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: 07-06-2025

Time: 09.00Am to 12.00Pm | WTM-31 | Max. Marks: 300

KEY SHEET

MATHEMATICS

1	**2**	2	**4**	3	**3**	4	**2**	5	**3**
6	**3**	7	**4**	8	**3**	9	**2**	10	**4**
11	**2**	12	**4**	13	**1**	14	**4**	15	**2**
16	**3**	17	**2**	18	**4**	19	**4**	20	**3**
21	**239**	22	**10**	23	**16**	24	**14**	25	**7**

PHYSICS

26	**3**	27	**2**	28	**1**	29	**3**	30	**2**
31	**1**	32	**1**	33	**1**	34	**4**	35	**3**
36	**2**	37	**4**	38	**4**	39	**2**	40	**3**
41	**3**	42	**4**	43	**3**	44	**2**	45	**4**
46	**1**	47	**9**	48	**331**	49	**32**	50	**200**

CHEMISTRY

51	**3**	52	**1**	53	**1**	54	**2**	55	**1**
56	**4**	57	**1**	58	**1**	59	**1**	60	**1**
61	**3**	62	**2**	63	**3**	64	**4**	65	**3**
66	**3**	67	**3**	68	**4**	69	**2**	70	**2**
71	**6**	72	**17**	73	**5**	74	**2**	75	**14**

SOLUTIONS

MATHEMATICS

1. ${}^{10}C_4 \times 2 \times 2 \times 2 \times 2$

2. ${}^{8}C_2 \times {}^{6}C_2 \times 2$

3. ${}^{9}C_6 + {}^{9}C_5$

4. $m = {}^{8}C_6 \times {}^{5}C_5 + {}^{8}C_7 \times {}^{5}C_4 + {}^{8}C_8 \times {}^{5}C_3 = 78$

   $n = {}^{5}C_3 \times {}^{8}C_8 + {}^{5}C_4 \times {}^{8}C_7 + {}^{5}C_5 \times {}^{8}C_6 = 78$

5. ${}^{17}C_2 - 3 \times 7 - 1$

6. $y = 3, z = 2 \qquad (3+1)(2+1) = 12$

7. $K^2 - 3 = \dfrac{r+1}{6} \qquad \Rightarrow r = 5, 35 \qquad \Rightarrow K = \pm 2, \pm 3$

8. $1 \times {}^{21}C_9 + 1 \times {}^{21}C_8 + 1 \times {}^{21}C_7 + \ldots\ldots + 1 \times {}^{21}C_0 \qquad = \dfrac{2^{21}}{2} = 2^{20}$

9.

		R		

   ${}^{17}C_2 \times 1 \times {}^{8}C_2$

10. Total – (Row 1 empty + Row 2 empty + Row 3 empty)

    $= {}^{8}C_5 \times 5! - (5! + 5! + {}^{6}C_5 . 5!)$

11. ${}^{6}C_5 \times {}^{5}C_3 + {}^{6}C_4 \times {}^{5}C_4 + {}^{6}C_3 \times {}^{5}C_5$

12. ${}^{12}C_3 - {}^{5}C_3$

13. $x = 0, \quad y + z = 24 \longrightarrow {}^{25}C_1$

    $x = 1, \quad y + z = 21 \longrightarrow {}^{22}C_1$

    $x = 2, \quad y + z = 18 \longrightarrow {}^{19}C_1$

    $x = 3, \quad y + z = 15 \longrightarrow {}^{16}C_1$

    $x = 4, \quad y + z = 12 \longrightarrow {}^{13}C_1$

    $x = 5, \quad y + z = 9 \longrightarrow {}^{10}C_1$

    $x = 6, \quad y + z = 6 \longrightarrow {}^{7}C_1$

    $x = 7, \quad y + z = 3 \longrightarrow {}^{4}C_1$

    $x = 8, \quad y + z = 0 \longrightarrow {}^{1}C_1$

    We get answer as 117

14. No. of two elements subsets having

    1 as least element ${}^{8}C_1$

    2 as least elements ${}^{7}C_1$

    3 as least elements ${}^{6}C_1$

    4 as least elements ${}^{5}C_1$

5 as least elements ${}^4C_1$

6 as least elements ${}^3C_1$

7 as least elements ${}^2C_1$

8 as least elements ${}^1C_1$

$\therefore \sum_{A\in X}(\text{minimum of } A) = 1\times 8+2\times 7+3\times 6+4\times 5+5\times 4+6\times 3+7\times 2+8\times 1=120$

