Sri Chaitanya IIT Academy.,India.

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A right Choice for the Real Aspirant

ICON Central Office - Madhapur - Hyderabad

SEC: Sr.Super60_NUCLEUS-BT	JEE-MAIN	Date: 12-07-2025
Time: 09.00Am to 12.00Pm	RPTM-01	Max. Marks: 300

KEY SHEET

MATHEMATICS

1)	**4**	2	**2**	3)	**3**	4)	**3**	5)	**2**
6)	**1**	7)	**2**	8)	**1**	9)	**2**	10)	**1**
11)	**2**	12)	**1**	13)	**4**	14)	**4**	15)	**2**
16)	**1**	17)	**1**	18)	**2**	19)	**4**	20)	**4**
21)	**50**	22)	**3**	23)	**12**	24)	**5**	25)	**5**

PHYSICS

26	**1**	27	**3**	28	**1**	29	**3**	30	**3**
31	**3**	32	**1**	33	**2**	34	**3**	35	**3**
36	**1**	37	**3**	38	**2**	39	**2**	40	**2**
41	**3**	42	**3**	43	**3**	44	**2**	45	**1**
46	**90**	47	**5**	48	**10**	49	**41**	50	**773**

CHEMISTRY

51	**3**	52	**3**	53	**1**	54	**3**	55	**3**
56	**2**	57	**1**	58	**1**	59	**3**	60	**3**
61	**1**	62	**4**	63	**2**	64	**1**	65	**3**
66	**1**	67	**4**	68	**2**	69	**1**	70	**3**
71	**9**	72	**0**	73	**7**	74	**5**	75	**6**

SOLUTION
MATHEMATICS

1. $f(n)=\left[\frac{1}{3}+\frac{3n}{100}\right]n \quad [n]=GIF$

For $n=1,2,3.......22$ Get f(n)=0

For $n=23,24,.....55$ Get f(n)=1(n)

For n=56 f(n) =2(n)

$\sum_{n=1}^{56} f(n)=0+1(23)+1(24)+----+1+(55)+21(56) \qquad =1399$

2. F is define when $\frac{2x-3}{5+4x}>0,-1\le\frac{4+3x}{2-x}\le 1$

$\frac{+-+}{\frac{-5}{4}\quad\frac{3}{2}} \qquad \frac{4+3x}{2-x}+1\ge 0,\frac{4+3x}{2-x}-1\le 0$

$x\in\left(-\infty,\frac{-5}{4}\right)\cup\left(\frac{3}{2},\infty\right) \quad \frac{x+3}{x-2}\le 0\, and\, \frac{2x+1}{x-2}\ge 0$

$-3\le x<2\, and x\le-\frac{1}{2} or\, x>2,\left[-3,\frac{-1}{2}\right]\to 2$

$1\cap 2\Rightarrow\left[-3,\frac{-5}{4}\right)=[\alpha,\beta)$

3. $\tan^{-1}\frac{(n+1)-n}{1+n(n+1)}=\tan^{-1}(n+1)-\tan^{-1}n$

4. $f(g(x))=\begin{cases}2+2g(x) & -1\le g(x)<0\\ 1-\frac{g(x)}{3} & 0\le g(x)\le 3\end{cases} \qquad =\begin{cases}1+\frac{x}{3}, & -3\le x\le 3\\ 1-\frac{x}{3}, & 0\le x\le 1\end{cases}$

5. $\tan\left(2\tan^{-1}\frac{3}{2}+\tan^{-1}\frac{5}{12}\right) \qquad$ =tan(2A+B)

$=\frac{\tan 2A+\tan B}{1-\tan 2A\tan B} \qquad \tan 2A=\frac{2.\frac{3}{5}}{1-\frac{9}{15}} \qquad =\frac{\frac{15}{8}+\frac{5}{12}}{1-\frac{15}{8}\frac{5}{12}} \qquad =\frac{15}{8}$

