+3}{Na}\overset{+3}{N}O_2$

(2) **Answer :** (2)
Hint:
Simplest formula would be given by the molar ratio of atoms.
Solution:
Moles of $Zn = 0.15$
Moles of $Cr = \frac{1.8\times10^{23}}{6\times10^{23}} = 0.3$
Moles of O = 0.6
$\therefore \ 0.15 : 0.3 : 0.6$
$\Rightarrow \ 1 : 2 : 4$
$\therefore \ ZnCr_2O_4$

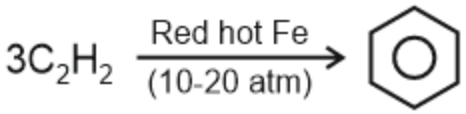
(3) **Answer :** (2)
Hint:
Br_2 disproportionates in basic medium.
Solution:
$\left(\frac{1}{2}Br_2 + e^- \rightarrow Br^-\right) \times 5$
$\frac{1}{2}Br_2 + 6\,OH^- \rightarrow BrO_3^- + 3H_2O + 5e^-$

$3\,Br_2 + 6\,OH^- \rightarrow 5\,Br^- + BrO_3^- + 3H_2O$
a = 3
b = 6
c = 5
d = 1
e = 3

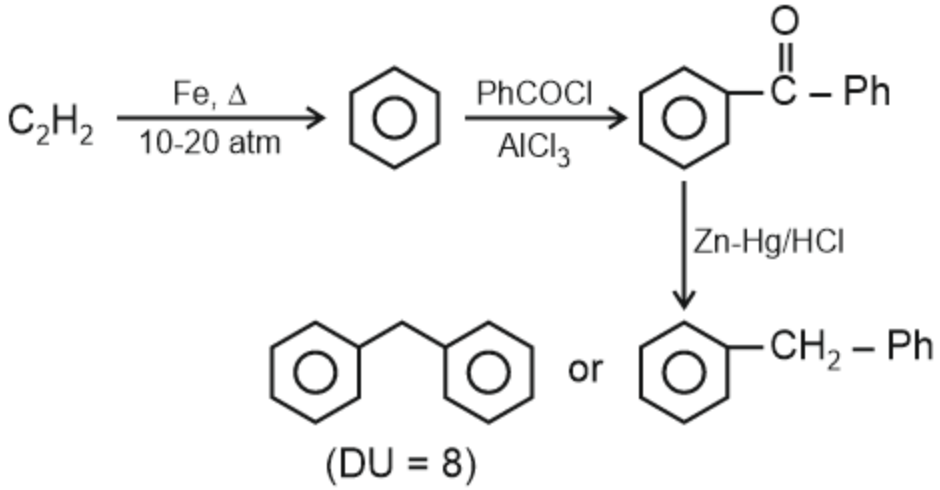
(4) **Answer :** (4)
Hint:
Aniline + H_2O is separated through steam distillation.
Solution:
$CHCl_3$ + Aniline → Simple Distillation
Crude oil → Fractional distillation
Spent lye + Glycerol → Distillation under reduced pressure
Aniline + Water → Steam Distillation.

(5) **Answer :** (1)
Hint:
Number of moles of atoms = Moles of molecule × Number of atoms present in it.
Solution:
$3.2\ g\ CH_4 = \frac{3.2}{16}\times5 = 1.0$ mol atoms
$1.7\ g\ NH_3 = \frac{1.7}{17}\times4 = 0.4$ mol atoms
1.2×10^{23} molecules of $SO_2 = \frac{1.2\times10^{23}}{6\times10^{23}}\times3 = 0.6$ mol atoms
$\therefore \ 3.6\ g\ H_2O = \frac{3.6}{18}\times3 = 0.6$ mol atoms

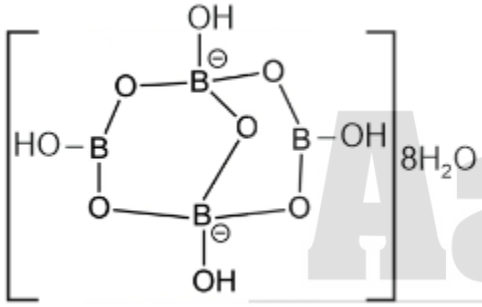
(6) **Answer :** (2)
Hint:



Solution:

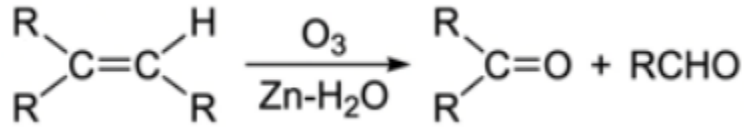


(7) **Answer :** (2)
Hint:
formula of borax is $\mathrm{Na_2\,B_4O_7\cdot 10H_2O}$
Solution:

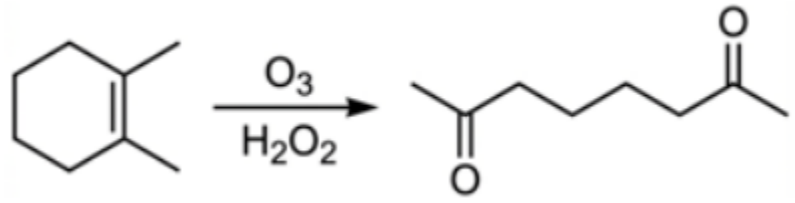


$2\mathrm{B} \rightarrow sp^2$
$2\mathrm{B} \rightarrow sp^3$

(8) **Answer :** (4)
Hint:



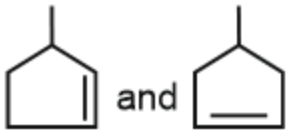
Solution:

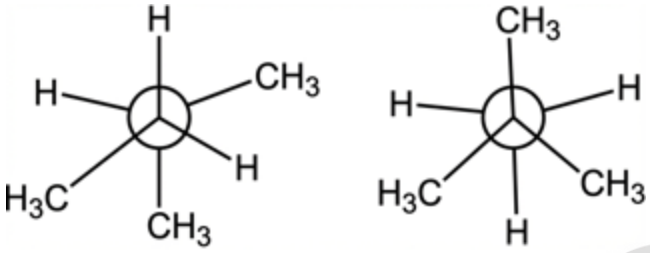


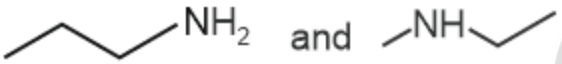
(9) **Answer :** (2)
Hint:
Higher is the standard reductions potential values, stronger is the oxidising agent.
Solution:
$\mathrm{Co^{3+}\,/\,Co^{2+}}$ has maximum SRP value.
$\therefore$ So this is the strongest reducing agent out of all.

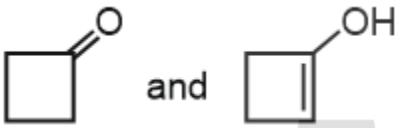
(10) **Answer :** (3)
Hint:
Pyrosilicate share only one corner.
Solution:
$Sc_2 Si_2 O_7 \Rightarrow Si_2 O_7^{2-}$ is pyrosilicate

(11) **Answer :** (2)
Hint:
Different degree amides and amine are functional isomers.
Solution:

(A)  → Position isomer

(B)  → Chain isomer

(C)  → Functional isomer

(D)  → Tautomer or functional group isomers

(12) **Answer :** (3)
Hint:

$\text{molality} = \frac{\text{mol of solute} \times 1000}{\text{mass of solvent (in g)}}$

Solution:
$X_{\text{urea}} = 0.2 = \frac{2}{10} = \frac{2}{2+8}$
$n_{\text{urea}} = 2$
$n_{H_2O} = 8$
$\text{molality} = \frac{2 \times 1000}{8 \times 18} = 13.88$

(13) **Answer :** (2)
Hint:
Alkane halogenation occurs via free radical substitution.
Solution:
$F_2 > Cl_2 > Br_2 > I_2$

(14) **Answer :** (1)
Solution:
$\underset{(\text{Stability})}{CF_4 > CCl_4 > CBr_4 > CI_4}$

(15) **Answer :** (1)
Hint:
Pb^{2+} is more common oxidation state than Pb^{4+}.
Solution:
I.E. of g-13: $B > Tl > Ga > Al > In$
Pb^{2+} is more stable than Pb^{4+}.

(16) **Answer :** (1)
Hint:

Molar volume (V_m) = 22.4 L at STP for all gases.

Solution:

2 g molecule of O_2 = 4 mol of O-atom

g eq volume of H_2 = 11.2 L at STP

22 g CO_2 = 0.5 mol = 11.2 L at STP

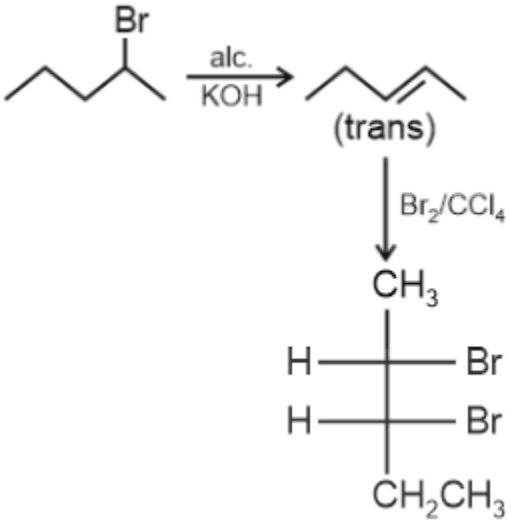
18 g H_2O = 1 mol = 3 mol of atoms

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

Hint:

Anti addition to trans alkene forms erythro product.

Solution:



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

Hint:

Precipitate of AgX is observed.