15. $xyz = 30 = 2\times 3\times 5$

2 can be assigned to one of x, y, z in 3 ways

3 can be assigned to one of x, y, z in 3 ways

5 can be assigned to one of x, y, z in 3 ways

$\therefore$ No. of +ve integers sol $= 3\times 3\times 3 = 27$

In each case we get 3 more solutions by assigns $(+,-,-);\ (-,+,-);\ (-,-,+)$

$\therefore$ Ans $4\times 27 = 108$

16. $R = \dfrac{\text{sum of all divisors}}{N} = \dfrac{31\times 13\times 13}{3600} = 3.47$

17. (A) $\dfrac{(2n-4)90^0}{n} = 150^0$

$3(2n-4) = 5n \qquad \Rightarrow n = 12$

No. of diagonals $= \dfrac{n(n-3)}{2} = 54$

(B) ${}^4C_2\times 2 + {}^4C_2\times 1 + {}^4C_1\times {}^4C_1\times 2 = 50$

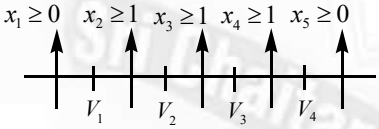
(C) $n(n-4)$ where $n = 10$

(D) $\dfrac{1}{4}.{}^nC_3 = {}^{(n-1)}C_2 \Rightarrow n = 12$

18. $x_1+x_2+x_3+x_4+x_5 = 11$

$x_1+y_2+y_3+y_4+x_5 = 8,\ y_i = x_i - 1$

Ans : ${}^{8+5-1}C_{5-1} = {}^{12}C_4$



19. Odd elements 1, 3, 5, 7, 9

Even elements 2, 4, 6, 8

$N_1 = {}^5C_1\times {}^4C_4 = 5$

$N_2 = {}^5C_2\times {}^4C_3 = 40$

$N_3 = {}^5C_3\times {}^4C_2 = 60$

$N_4 = {}^5C_4\times {}^4C_1 = 20$

$N_5 = {}^5C_5\times {}^4C_0 = 1$

20. $d(P^7) = 7+1 = 2^3$

$d(d(P^7)) = d(2^3) = 4 = 2^2$

$d(d(d(P^7)) = 2+1 = 3$

21. A divisor of $3^3 5^7 7^9$ will be of the form

$d = 3^a.5^b.7^c$ where $a \in \{0,1,2,3,4,5\}$; $b \in \{0,1,2,3,.....,7\}$; $c \in \{0,1,2,3,.....,8,9\}$

$d = (4-1)^a.(4+1)^b.(8-1)^c$

$= 4\lambda + (-1)^a.1^b.(-1)^c$

a,c even, b any $\rightarrow 3\times 8\times 5 = 120$

a,c odd, b any $\rightarrow 3\times 8\times 5 = 120$

$\therefore$ Total no. of divisors $= 240-1$ (exclusively divisor)

22. $n = {}^nC_2 - n \qquad \Rightarrow 2n = \dfrac{n(n-1)}{2} \Rightarrow n = 5$

23. $N_1 = 166320 \qquad = 2^4\times 3^3\times 7\times 5\times 11$

$N_2 = 792 = 2^3\times 3^2\times 11$

For L.C.M 2^4 must be a factor of at least one of a,b

HCF 2^3 must be a factor of both a and b

$\left.\begin{matrix} a & b \\ 2^4 & 2^3 \\ 2^3 & 2^4 \end{matrix}\right\}$ 2 ways

$\left.\begin{matrix} 3^3 & 3^2 \\ 3^2 & 3^3 \end{matrix}\right\}$ 2 ways

$\left.\begin{matrix} 7^1 & 7^0 \\ 7^0 & 7^1 \end{matrix}\right\}$ 2 ways

$\left.\begin{matrix} 5^0 & 5^1 \\ 5^1 & 5^0 \end{matrix}\right\}$ 2 ways

$\left.\begin{matrix} 11^1 & 11^1 \end{matrix}\right\}$ 1 way

$\therefore$ No. of order pairs $= 2\times 2\times 2\times 2\times 1 = 16$

24. Observe the regions by drawing 4 circles under the given conditions.

25.