6. $f(x)=\sin x.\tan x.\cot x \qquad =\sin x, x\ne\frac{n\pi}{2}$

7. $f(x)=x^2+6x+7$

Minimum$=\frac{4(7)-36}{4}=-2$ occurs at $x=-3$

$f(x)\in[-2,\infty)$

$f(f(x)\in[-1,\infty)$

$f(f(f(x)))\in[2,\infty)$

$f(f(f(f(x))))\in[23,\infty)$

8. $f(x)=x(4-x)$

$y=x(4-x)$

$x^2-4x+y=0$

$x=2\pm\sqrt{4-y}$

$f^{-1}(x)=2+\sqrt{4-x}, f^{-1}(x)=2-\sqrt{4-x}$

Not possible

9. put x=2 $f(2)+f(-1)=3\to(1)$

Put $x=-1$ $f(-1)+f\left(\frac{1}{2}\right)=0\to(2)$

Put $x=\frac{1}{2}$ $f\left(\frac{1}{2}\right)+f(2)=\frac{3}{2}\to(3)$

1-2$\Rightarrow f(2)-f\left(\frac{1}{2}\right)=3$

$3+4\Rightarrow 2f(2)=9$

10. $f(x)=\sin^2 x+1-\cos^2\left(x+\frac{\pi}{3}\right)+\dfrac{\cos\left(2x+\frac{\pi}{3}\right)+\cos\frac{\pi}{3}}{2}$

$=1-\cos\left(2x+\frac{\pi}{3}\right)\cos\frac{\pi}{3}+\frac{1}{2}\cos\left(2x+\frac{\pi}{3}\right)+\frac{1}{4}$ $=\frac{5}{4}$

11. $f(x)+f(1-x)=1$

12. $f'(x)=3x^2+2x+3+\cos x>0$

13. $x+y=\frac{\pi}{2}-\tan^{-1}1$ $\because$ a must be zero

14. $f(f(x))=\left(9-f^{40}(x)\right)^{\frac{1}{40}}$ $f(f((f(x)))=f(x)=\left(9-x^{40}\right)^{\frac{1}{40}}$

$\left(9-\left(9-x^{40}\right)\right)^{\frac{1}{40}}=x$

15. $f(f(x))=-\frac{1}{x}$ $f(f(f(x)))=x$

16. $\cos^{-1}\left\{\beta+\frac{1+\beta^2}{\alpha-\beta}\right\}$ $\cos^{-1}\frac{\alpha\beta-\beta^2+1+\beta^2}{\alpha-\beta}$

$\cos^{-1}\frac{\alpha\beta+1}{\alpha-\beta}=\cos^{-1}\alpha-\cot^{-1}\beta$ $\because\alpha-\beta>0$

17. $\cos^{-1}2x = \pi + 2\cos^{-1}\sqrt{1-x^2}$

True only when $\cos^{-1}2x = \pi$ and $2\cos^{-1}\sqrt{1-x^2} = 0$

$x = -\frac{1}{2}$ and $x = 0$ So no solution

18. $A)\ f(x) = \frac{x}{1+x} = 1 - \frac{1}{1+x}$

$f'(x) = \frac{1}{(1+x)^2} > 0$ $\therefore$ f is one – one

$\left|\sum_{x\to\infty} f(x) = 1\right|$ $\therefore$ not onto

$B)\ f(1) = 0, f(-1) = 0$ not one one

Range is R $\therefore$ onto

19. **statement -I:** By drawing the graph two points of intersection possible

statement –II : draw the graph

20. $\frac{x + \frac{3}{x} - \left(x - \frac{3}{x}\right)}{1 + x^2 - \frac{9}{x^2}} = \frac{6}{x}$ $x^4 = 9$

21. Put $x = 1, y = 1 \Rightarrow f(1) = 2$

Put $y = \frac{1}{x} \Rightarrow f(x) = 1 \pm x^n$

$f(2) = 5 \Rightarrow n = 2$ $\therefore f(x) = 1 + x^2$

22. $f(x-2) = f\left(x + \left[6 + \frac{1}{x^2+4}\right]\right)$

$\Rightarrow f(x-2) = f(x+6)$

$\Rightarrow f(x) = f(x+8)$

Periodic function with period=8

23. when $x > 0$ $\sin^{-1}x = \cos^{-1}\sqrt{1-x^2}$.