Solution:

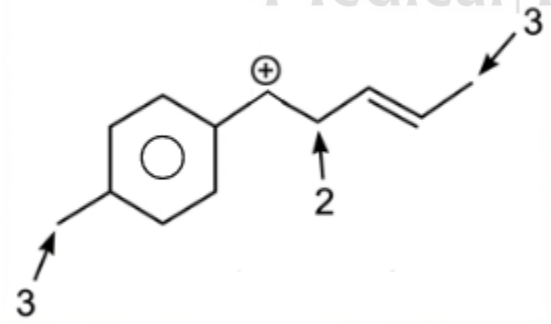
Due to HNO_3, N & S (if present) are expelled as HCN & H_2S respectively.

(19) **Answer :** (1)

Hint:

α-H wrt sp^2-hybrid carbon

Solution:



Total $= 8$ αH

(20) **Answer :** (2)

Hint:

Equivalent weight = $\frac{\text{Molecular weight}}{n_{\text{factor}}}$

Solution:

$14e^- + 2NO_3^- + 16H^+ \rightarrow N_2H_4 + 6H_2O$

$E_{NO_3^-} = \frac{M}{7}$

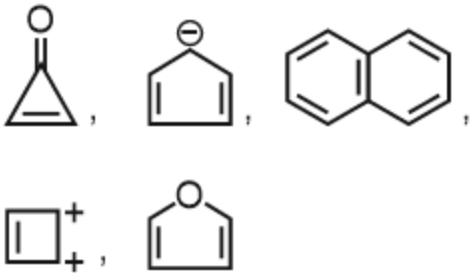
Section-II

(21) **Answer :** 5

Hint:

Aromatic compounds follow Huckel's rule.

Solution:



(22) **Answer :** 58

Hint:

In graphite, carbon is sp^2 hybridised.

Solution:

$C \rightarrow sp^2$ (in graphite)

$C \rightarrow sp^3$ (in diamond)

$\%p = (25 + 33.33)\%$

$= 58.33\%$

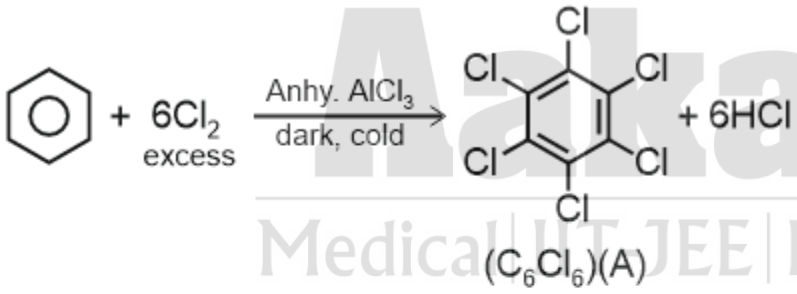
$\approx 58\%$

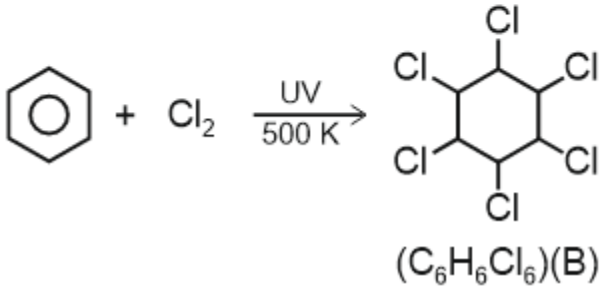
(23) **Answer :** 6

Hint:

Benzene undergoes electrophilic aromatic substitution reactions with Cl_2/ $AlCl_3$ in dark cold condition.

Solution:





Difference in molecular weight of A & B is 6.

(24) **Answer :** 4

Hint:

MnO_4^- changes to Mn^{2+} in acidic medium.

Solution:

$\underset{(n_f=3)}{\overset{+2}{Fe}}\overset{+3}{C_2}O_4 \rightarrow Fe^{3+} + \overset{+4}{C}O_2$

$\overset{+3}{Fe_2}\underset{(n_f=6)}{\left(\overset{+3}{C_2}O_4\right)_3} \rightarrow Fe^{3+} + \overset{+4}{C}O_2$

$\therefore$ Equivalent of $KMnO_4$ = equivalent of FeC_2O_4 + equivalent of $Fe_2(C_2O_4)_3$

$\Rightarrow n \times 5 = 2 \times 3 + 2 \times 6$

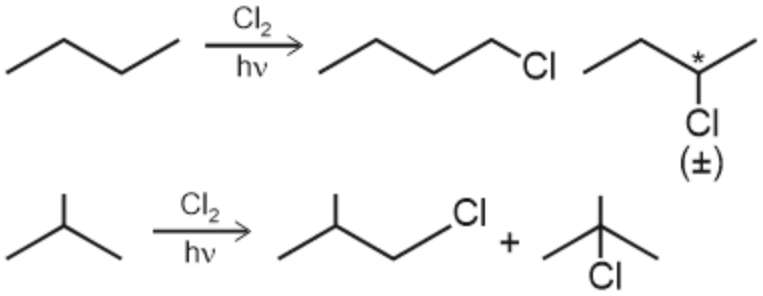
$\Rightarrow n = \frac{18}{5} = 3.6$

$\therefore\ n = 3.6$ moles

(25) Answer : 5

Solution:

C_4H_{10} (DU = 0)



Total = 5

Mathematics

Section-I

(26) Answer : (2)

Solution:

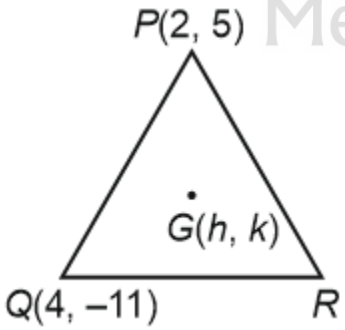
The required 3 digit number should occur 3 times in $2000!$ and once in $1000!$

So $\frac{2000}{3} = 666\frac{2}{3}$

661 is the nearest prime number

(27) Answer : (4)

Solution:



R lies on $9x + 7y + 4 = 0$

$\Rightarrow 9(3h-6) + 7(3k+6) + 4 = 0$

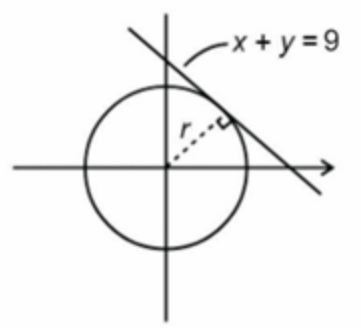
$\Rightarrow (9h + 7K)3 - 8 = 0$

Which is parallel to N.

(28) Answer : (4)

Solution:

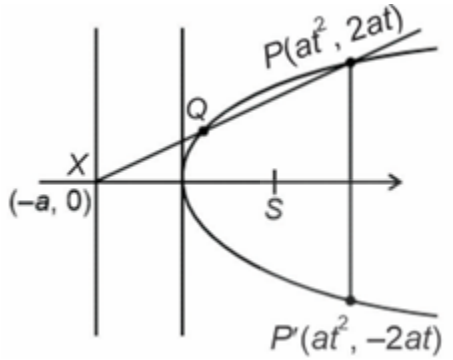
Shifting origin to (2, 3)



$C : (x-2)^2 + (y-3)^2 = 8$

$r = \frac{4}{\sqrt{2}} = 2\sqrt{2}$

(29) **Answer :** (1)
Solution:



PX : $(1+t^2)y = 2t(x+a)$

For point *Q*

$t^2(x+a)^2 = ax(1+t^2)^2$

$(x - at^2)(xt^2 - a) = 0$

$x = \frac{a}{t^2}$

$Q\left(\frac{a}{t^2}, \frac{2a}{t}\right)$

P'Q : $\left(x-a\right) + \left(\frac{t^2-1}{2t}\right)y = 0$

P'Q always passes through $(a,\ 0)$.

(30) **Answer :** (1)
Solution:
Let extremities of the chord be $P_1 = (a\cos\theta,\ b\sin\theta)$ and $P_2 = (-a\sin\theta,\ b\cos\theta)$

$(P_1P_2)^2 = a^2 + b^2 + (a^2 - b^2)\sin 2\theta \le a^2 + b^2 + a^2 - b^2$

$(P_1P_2)^2 \le 2a^2$

$P_1P_2 \le \sqrt{2}a$

(31) **Answer :** (2)
Solution:
Centre of rectangular hyperbola $\equiv (1, -2)$

So equation of asymptote $\Rightarrow x = -1$ and $y = -2$

So, radius = $\frac{\sqrt{5}}{2}$

(32) **Answer :** (2)
Solution:
For $n = -(l+m)$

$al^2+bm^2+c(l+m)^2=0$

$=(a+c)l^2+2clm+(b+c)m^2=0$

For parallel lines

$4c^2-4(b+c)(a+c)=0$

$ab+bc+ca=0$

$=\frac{1}{a}+\frac{1}{b}+\frac{1}{c}=0$

(33) Answer : (4)

Solution:

$f(x)=a(x-\alpha)^2$

$\because f''(0)=6$

$f'(x)=2a(x-\alpha)$

$f''(x)=2a=6$

$\Rightarrow a=3$

$\therefore f(x)=3(x-\alpha)^2$

Now $\lim\limits_{x\to\alpha}\frac{3(x-\alpha)^2}{1-\cos(x-\alpha)}$

= 6

(34) Answer : (3)

Solution:

Let $z=r(\cos\theta+i\sin\theta)$

$\Rightarrow r^2+\frac{4}{r^2}-2\cdot2\cos\theta-16=0$

$\Rightarrow r^4-4r^2(\cos2\theta+4)+4=0$

$\Rightarrow r_{\max}=2+\sqrt{6}$ (when $\cos2\theta=1$)

(35) Answer : (2)

Solution:

$\sin^6x+\cos^6x=a\Rightarrow1-3\sin^2x\cos^2x=a$

$\Rightarrow a=1-\frac{3}{4}\sin^2 2x$

$\sin^2 2x=\frac{4(1-a)}{3}$

$\because\ \sin^2 2x\in[0,1]$

$\Rightarrow\frac{4}{3}(1-a)\in[0,1]$

$\Rightarrow a\in[\frac{1}{4},1]$

(36) Answer : (1)

