Sri Chaitanya IIT Academy.,India.

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A right Choice for the Real Aspirant

ICON Central Office - Madhapur - Hyderabad

SEC: : Sr.S60_Elite, Target & LIIT-BTs | JEE-MAIN(2nd Year Syllabus) | Date: 18-12-2024

Time: 09.00Am to 12.00Pm | GTM-06/01 | Max. Marks: 300

KEY SHEET

MATHEMATICS

1	**4**	2	**4**	3	**4**	4	**2**	5	**3**
6	**1**	7	**2**	8	**1**	9	**2**	10	**3**
11	**1**	12	**4**	13	**1**	14	**1**	15	**2**
16	**2**	17	**2**	18	**2**	19	**2**	20	**2**
21	**25**	22	**19**	23	**24**	24	**2**	25	**180**

PHYSICS

26	**1**	27	**1**	28	**4**	29	**3**	30	**1**
31	**1**	32	**2**	33	**3**	34	**3**	35	**2**
36	**2**	37	**1**	38	**2**	39	**2**	40	**4**
41	**2**	42	**3**	43	**2**	44	**2**	45	**4**
49	**13**	47	**6**	48	**3**	49	**5**	50	**8**

CHEMISTRY

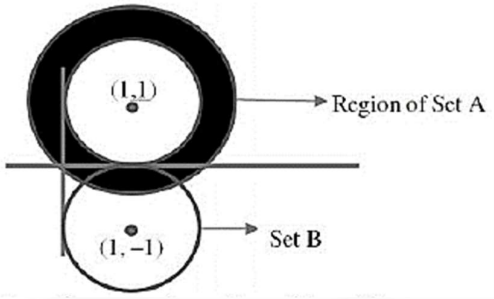
51	**3**	52	**2**	53	**2**	54	**1**	55	**1**
56	**4**	57	**3**	58	**2**	59	**2**	60	**3**
61	**4**	62	**4**	63	**4**	64	**3**	65	**1**
66	**4**	67	**3**	68	**3**	69	**2**	70	**1**
71	**2**	72	**28**	73	**83**	74	**6**	75	**69**

SOLUTION
MATHEMATICS

1. $\frac{\pi}{4}ab-\frac{1}{2}ab$

where a, b are length of semi minor and major axis.

2. $A=\left\{z\in C:1\le\left|z-(1+i)\right|\le 2\right\}$



$B=\left\{z\in A:\left|z-(1-i)\right|=1\right\}$ $A\cap B$ has infinite set.

3. $-6\le x\le -4,\ x=3\ \&\ |x|\le\frac{7+\sqrt{13}}{2}\Rightarrow x=-5,-4,3$

4. $\int\frac{6x^{10}+4}{x^5\sqrt{x^6-3-x^{-4}}}dx=\int\frac{6x^5+4x^{-5}}{\sqrt{x^6-3-x^{-4}}}dx$

$x^6-3-x^{-4}=t \qquad \left(6x^5+4x^{-5}\right)dx=dt$

5. $I=\int_{-2}^{2}(-x)^3\ln\left(\frac{15^x+5^x+3^x+1^x}{15^x}\right)dx \quad 2I=\int_{-2}^{2}x^4\ln 15dx$

6. $x^2+y^2+Ax+By+C=0$

is passing through (0, 6) $\Rightarrow 6B+C=-36$

The tangent of the parabola $y=x^2$ at (2, 4) is

$4x-y-4=0 \qquad \ldots\ldots (1)$

The tangent of circle $x^2+y^2+Ax+By+C=0$ at (2, 4) is

$(4+A)x+(8+B)y+2A+4B+2C=0 \ \ldots (2)$

From Equation (1) and (2)

$\frac{4+A}{4}=\frac{8+B}{-1}=\frac{2A+4B+2C}{-4}$

$A+4B=-36 \ \ldots..(3)$

$3A+4B+2C=-4 \ \ldots\ldots (4)$

From equation (3) and (4) $A+C=16$

7. A) Area of triangle $=\frac{\sqrt{3}}{4}|z|^2=16\sqrt{3} \quad |z|=8$

B) Required area $4\times\frac{1}{2}\times 3^2$

C) $|z|-\frac{6}{|z|}\le 5 \qquad |z^2|-5|z|-6\le 0 \qquad |z|\le 6$

D) Conceptual

8. $\sum_{i=0}^{2016} a_i x^i = (1+x)^{2017} - x^{2017}$ $\qquad a_{17}$=coefficient of x^{17} in $(1+x)^{2017}$