$x < 0$ $\sin^{-1} = -\cos^{-1}\sqrt{1-x^2}$

24. $(K-2)x^2 + 8x + k + 4 > 12 - 4\pi + 4\pi - 12$

$(k-2)x^2 + 8x + K + 4 > 0 \forall x \in R$

$\therefore k - 2 > 0$ and $\Delta < 0$

25. $\cot^{-1}\frac{n}{\pi} > \frac{\pi}{6}$ $\Rightarrow \frac{n}{\pi} < \cot^{-1}\frac{\pi}{6}$

$\Rightarrow n < \pi\sqrt{3}$

PHYSICS

26. Density of water is maximum at 4°C. Hence volume is minimum at 4°C,

27. due to motion of gas molecules, average momentum $p_{avg} = 0$. So p_{avg} do not depend on temperature $V_{rms} = \sqrt{\dfrac{3RT}{M}}$

When temperature is double, $T_{new} = 2T$ $\quad M_{new} = \dfrac{M}{2}$

$$\frac{v_{new}}{v} = \frac{\sqrt{\dfrac{2}{M/2}}}{\sqrt{\dfrac{T}{M}}} = 2 \qquad \text{So. } v_{new} = 2v$$

28. Moon has less escape velocity due to its small radius and low value of acceleration due to gravity. Also the rms velocity of molecules at moon is greater than Its escape velocity. Hence molecules of air escape and there is no atmosphere at Moon.

29. Mean free path is given by,

$$\lambda = \frac{RT}{\sqrt{2}\pi d^2 N_A P} \Rightarrow \lambda \alpha \frac{1}{d^2}$$

Kinetic energy 1s given by, $K = \dfrac{f}{2} nRT \qquad \Rightarrow K \alpha T$

30. As we know,

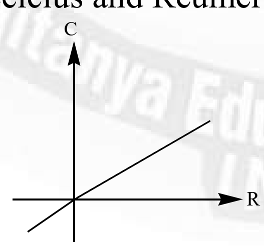
$\gamma = \dfrac{C_p}{C_p} = 1 + \dfrac{2}{f}$, where f= degree of freedom

Monatomic, $f = 3 \ \therefore \gamma = 1 + \dfrac{2}{3} = \dfrac{5}{3}$

Diatomic rigid molecules, f=5 $\quad \therefore \gamma = 1 + \dfrac{2}{5} = \dfrac{7}{5}$

Diatomic non-rigid molecules, f= 7 $\quad \therefore \gamma = 1 + \dfrac{2}{7} = \dfrac{9}{7}$

31. The equation for Celcius and Reumer scale temperature is



$$\frac{C}{100} = \frac{R}{80} \qquad \Rightarrow C = \frac{10}{8} R \Rightarrow y = mx$$

C - R graph is straight line

32. Length of rod 1 is given by,

$l_1' = l_1 (1 + \alpha_1 \Delta T)$

and length of rod 2 is given by,

$l_2' = l_2(1+\alpha_2\Delta T)$

$l_1' - l_2' = l_1 + \alpha_1 l_1 \Delta T - l_2 - \alpha_2 l_2 \Delta T$

Since $l_1' - l_2'$ is independent of temperature,

$\alpha_1 l_1 \Delta T - \alpha_2 l_2 \Delta T = 0, \alpha_1 l_1 = \alpha_2 l_2, \frac{l_1}{l_2} = \frac{\alpha_2}{\alpha_1}$