Solution:

$X=\{a_1,a_2,a_3\cdots a_{10}\}$

Number of subsets 2^{10}

Number of ways of choosing *A* and *B* is

$=2^{10}\cdot2^{10}=2^{20}$

Number of ways of choosing *A* and *B* so that they have same number of elements

$^{10}C_0\cdot{}^{10}C_0+{}^{10}C_1\cdot{}^{10}C_1+{}^{10}C_2\cdot{}^{10}C_2+\cdots+{}^{10}C_{10}\cdot{}^{10}C_{10}$

$={}^{20}C_{10}$

Therefore, $P(E)=\frac{{}^{20}C_{10}}{2^{20}}$

(37) Answer : (4)

Solution:

$(b^3)^4(c^2)^3(d^5)^3(e^3)^{4n/3}$

Now = $4+3+3+\frac{4n}{3}=26$

$\Rightarrow n=12$

coeff of $b^{12}c^6d^{15}e^{48}$

$B={}^{26}C_4\times{}^{22}C_3\times2^3\times{}^{19}C_3\times{}^{16}C_{16}$

$=\frac{26!}{108\times16!}$

(38) Answer : (3)
Solution:
$X = x - 2,\ Y = y + 3$
Angle bisector $\alpha X^2 + 2\gamma XY + \beta Y^2 = 0$ is $3x - y = 9$
So other bisector is $x + 3y + 7 = 0$
$x_{\text{int}} = -7$
$y_{\text{int}} = -\frac{7}{3}$
$x_{\text{int}} + y_{\text{int}} = -7 - \frac{7}{3} = -\frac{28}{3}$

(39) Answer : (2)
Solution:
Line through (2, 2) can be
$\frac{x-2}{\cos\theta} = \frac{y-2}{\sin\theta} = r$
when this line cuts circle $x^2 + y^2 = 2$.
$(r\cos\theta + 2)^2 + (r\sin\theta + 2)^2 = 2$
$r^2 + 4(\sin\theta + \cos\theta)r + 6 = 0$
$\frac{PB}{PA} = \frac{r_2}{r_1} \qquad r_1 = \alpha \qquad r_2 = 3\alpha$
$4\alpha = -4(\sin\theta + \cos\theta)$
$\Rightarrow 3\alpha^2 = 6 \Rightarrow \sin 2\theta = 1 \Rightarrow \theta = \pi/4$
So chord will be $y = x$

(40) Answer : (3)
Solution:

$$\lim_{x\to 0} \frac{\left[\frac{\sin\left(m^2+n^2\right)x}{\left(m^2+n^2\right)x}\right]\left(m^2+n^2\right)x}{\frac{\tan\left(\frac{x}{\sqrt{3}}\right)}{\left(\frac{x}{\sqrt{3}}\right)} \times \frac{x}{\sqrt{3}}} = 25$$

$\Rightarrow \quad \left(m^2 + n^2\right)\sqrt{3} = 25$

(41) Answer : (1)
Solution:
$z = x_1 + iy_1$ and $w = x_2 + iy_2$
$|z - 3| = \text{Re}(z) \ \Rightarrow \ (x_1 - 3)^2 + y_1^2 = x_1^2 \qquad \ldots(1)$
$|w - 3| = \text{Re}(w) \ = \ (x_2 - 3)^2 + y_2^2 = x_2^2 \quad \ldots(2)$
$\arg\left(z - w\right) = \frac{\pi}{4} \ \Rightarrow \ \frac{y_1 - y_2}{x_1 - x_2} = 1 \qquad \ldots(3)$
From (1), (2), (3)
$\Rightarrow \ y_1 + y_2 = 6$

(42) Answer : (4)
Solution:
$(\sin^2 x + 1)^2 = 3 - a^2$
$1 \le 3 - a^2 \le 4$
$-\sqrt{2} \le a \le \sqrt{2}$

(43) Answer : (2)
Solution:
$n(S) = {}^{m+n}C_2$
$n(A) = \frac{{}^{m}C_2 + {}^{n}C_2}{{}^{m+n}C_2} = \frac{1}{2}$
$m^2 + n^2 - (m + n) = 2mn$
$(m - n)^2 = m + n = k^2, \ \ k \in N$
$\Rightarrow m + n = k^2,\ m - n = k$
$m = \frac{k(k+1)}{2}, \ \ n = \frac{k(k-1)}{2}$
$k^2 \le 51 \Rightarrow k_{\text{max.}} = 7$

$m_{max.} = \frac{7\times 8}{2} = 28$

(44) Answer : (4)
Solution:
$\frac{\sum f_i}{2} = \frac{68}{2} = 34$

x	f	Cf
6	4	4
12	7	11
18	9	20
24	18	38
30	15	53
36	10	63
42	5	68

$\therefore$ 34th term lies in *Cf* 38. Median class 24.
$\therefore\ f_i|x_i - 24| = 72 + 84 + 54 + 0 + 90 + 120 + 90 \quad = 510$
Mean Deviation $= \frac{510}{68} = 7.5$