9. Equation of parabola $\qquad x = 5t^2+2,\ y = 10t+4$

$t^2 = \frac{x-2}{5}, t = \frac{y-4}{10} \qquad \Rightarrow \frac{x-2}{5} = \left(\frac{y-4}{10}\right)^2 \qquad \Rightarrow (y-4)^2 = 20(x-2)$

focus (7, 4)

10. Since $x^2y^3z^4$ is occurring in the expansion of $(x+y+z)n$, so n should be 9 only.

Now $A = \frac{9!}{2!\times 3!\times 4!} = 1260$

Coefficient of $x^4y^4z = \frac{9!}{4!\times 4!} = 630 = \frac{A}{2}$

11. $\sum_{k=1}^{\infty} \frac{6^k}{\left(3^k-2^k\right)\left(3^{k+1}-2^{k+1}\right)} = \frac{1}{3}\sum_{k=1}^{\infty} \frac{\left(\frac{2}{3}\right)^k}{\left(1-\left(\frac{2}{3}\right)^k\right)\left(1-\left(\frac{2}{3}\right)^{k+1}\right)} = 2$

12. a= 1, b = 0, c = -2 then transitive fails for R_1

13. Mirror image of focus in the tangent of parabola lie on its directrix.

14. The given equation is $dx - x(ydx+xdy) = x^5y^4(ydx+xdy)$

$\Rightarrow \frac{dx}{x} = (1+x^4y^4)d(xy) \Rightarrow \ln x = xy + \frac{1}{5}x^5y^5 + \ln c \ \Rightarrow x = ce^{xy+\frac{1}{5}x^5y^5}$

15. $I_1 = \int_0^x e^{\frac{x^2}{4}-\left(t-\frac{x}{2}\right)^2} dt = e^{\frac{x^2}{4}} \int_{\frac{-x}{2}}^{x/2} e^{-z^2} dz \qquad t-\frac{x}{2} = z$

$= 2e^{x^2/4}.\int_0^{x/2} e^{-z^2} dz \qquad I_2 = \int_0^x e^{-\frac{t^2}{4}dt}$ Let $\frac{t}{2} = z \qquad = \int_0^{x/2} e^{-z^2} \times 2dz$

16. Foci of the Ellipse $= (\pm 3, 0)$

Foci of the Hyperbola $= (\pm\frac{1}{5}\sqrt{144+\alpha}, 0) \qquad \therefore \alpha = 81$

length of the latus rectum $= \frac{2b^2}{a} = \frac{27}{10}$

17. Ellipse passes through $(0, \pm 8)$

$b^2 = 64 \qquad e_E = \sqrt{1-\frac{b^2}{a^2}},\ e_H = \frac{\sqrt{113}}{8},\ \lambda = \frac{2b^2}{a}$

18. (2) Corrected $\sum x = 40\times 200 - 50 + 40 = 7990$

$\therefore$ Corrected $\bar{x} = 7990/200 = 39.95$

Incorrect $\sum x^2 = n\left[\sigma^2 + \bar{x}^2\right] = 200\left[15^2 + 40^2\right] = 365000$

Correct $\sum x^2 = 365000 - 2500 + 1600 = 364100$

$\therefore$ Corrected $\sigma = \sqrt{\dfrac{364100}{200} - (39.95)^2} = \sqrt{(1820.5 - 1596)} = \sqrt{224.5} = 14.98$

19. $\sum_{i=1}^{n} a_i = \dfrac{n}{2}\{2a_1 + (n+1)\} = 192 \quad \Rightarrow 2a_1 + (n-1) = \dfrac{384}{n} \ldots\ldots(1)$

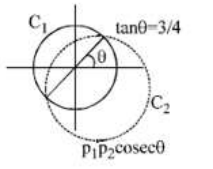
$\sum_{i=1}^{n/2} a_{2i} = \dfrac{n}{4}\left[2a_1 + 2 + \left(\dfrac{n}{2} - 1\right)2\right] = 120$

$2a_1 + n = \dfrac{480}{n}$ ..... (2)