33 Heat lost by one liquid = Heat gained by another liquid

$ms_1(40-32) = ms_2(32-20)$

$8s_1 = 12s_2$

$\frac{s_1}{s_2} = \frac{12}{8} = \frac{3}{2}$

thus, $\frac{s_2}{s_1} = \frac{2}{3}$

34. When temperature is increased, both glass vessel and mercury will expand

Here, apparent coefficient of expansion is

$\gamma_a = \gamma_{Hg} - \gamma_g$

$\gamma_a = (182\times10^{-6}) - (30-10^{-6})$

$\gamma_a = 152\times10^{-6}\ {}^0C$

Overflow volume is $\Delta V = V\gamma_a \Delta T$

$= 1000\times152\times10^{-6}\times(100-0)$

$= 15.2cm^3$

35. let specific A and C are mixed, let final temperature T

Form (1)and (2),

$ms_A(16-12) = ms_B(19-16)$

$4s_A = 3s_B$

$ms_g(23-19) = ms_C(28-23)$

$4s_B = 5s_C$

When A and C are mixed, let final temperature is T

Form (1) and (2),

$16s_A = 12s_B = 15s_C$

$ms_C(28-T) = ms_A(T-12)$

$15s_C(28-T) = 15s_A(T-12)$

$16s_A(28-T) = 15s_A(T-12)$

$T = \frac{16\times28+12\times15}{16+15}$

$T = 20.26^o c = 20.3^o C$

36. Let mass of hail stone that falls is mkg

$K.E = m(10)(1000) = 10^4 ml$

for m kg of ice to melt, heat required

$H = m \times 34 \times 10^5 J = 33m \times 10^4 J$

Fraction of ice that will melt $= \dfrac{10^4 m}{33m \times 10^4} = \dfrac{1}{33}$

37. $\dfrac{(\Delta t)_c}{100} = \dfrac{(\Delta t)_F}{180}$ $\quad \dfrac{30}{100} = \dfrac{(\Delta t)_F}{180}$ $\quad (\Delta t)_F = 54^o$

38. $\dfrac{\text{Re}\,ading\ of\ thermomenter - LFP}{UFP - LFP} = \dfrac{F-32}{180}$

$\dfrac{52-5}{99-5} = \dfrac{F-32}{180}$

$90 = F - 32$

$F = 122^o F$

39. $PT^1 =$ constant

$\left(\dfrac{nRT}{V}\right)T^1 =$ constant

$T^2V^{-1} =$ constant

[using pv = nRT]

Taking log on both sides

$2\ln T - 1\ln V =$ constant

Differentiate w.r.t V

$2\dfrac{dT}{T} = \dfrac{dV}{V} \quad \Rightarrow V\left(\dfrac{2}{T}\right)dT = dv$

Form (i) and (iii) $\quad \gamma = \dfrac{2}{T}$

40. If m is the total mass of the gas, then its kinetic energy = $1/2mv^2$ When the vessel is suddenly stopped, total kinetic energy Will increase the temperature of the gas (because process will be adiabatic)

$\dfrac{1}{2}mv^2 = \mu C_v \Delta T \Rightarrow \dfrac{m}{M}\dfrac{R}{\gamma-1}\Delta T = \dfrac{1}{2}mv^2 \quad \left(As\ C_v = \dfrac{R}{\gamma-1}\right)\Delta T = \dfrac{Mv^2(\gamma-1)}{2R}$

41. $\dfrac{\Delta P}{P} = \dfrac{\Delta T}{T} \quad \dfrac{0.4}{100} = \dfrac{10}{T} \quad T = 2500K$

42. We know that for a given mass of a gas $\quad V_{rms} = \sqrt{\dfrac{3RT}{M}}$

Where R is gas constant, T is temperature in kelvin and M is molar mass of the gas. Clearly for a given gas, $v_{rms} \propto \sqrt{T}$, as R, M are constants.

Hence, $\dfrac{(v_{rms})_1}{(v_{rms})_2} = \sqrt{\dfrac{T_1}{T_2}}$

$(v_{rms})_1 = 100\ m/s, T_1 = 27^o C = 27 + 273 = 300K, T_2 = 127^o C = 127 + 273 = 400K$

$\therefore$ form eq (i)

$$\frac{100}{(v_{rms})_2} = \sqrt{\frac{300}{400}} = \frac{\sqrt{3}}{2} \Rightarrow (v_{rms})_2 = \frac{2\times 100}{\sqrt{3}} = \frac{200}{\sqrt{3}} m/s$$

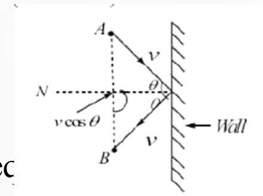
43. (A) K-E. decreases with decrease in temperature

$K \alpha T$

(D) Volume of a gas increases with increase in temperature at constant pressure.