(45) Answer : (3)
Solution:
$y = x + \sqrt{4x^2 + x}$
$y(3) = 3 + \sqrt{39}$

Section-II

(46) Answer : 730
Solution:
$T_{r+1} = {}^{6561}C_r \left(7^{\frac{1}{3}}\right)^{6561-r} \left(11^{\frac{1}{9}}\right)^r$
$\frac{6561-r}{3} = 9$
$\Rightarrow$ 730 total rational number

(47) Answer : 3
Solution:
$P(E_2) = \lambda$
$P(E_1) = \lambda^2$
Odd against $E_1 = \frac{1-\lambda^2}{\lambda^2}$
Odd against $E_2 = \frac{1-\lambda}{\lambda}$
$\left(\frac{1-\lambda^2}{\lambda^2}\right) = \left(\frac{1-\lambda}{\lambda}\right)^3$
$\Rightarrow 3\lambda = 1$
$3\lambda + 2 = 3$

(48) Answer : 19
Solution:
Given numbers are in AP
$a = 1,\ d = 3$
$19 \times k = \frac{3k^2}{2} - \frac{k}{2}$
$\Rightarrow k = 13$
$T_n = 3n - 2$
T_7 will be the median
$T_7 = 19$

(49) Answer : 4
Solution:
Let's consider α as real root and $i\beta$ as the imaginary root then
$\alpha + i\beta = -a \Rightarrow \alpha - i\beta = -\bar{a}$

$\Rightarrow 4i\alpha\beta = a^2 - \bar{a}^2$
$= a^2 - \bar{a}^2 = 4b$

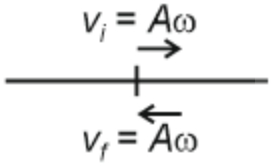
(50) Answer : 0
Solution:

$2\sin\left(x+\frac{\pi}{3}\right) = 2\left[x-\pi\right]^2 + 2$
$-2 \le \text{LHS} \le 2$
$\text{RHS} \ge 2$ for $x = \pi$
LHS takes extremes at $x = \frac{\pi}{6}$
If $\text{LHS} \ne \text{RHS}$
$\therefore$ No solution

Physics

Section-I

(51) Answer : (2)
Solution:



$a_{avg} = \frac{2A\omega}{T/2}$
$= \frac{4\times4\times2\pi}{6\times6}$
$= \frac{8\pi}{9}\ \text{cm/s}^2$

(52) Answer : (2)
Solution:

PV^{γ} = constant
$\gamma = \left(\frac{5}{3}\right)$
$P_Q(V_0)^{5/3} = P_2(8V_0)^{5/3}$
$P_2 = \frac{P_0}{32}$
$Q = nC_P\Delta T$
$= \frac{5}{2}(P_2V_2 - P_1V_1)$
$\Rightarrow \quad \frac{-P_0}{32}\times\frac{5}{2}\times7V_0 = \frac{-P_0V_0\times35}{64}$

(53) Answer : (3)
Solution:

$< I >= \frac{P_0^2V}{2B}$
$B = \frac{P_0^2V}{2I}$
$= \frac{10^6.300}{2\times2}$
$= 0.75 \times 10^8$
$= 7.5\times10^7$

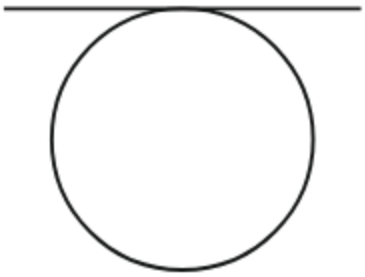
(54) Answer : (1)
Solution:

$\ell = \left(2n\pm1\right)\frac{\lambda}{4}$
$\ell = \frac{9\lambda}{4}$

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

$\therefore$ 5 nodes

(55) **Answer :** (3)
Solution:



$I = \frac{mR^2}{2} + mR^2 = \frac{3}{2}mR^2$

$T = 2\pi\sqrt{\frac{I}{mgd}}$

$= 2\pi\sqrt{\frac{\frac{3}{2}mR^2}{mgR}} = 2\pi\sqrt{\frac{3R}{2g}}$

(56) **Answer :** (3)
Solution:
This is an isothermal process

$W = n\,RT\,\ln\frac{V_2}{V_1}$

$= RT\,\ln\,3$

$U_0 = nC_VT$

$T = \frac{U_0}{nC_v} = \frac{U_0}{\frac{5R}{2}} = \frac{2U_0}{5R}$

$W = R \times \frac{2U_0}{5R}\,\ln\,3$

$= \frac{2}{5}U_0\,\ln\,3$

(57) **Answer :** (2)
Solution:

$R_{eq} = 2R + \frac{2R}{3} = \frac{8R}{3}$

$i = \frac{\Delta T}{R_{eq}} = \frac{T3}{8R}$

$T_D = T_A - iR$

$= T - \frac{3T \times R}{8R}$

$= \frac{5T}{8}$

(58) **Answer :** (4)
Solution:

$P_1V_1 = P_2V_2$

$\left(P_0 + \frac{4T}{R}\right)\frac{4}{3}\pi R^3 = \left(P + \frac{4T}{R}\right)\frac{4}{3}\pi\frac{R^3}{8}$

$8\left(P_0 + \frac{4T}{R}\right) = \left(P + \frac{4T}{R}\right)$

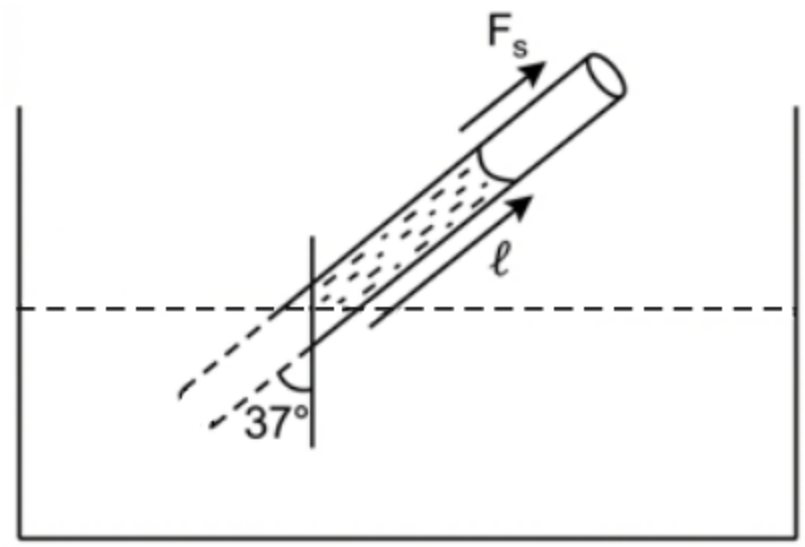
$8P_0 + \frac{24T}{R} = P$

(59) **Answer :** (2)
Solution:

$\Delta l = \frac{F_{avg}L}{AY}$

$\Delta l = \frac{5MgL}{2AY}$

(60) **Answer :** (2)
Solution:



$F_s = \rho l g \cos 37^\circ \cdot \pi r^2$

$T 2\pi r \cos 30^\circ = \rho l g \cdot \cos 37^\circ \cdot \pi r^2$

$T = \frac{\rho l g 4 r}{5\sqrt{3}}$

$l = \frac{5\sqrt{3}T}{4\rho g r}$

(61) Answer : (2)
Solution:

$\mathrm{TE}_i = \mathrm{TE}_f$

$0 + 0 = \frac{1}{2}\mathrm{mv}^2 - \frac{3\,\mathrm{GMm}}{2R}$

$V = \sqrt{\frac{3\,\mathrm{GM}}{R}} = \sqrt{\frac{3}{2}}V_e$

(62) Answer : (4)
Solution:

$dQ = dU + dW = 0$

$d(7 + 4PV) + PdV = 0$

$4PdV + 4VdP + PdV = 0$

$5PdV + 4VdP = 0$

$\frac{4dP}{P} = \frac{-5dV}{V}$

$PV^{\frac{5}{4}} = C$

$\gamma = \frac{5}{4}$

(63) Answer : (1)
Solution:

$v = \sqrt{2gl}$

$t = \sqrt{\frac{2h}{3g}}$

$R = 2\sqrt{\frac{hl}{3}} = 2h$

$l = 3h$

$l' + \frac{2h}{3} = 3h$

$l' = \frac{7h}{3}$

$M = \rho A l' = \frac{7}{3}\rho A h$

(64) Answer : (3)
Solution:

$U = \frac{1}{2} \times Y \times (\text{longitudinal strain})^2$

Lateral strain

longitudinal strain = $\frac{1}{4}$

longitudinal strain = 4 lateral strain

$U = \frac{1}{2} \times Y \times (16)\ \varepsilon^2$

$= 8Y\varepsilon^2$

(65) **Answer :** (4)

Solution:

$V = \omega\sqrt{A^2 - x^2}$

$V = \frac{\omega A\sqrt{3}}{2}, V_{\max} = A\omega = A\sqrt{\frac{k}{m}}$

$V = \frac{\sqrt{3}V_{\max}}{2}$

$V' = \frac{mV}{3m} = \frac{V}{3} = \frac{V_{\max}}{\sqrt{32}}$

$\omega' = \sqrt{\frac{k}{3m}}$

$V' = \omega'\sqrt{(A')^2 - \left(\frac{A}{2}\right)^2}$

$\frac{V_{\max}}{2\sqrt{3}} = \frac{\omega}{\sqrt{3}}\sqrt{(A')^2 - \left(\frac{A}{2}\right)^2}$

$\frac{A^2}{4} + \frac{A^2}{4} = A'^2$

$A' = \frac{A}{\sqrt{2}}, f' = \frac{f}{\sqrt{3}}$

(66) **Answer :** (4)