n_1	n_2	n_3	n_4	n_5
1	2	3	5	9
1	2	3	6	8
1	2	4	5	8
1	2	4	6	7
1	3	4	5	7
2	3	4	5	6
1	2	3	4	10

PHYSICS

26. Thin film interference

27. The light of wavelength λ is strongly reflected if $2\mu d = \left(n+\frac{1}{2}\right)\lambda$

where n is a non-negative integer.

Here $2\mu d = 2\times1.50\times0.5\times10^{-6}m = 1.5\times10^{-6}\ m.$

Putting $\lambda = 400\,nm$ in Eq. (i), we get

$1.5\times10^{-6}\ m = \left(n+\frac{1}{2}\right)\left(400\times10^{-9}\ m\right)$ or $n = 3.25$

Putting $\lambda = 700\,nm$ in Eq. (i), we get

$1.5\times10^{-6}\ m = \left(n+\frac{1}{2}\right)\left(700\times10^{-9}\ m\right)$ or $n = 1.66$

Thus, within 400 nm to 700 nm, the integer n can take the values 2 and 3. Putting these values of n in Eq. (i), the wavelengths become

$\lambda = \frac{4\mu d}{2n+1} = 600\ nm$ and 429 nm

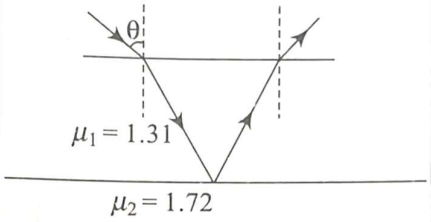
Thus, light of wavelengths 429 nm and 600 nm are strongly reflected.

28. There is air on both sides of the soap film. Therefore, the reflections of the light produces a net 180° phase shift.

The condition for bright fringes is $2t = \left(m+\frac{1}{2}\right)\lambda_{film}$

$$t = \frac{\left(m+\frac{1}{2}\right)\lambda_{film}}{2} = \frac{\left(m+\frac{1}{2}\right)\lambda}{2n} = \frac{\left(\frac{1}{2}\right)\left(650\times10^{-9}\ m\right)}{2(1.41)} = 1.2\times10^{-7}\ m$$

29. There is no net change in phase produced by the two reflections. Hence,

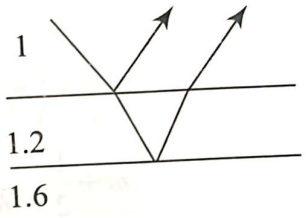


$\frac{\lambda}{2} = 2\mu_1 d\cos\theta$

For normal incidence, $\cos\theta = 1 .\therefore d = \frac{1}{4\mu_1} = \frac{5.3\times10^{-7}}{4\times1.31} = 10^{-7}\ m = 0.1\ \mu m$

30. $2\mu = n\lambda \Rightarrow t = \frac{n\lambda}{2\mu}$

$\Rightarrow t = \frac{\lambda}{2\mu} = 200\ nm$



31. Condition for observing bright fringe is $2nd = \left(m + \frac{1}{2}\right)\lambda$

$$\therefore \lambda = \frac{2nd}{\left(m+\frac{1}{2}\right)} = \frac{2\times 1.5\times 4\times 10^{-5}}{m+\frac{1}{2}} = \frac{12\times 10^{-5}}{m+\frac{1}{2}}$$

The integer m that gives the wavelength in the visible region (4000 Å to 7000 Å) is $m = 2$. In that case, $\lambda = \frac{12\times 10^{-5}}{2+\frac{1}{2}} = 4.8\times 10^{-5} = 4800\,\text{Å}$

32. Theory of telescopes

33. $\theta = \frac{2\lambda}{a}$.