44. Since the collision is elastic, the speed v of the molecule before collision = speed after rebound. Therefore, the magnitude of the change in momentum normal to the wall is

$$|\Delta p| = mv\cos\theta - (-mv\cos\theta) = 2mv\cos\theta$$



45. Ideal gas ec f density

$$\frac{P_1}{\rho_1 T_1} = \frac{P_2}{\rho_1 T_2} = \text{constant} \qquad \therefore \frac{\rho_1}{\rho_2} = \frac{p_1}{P_2} \times \frac{T_2}{T_1} \frac{\rho_{Top}}{\rho_{Bottom}} = \frac{P_{Top}}{P_{Bottom}} \times \frac{T_{bottoam}}{T_{Top}} = \frac{70}{76} \times \frac{300}{280} = \frac{75}{76}$$

46. Given $m_{ice} = 120g = 0.12Kg, T_{ice} = 0^o C$

$m_{water} = 300g = 0.3Kg, T_w = 24^o C$

Heat lost water $= 300 \times 24 = 7200 cal$

Heat gain by x grams ice, $H_2 = 7200 cal$

Ice melted = 90 g

47. $\varepsilon = \frac{5}{2} nRT = \frac{5}{2}, \frac{m}{M} RT \qquad \frac{5}{2} m\left(\frac{p}{\rho}\right) = 5\times 10^4 J$

48. The heat required to raise the temperature of bullet, $Q_1 = mC\Delta T$

Heat required to melt the bullet, Q_2=mL $Q = Q_1 + Q_2$

$$625 = ms\Delta T + mL \Rightarrow 625 = m\left[125\times 300 + 2.5\times 10^4\right]$$

$$625 = m[62500] m = \frac{1}{100} kg = 10 grams$$

49. Room mean square speed is given by $v_{rms} = \sqrt{\frac{3RT}{M}}$

Here, M = Molar mass of gas molecule T-temperature of the gas molecule

We have given VN2 = VH2

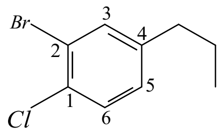
$$\therefore \sqrt{\frac{3RT_{N_2}}{N_{N_2}}} = \sqrt{\frac{3RT_{H_2}}{M_{H_2}}}, \frac{T_{H_2}}{2} = \frac{573}{28} \Rightarrow T_{H_2} = 41K$$

50. Given, translation kinetic energy of N_2 = kinetic energy of electron, $\frac{3}{2} k_B T = eV$

$$\Rightarrow \frac{3}{2} \times 1.38 \times 10^{-23} \times T = 1.6 \times 10^{-19} \times 0.1 \qquad \Rightarrow T = \frac{2\times 1.6\times 10^{-20}}{3\times 1.38\times 10^{-23}} or\ T = 773K$$

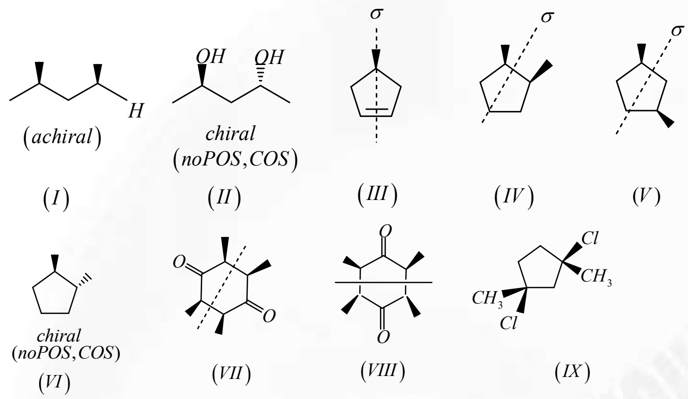
CHEMISTRY

51.