Solution:

$\frac{70\times1+\omega}{10} = \frac{150\times1+\omega}{20}$

$160 = 150 + \omega$

$\omega = 10g$

(67) **Answer :** (4)

Solution:

$E_x = -\frac{\partial V}{\partial x},\ E_y = -\frac{\partial V}{\partial y},\ E_z = -\frac{\partial V}{\partial z}$

$\vec{E} = -4\hat{i} - 12\hat{j} - 3\hat{k}$

$|E| = 13$

$\therefore\ F = Em = 13 \times 5 = 65$ N

(68) **Answer :** (4)

Solution:

$\frac{-dT}{dt} = \frac{\sigma eAT^4}{ms}$

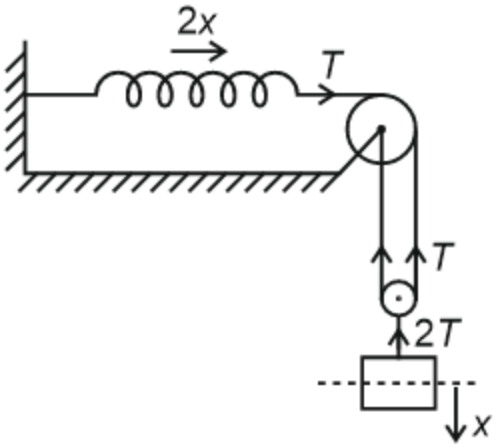
$= \frac{\sigma e.4\pi R^2T^4}{\rho\frac{4}{3}\pi R^3 s}$

$\propto \frac{T^4}{R}$

= 4 × 1 + 2

= 6%

(69) Answer : (2)
Solution:



$F_R = 2T = 2(k2x) = 4kx$

$T = 2\pi\sqrt{\frac{m}{4k}} = \pi\sqrt{\frac{m}{k}}$

(70) Answer : (1)
Solution:

$\lambda = \frac{1}{\sqrt{2}\pi d^2 n}$

n = number of molecules/volume

$\lambda = \frac{V}{\sqrt{2}\pi d^2 N}$

frequency = $\frac{v_{\text{arg}}}{\lambda}$

frequency $\propto \frac{\sqrt{T}}{V}$

$\frac{\sqrt{T}}{V}$ = constant

PV^{-1} = constant

$C = C_v + \frac{R}{1-(-1)}$

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

Section-II

(71) Answer : 31
Solution:

$mv_1 a(1+e) = mv_2 a(1-e)$

$\frac{15}{16} = \frac{1-e}{1+e}$

$15 + 15e = 16 - 16e$

$e = \left(\frac{1}{31}\right)$

(72) **Answer :** 25
Solution:

$$A_r = \frac{A_i}{4} = A_i\left(\frac{V_2 - V_1}{V_1 + V_2}\right)$$

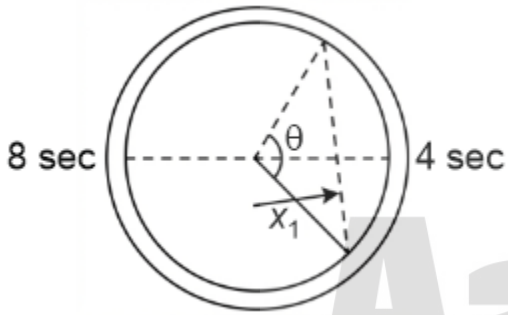
$$3V_2 = 5V_1$$

$$3\sqrt{\frac{T}{\mu_1}} = 5\sqrt{\frac{T}{\mu_2}}$$

$\mu_2 = 25$ g/m

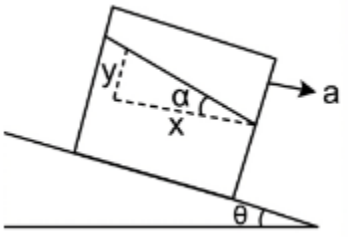
(73) **Answer :** 9
Solution:
Heat released = Heat gain
$m_1 \times \frac{1}{2} \times 20 + m_1 \times 80 = m_2 \times 1 \times 80$
$90m_1 = 80m_2$
$\frac{m_1}{m_2} = \frac{8}{9}$

(74) **Answer :** 4
Solution:



$T = 12 \text{ sec} \Rightarrow \omega = \frac{\pi}{6}$
$\theta = 120^\circ$
$x_1 = A\cos 60^\circ = \frac{A}{2}$
$5 = \frac{\pi}{6}\sqrt{A^2 - \frac{A^2}{4}}$
$5 = \frac{\pi}{6} \cdot \frac{\sqrt{3}A}{2}$
$A = \frac{60}{\pi\sqrt{3}} = \frac{5\times 4\sqrt{3}}{\pi}$

(75) **Answer :** 11
Solution:



$\rho(a - g\sin\alpha)x = \rho g\ \cos\theta \cdot y$
$\tan\alpha = \frac{a - g\sin\theta}{g\cos\theta}$
$\tan\alpha = \frac{3}{8}$