34. $\beta = \frac{\lambda}{2\mu\tan\alpha} = \frac{\lambda}{2\mu\alpha}$ $\quad\therefore \lambda = \beta\times 2\mu\alpha$

$= 0.12\times 10^{-2}\times 2\times 1\times\left(\frac{40}{60\times 60}\times\frac{\pi}{180}\right)$ $\quad= 4655$ Å.

35. $M = \frac{LD}{f_0 f_e}$

36. $L_\infty = f_0 + f_e, M_\infty = \frac{f_0}{f_e}$

37. $\sin\theta = \frac{\lambda}{d}$ or $\theta \simeq \frac{600\times 10^{-9}}{1\times 10^{-3}}$

or $\theta = 6\times 10^{-4}$ rad $\therefore \beta = D\theta = 2\times 6\times 10^{-4} = 1.2\times 10^{-3}\ m$

38. In YDSE intensity of all bright bands is same

39. (B) When a ray of light is incident on a plano convex lens placed on a glass plate, it reflects at two surfaces. These two reflected rays interfere and produce dark and bright rings which are known as Newton's rings.

The ray reflected at the upper surface of the air-film suffers no phase change but the ray reflected internally at the lower surface suffers a phase change of 180°.

40. One side of mirror is opaque and another side is reflecting this is not in case of lens hence, it is easier to provide mechanical support to large size mirrors than large size lenses. Reflecting telescope are based on the same principle except that the formation of images takes place by reflection instead of refraction.

41. As the waves diffracted from the edges of circular obstacle, placed in the path of light interfere constructively at the centre of the shadow resulting in the formation of a bright sopt.

42. Distance of retina is constant

43. Simple microscope concept

44. Simple microscope concept

45. $L = f_0 + 4f_\ell + f_e$

46. $2\mu t = n_1\lambda_1 = n_2\lambda_2 \Rightarrow (n_1 = n_2 + 1)$

As there is no minimum in between these two wavelengths

$(n+1)(512) = (n)(640)$

$n_2(640-512) = 512$

$n_2 = 4$

So $2\times 1.28t = (4)(640)$

$$t = \frac{4\times 640}{2\times 1.28} = 1000\ nm = 1\,\mu m$$

47. $a\sin\theta = n\lambda;\ \theta = \frac{\lambda}{a}\frac{n\pi}{180}\ rad$

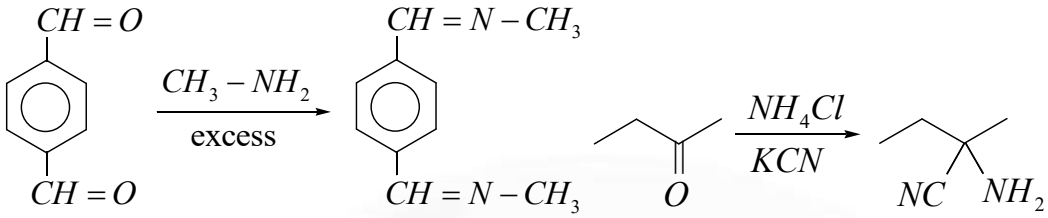
48. $$L = f_0 + \frac{Df_e}{D+f_e}$$

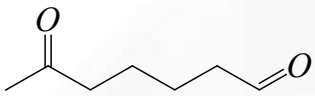
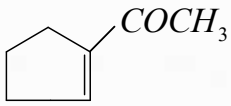
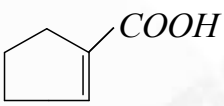
49. $\frac{1}{f_e} = \frac{1}{v_e} - \frac{1}{u_e}$ find u_e; $\frac{1}{f_e} = \frac{1}{v_e} - \frac{1}{u_e}$ find f_e

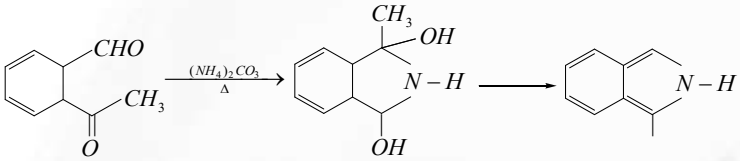
$$m = m_o m_e = \frac{v_o}{u_o}\frac{v_e}{u_e}$$

50. $\frac{1}{f_0} = \frac{1}{v_0} - \frac{1}{u_0}$ and $M = \frac{v_0}{u_0}\left(\frac{D}{f_e}\right)$

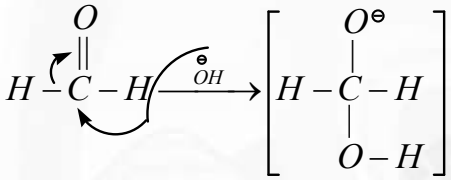
CHEMISTRY

51. 