From equation (2) and (1)

$1 = \dfrac{480}{n} - \dfrac{384}{n} \qquad n = 480 - 384 = 96$

20. Equation of common chord is $y = \dfrac{3}{4}x \Rightarrow 3x - 4y = 0$



Family of circle $x^2 + y^2 - 4 + \lambda(3x - 4y) = 0$

Equate radius of this circle as 5

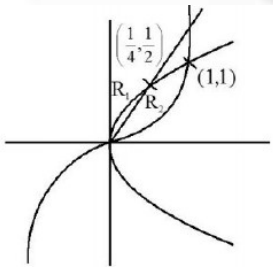
21. Heart and Not Ace = 12

Ace and Not Heart = 3

Ace and Heart = 1

$$P(E) = \frac{{}^{12}C_1 \cdot {}^{3}C_1 + {}^{3}C_1 \cdot {}^{1}C_1 + {}^{12}C_1 \cdot {}^{1}C_1}{{}^{52}C_2} = \frac{1}{26}$$

22.



$S = \int_0^1 \sqrt{x} - x^3$

$$=\left[\frac{2x^{3/2}}{3}-\frac{x^4}{4}\right]_1^0 \quad =\frac{5}{12}$$

$$R_1=\int_0^{1/4}\left(\sqrt{x}-2x\right)dx$$

$$=\left[\frac{2x^{3/2}}{3}-x^2\right]_0^{1/4}=\frac{1}{48}$$

$$\therefore R_2=\frac{19}{48}$$

So, $\frac{R_2}{R_1}=19$

23. Here $\alpha+\beta$ roots of equation

$$3x^2+\lambda x-1=0$$

$$\alpha+\beta=\frac{-\lambda}{3},\ \alpha\beta=\frac{-1}{3}$$

$$\frac{1}{\alpha^2}+\frac{1}{\beta^2}=\frac{(\alpha+\beta)^2-2\alpha\beta}{\alpha^2\beta^2}=15$$

$$\lambda^2=9$$

Now

$$6\left(\alpha^3+\beta^3\right)^2=6\left((\alpha+\beta)\left((\alpha+\beta)^2-3\alpha\beta\right)\right)^2$$

$$=6\left(\frac{\lambda^2}{9}\right)\left\{\frac{\lambda^2}{9}+1\right\}^2=24$$

24. $I=\int\left(x^2+1\right)\left((x+1)e^x\right)^2dx$

$$\left(x^2+1\right)e^x=t$$

$$\Rightarrow(x+1)^2e^xdx=dx$$

$$I=\frac{1}{2}\left(\left(x^2+1\right)e^x\right)^2+c$$

$$=\frac{1}{2}\left(f(x)\right)^2+c$$

$$2A+f(0)=1+1=2$$

25. Coefficient of x^5 in $5!\left(1+x+\frac{x^2}{2}\right)^2(1+x)^2$

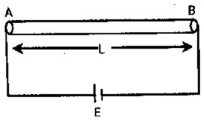
PHYSICS

26. Both correct and correct explanation also.

27. $\phi = \left(\frac{q}{2\in_0} - \frac{q}{6\in_0}\right) \times \frac{1}{4} \quad = \frac{q}{12\in_0}$

28. Statement 1 is wrong and statement 2 is correct

29. $V_{AB} = E$



$\therefore$ Potential gradient $K = \frac{V_{AB}}{L} = \frac{E}{L}$ $\therefore$ Potential difference across length ℓ is $V = K\ell$

30. Both correct and correct explanation

31. $r_p = \frac{\sqrt{2m_pK}}{eB}$ $r_d = \frac{\sqrt{2(2m_p)K}}{eB}$ $r_a = \frac{\sqrt{2(4m_p)K}}{(2e)B}$

32. $W=MB(\cos 0^0 - \cos 60^0 = \frac{MB}{2}$

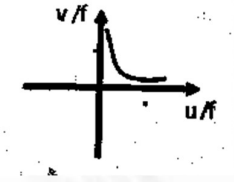
33. $F=1\ \ell B \quad = \frac{vB\ell}{(R+r)}\ell B \quad = \frac{vB^2\ell^2}{(R+r)}$

34. Due to phase difference between voltage and current $i \neq \frac{\upsilon}{x_L}$

35. Zener diode is used as voltage regulator.

36. $\vec{E}, \vec{B}$ and $\vec{C}$ are mutually perpendicular.