52. Metamer differ by Alkyl groups attached by polyvalent function group

53.



54. 2 & 3 are Diastereomers

55. $e.e = \frac{d-l}{d+l} \times 100 \quad = \frac{6-4}{6+4} \times 100 = 20\%$

$$e-e = \frac{Observed\ \ Specific\,rotation}{Specific\,rotation\,of\ \ pure\,Enantiomer} \times 100$$

$$20 = \frac{Observed\,Specific\,rotation}{13.5} \times 100$$

$\therefore \quad Observed\,Specific\,rotation = +2.7 units$

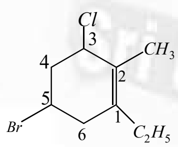
56. Conceptual

57. NCERT

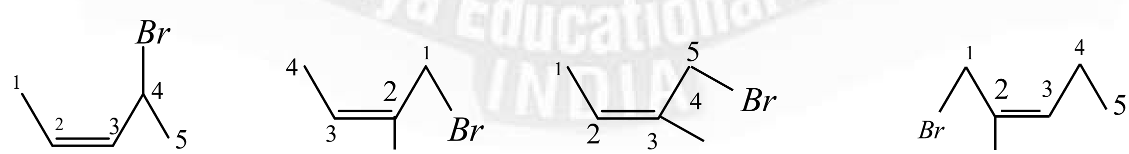
58. Conceptual

59. 2, 2, 4 – Trimethyl Pentane is called Isooctane

60. CIP Rules



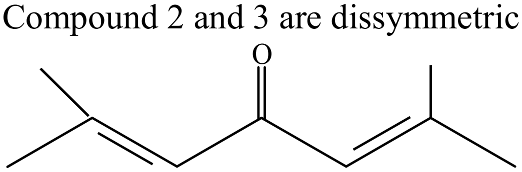
61.



62. Cis-1- Ethyl -3-methyl cyclohexane can be resolved in to enantiomers

63. Compound 2 and 3 are dissymmetric and chiral where as1 is meso.s

64.



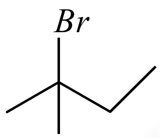
Phorone

65. Same m.f- differ by alkyl group attached to polyvalent functional groups

66. Unsymmetrical compounds

no of S. I = 2^n $= 2^3$ =8

67.



(no chiral ceutre)

68. B) It has chiral centre

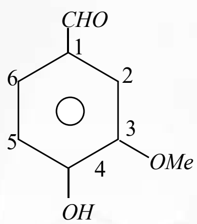
69. Only one amide function group present

70. Three possible

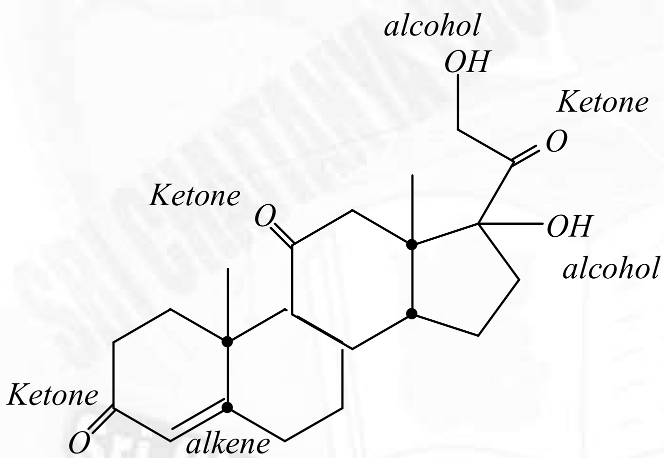
71. i, ii, iii, iv, x, vi, vii, viii, ix

72. All compounds are different

73.



74.



Only Ketone, Alkene, Alcohol are present; Z = 3

Thus $\left(\frac{X+Y+Z}{2}\right) = 5$

75. Geometrical isomerism occurs double bond as well as at 1, 4 -positions of both rings. Hence, the various geometrical isomers are-cis-cis and trans-cis-trans Cis-Cis-trans-trans-Cis, Cis-trans-Cis and trans-Cis-trans