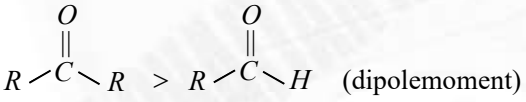
52. $x =$  ; $y =$  $z =$ 

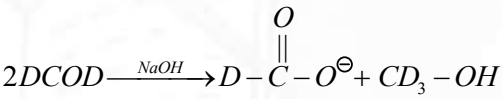
53. 

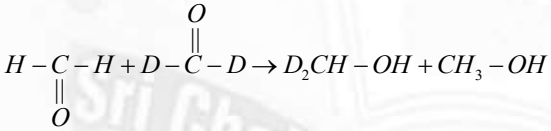
54. Ketones can't undergo cannizzaros

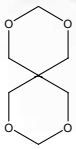
55. 
unstable tetrahedral intermediate

56. In haloform reaction all halogens are equally reactive

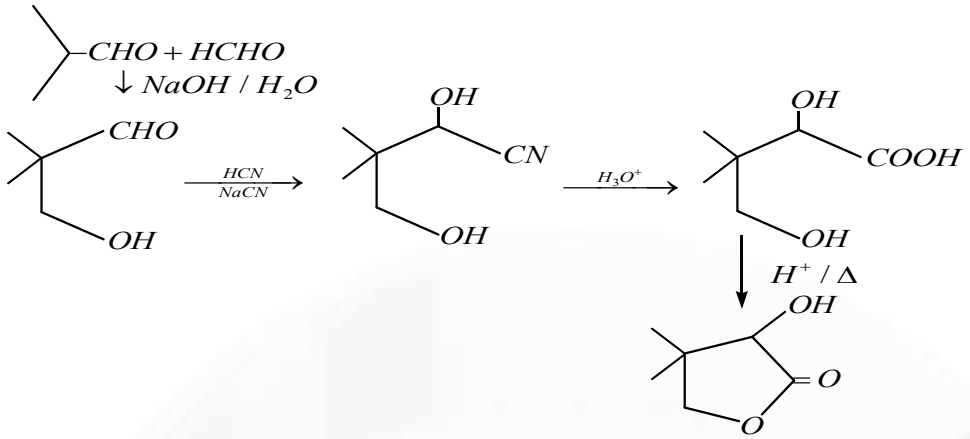
57.  (dipolemoment)

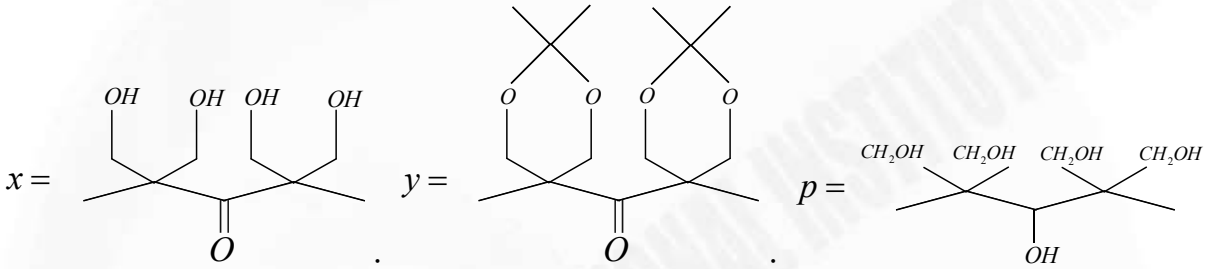
58. $2HCHO \xrightarrow{NaOH} CH_3OH + HCOONa$ 