37.



38. $6 = \frac{x_1}{1.5}, 4 = \frac{x_2}{1.5}$ width $= x_1 + x_2$

39. $\Delta\phi = \frac{\pi}{2}$ $\frac{I}{I_{max}} = \frac{I_0 + I_0}{4I_0} = \frac{1}{2}$

40. $P = IA = 8\times10^{-3} \times 2\times10^{-4} = 16\times10^{-7} W$

Photons per sec $= \frac{P}{h\upsilon} = \frac{16\times10^{-7}}{10\times1.6\times10^{-19}} = 10^{12}$

Photo electrons / sec $= 10^{12} \times \frac{1}{100} = 10^{10}$

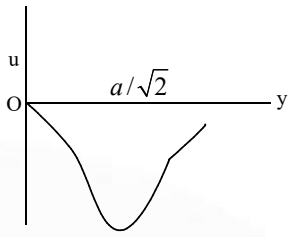
41. $B = \frac{\mu_0 i}{2r}$; magnetic field at centre of hydrogen atom i.e. at nucleus.

$i = \frac{e}{T} = ef = a\ z^2/n^3$ $r\ a\ n^2/Z$, $B\ a\ i/r\ a\ Z^3/n^5$ $B\ a\ 1/n^5$

42. Energy released $= (80\times7 + 120\times8 - 200\times6.5 = 220MeV)$

43. $Y = \overline{\overline{A.B}} = A + B$ i.e. OR gate

44. E will be maximum at $y = \pm\frac{a}{\sqrt{2}}$ $U = -\vec{P}.\vec{E}$ is min at this location.

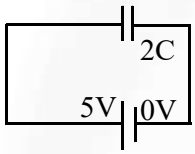


So, $y = +a/\sqrt{2}$ is stable equilibrium

Since dipole was released from O so it will continue upto ∞ (conservation of energy).

45.

0 - 5 V	2C
0 - 0V	C

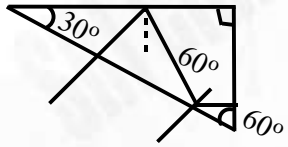


46. $C_1 = \frac{\epsilon_0 A}{\frac{d}{4K} + \frac{3d}{4}} = \frac{\epsilon_0 A}{\frac{13}{16}d}$ $C_2 = \frac{\epsilon_0 A}{\frac{d}{2K} + \frac{d}{2}} = \frac{\epsilon_0 A}{\frac{5d}{8}}$ $\Rightarrow \frac{C_2}{C_1} = \frac{13}{10}$

47. $\frac{4}{Q} = \frac{40}{60} \Rightarrow Q = 6$ $\frac{4}{6+x} = \frac{25}{75} \Rightarrow x = 6$

48. $I = \frac{P}{4\pi r^2} = \frac{1}{2}\epsilon_0 CE_0^2$

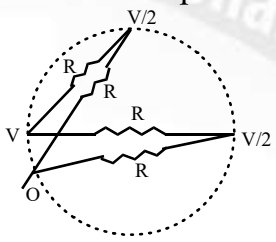
49. Beam is incident normally on reflecting surface. So it will retrace the path.



$\theta_c = \sin^{-1}\frac{1}{2.2}$ $\Rightarrow \theta_c < 30^o$

$\therefore$ Deviation $= 180^o$ $= 5 \times 36^o$

50. All other 14 points are at same potential



$$\frac{1}{Req} = \underbrace{\frac{1}{2R} + \frac{1}{2R} + \ldots\ldots + \frac{1}{R}}_{14 \text{ terms}}$$

$$\Rightarrow R_{eq} = \frac{R}{8}$$

CHEMISTRY

51. Aliphatic carboxylic acids upto nine carbon atoms are colorless liquids at room temperature with unpleasant odours.

52. $NaHSO_3$ does not react with glucose

53. $Ni(CO)_4$ - Tetrahedral

$[NiCl_2Br_2]^{-2}$ - Can't show G.I

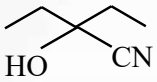
54. $S = -200$
$F = -333$
$Cl = -349$
Ne = +ve value

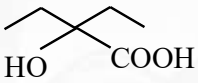
55. $PbSO_4 \xrightarrow{4CH_3COONH_4} [Pb(CH_3COO)_4]^{-2}$

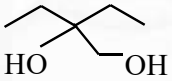
56. HF has H.B but not HCl.