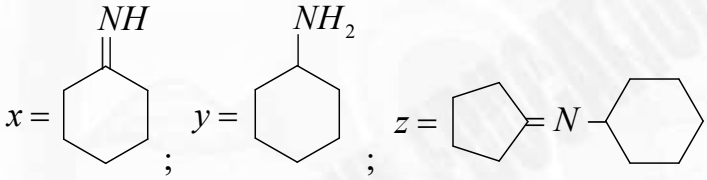


59. z is 

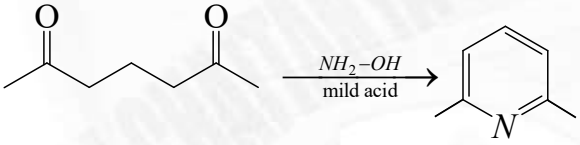
60.



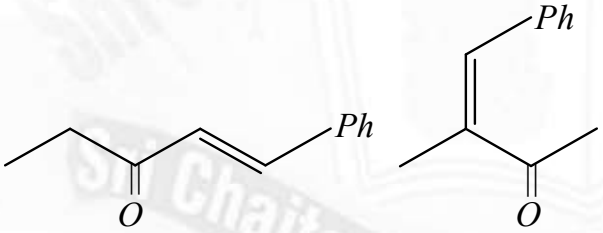
61. 

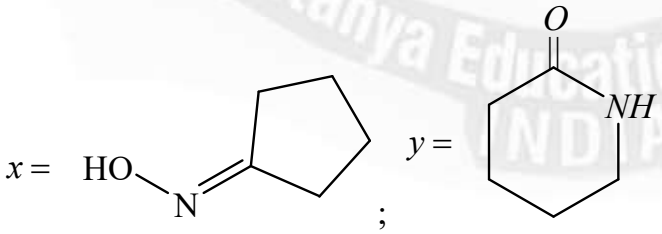
62. 

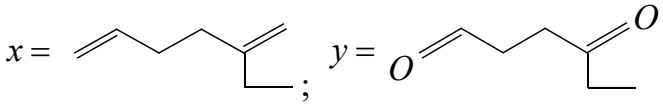
63. Benzophenone and quinone don't have alpha H

64. 

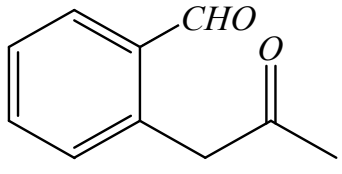
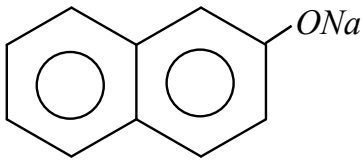
Hint paul-knorr synthesis

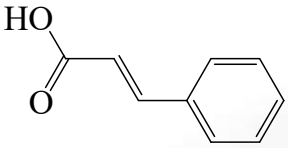
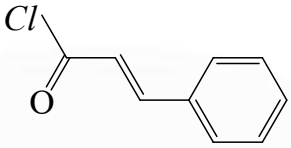
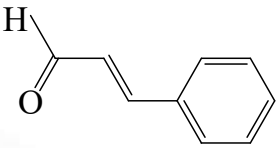
65. 

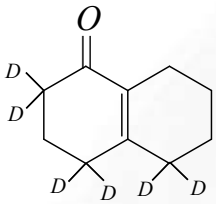
66. 

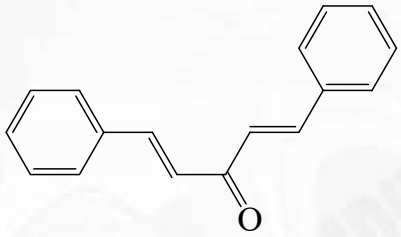
67. 

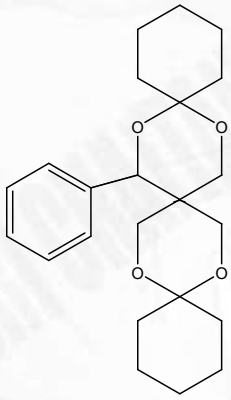
68. Nitroaldol condensation

69. $x =$  ; $y =$ 

70. $x =$  ; $y =$  ; $z =$ 

71. 
$[P]$

72. P is 

73. D is 

74. $Ph-COOH + HCOOH$

75. P is