57. $R-OH \xrightarrow{RMgX} R-H$

58.

A= 

B= 

C= 

59. SN^1 rate $\propto C^+$ stability

60. 1) $ArSN^2$
3) Aniline does not undergo F.C alkylation

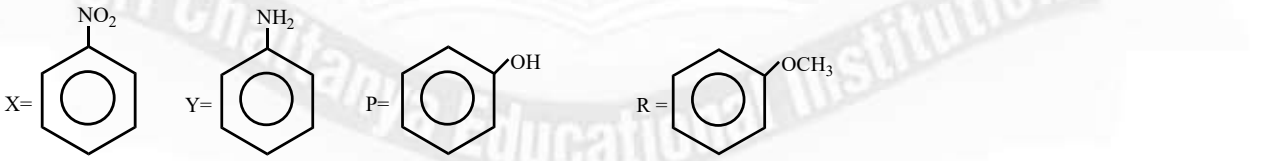
61. $1^o\ R-OH > 2^o\ R-OH > 3^o\ R-OH$
boiling point order

62. Aldehydes are more reactive than ketones

63. NP & PU Show +3 to +7

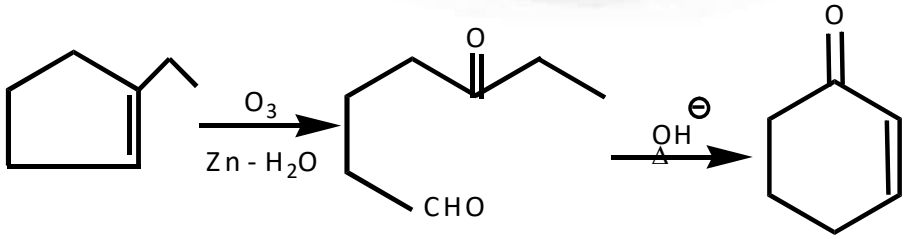
64. $x = K_2MnO_4,\ y = KMnO_4,\ z = MnO_2$

65.



66. Tyrosine – Y

67.



68. $3^o\ R-X$ Can't undergo G.T.S

69. In 100gm solution

$n_{MgCl_2}=0.1 \qquad n_{NaCl}=0.1$

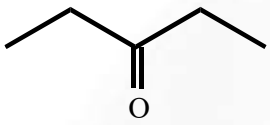
After dissociation total moles $=0.1\times3+0.1\times2 \quad =0.5$

$W_{water}=100-9.5-5.85 \quad =84.65$ gm

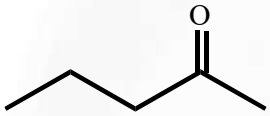
$$\therefore \Delta T_b=0.52\times0.5\times\frac{1000}{84.65} \qquad =3.07^oC \qquad \therefore T_b=103.07^oC$$

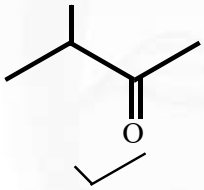
70.

71.



X





72. 28

73. 83

74. 3, 4, 5, 6, 7, 9

75. $AgBr_{(s)} \rightleftharpoons \underset{(s+10^{-7})}{Ag^+} + \underset{s}{Br^-}$

$s^2+10^{-7}s-20\times10^{-14}=0$

$$s=\frac{-10^{-7}+\sqrt{10^{-14}+80\times10^{-14}}}{2}=4\times10^{-7}$$

$\left[Ag^+\right]=5\times10^{-7}M$

$\left[Br^-\right]=4\times10^{-7}M$

$\left[NO_3^-\right]=1\times10^{-7}M$

$$\wedge^o=\frac{K}{1000C}\Rightarrow K^1_{Ag^+}=6\times10^{-3}\times1000\times5\times10^{-7}$$

$=30\times10^{-7}s-m^2/mol$

$K^1_{NO_3^-}=7\times1\times10^{-7}sm^2/mol$

$K^1_{Br^-}=8\times4\times15^7sm^2/mol \qquad =32\times10^{-7}$

$K^1_{total}=69\times10^{-7}sm^2/mol$