Sri Chaitanya IIT Academy.,India.

✪ A.P ✪ T.S ✪ KARNATAKA ✪ TAMILNADU ✪ MAHARASTRA ✪ DELHI ✪ RANCHI

A right Choice for the Real Aspirant
ICON Central Office - Madhapur - Hyderabad

SEC: **Sr. Super60 NUCLEUS-BT**	**JEE-MAIN**	Date: 31-05-2025
Time: **09.00Am to 12.00Pm**	**WTM-30** #	Max. Marks: 300

KEY SHEET

MATHEMATICS

1	**4**	2	**1**	3	**3**	4	**4**	5	**2**
6	**4**	7	**4**	8	**2**	9	**3**	10	**3**
11	**1**	12	**2**	13	**4**	14	**3**	15	**2**
16	**1**	17	**1**	18	**1**	19	**1**	20	**1**
21	**18**	22	**72**	23	**1436**	24	**70**	25	**86**

PHYSICS

26	**3**	27	**1**	28	**2**	29	**2**	30	**2**
31	**3**	32	**2**	33	**4**	34	**3**	35	**3**
36	**3**	37	**4**	38	**4**	39	**3**	40	**3**
41	**2**	42	**3**	43	**2**	44	**2**	45	**1**
46	**5**	47	**3**	48	**3**	49	**0**	50	**50**

CHEMISTRY

51	**3**	52	**3**	53	**4**	54	**1**	55	**2**
56	**3**	57	**2**	58	**3**	59	**4**	60	**3**
61	**2**	62	**2**	63	**4**	64	**3**	65	**2**
66	**4**	67	**3**	68	**4**	69	**4**	70	**2**
71	**4**	72	**0**	73	**3**	74	**2**	75	**94**

SOLUTIONS
MATHEMATICS

1)   (i) number of numbers created using

$$1111133 = \frac{7!}{5!2!} \Rightarrow 21$$

    (ii) number of numbers created using

$$1111223 = \frac{7!}{4!2!} \Rightarrow 105$$

    (iii) number of numbers created using

$$1112222 = \frac{7!}{4!3!} \Rightarrow 35$$

2.   (i) Single letter is used, then no.of words=5

    (ii) Two distinct letters are used, then no.of words

$$^5C_2 \times \left(\frac{6!}{2!4!} \times 2 + \frac{6!}{3!3!} \right) = 10(30 + 20) = 500$$

    (iii) Three distinct letters are used, then no.of words

$$^5C_3 \times \frac{6!}{2!2!2!} = 900$$

3.   A,K,N,P,R,U

    A………..5!=20

    K………..5!=120

    PA………..4!=24

    PK………..4!=24

    PN………..4!=24

    PRA………..3!=6

    PRKANU=1

    PRKAUN=1

    Total =440

    440 th word is PRKAUN

4.   Case I   5…….0

    Case II   5……….2

          5   1

          5   3

          6   0

          6   1

          6   2

          7   0

          7   1

    $9 \times (8 \times 8 \times 8) = 4608$ but 50000 is not included, so total numbers 4608-1=4607

5.   Let x,y,z be the number of box which are filled

    $\Rightarrow 1 \le x \le 3, 1 \le y \le 3, 1 \le z \le 2$

x	y	z	Number of ways
3	1	1	$^3C_3 . ^3C_1 . ^2C_1 = 6$

2	2	1	$^3C_2.^3C_2.^2C_1 = 18$
1	3	1	$^3C_1.^3C_3.^2C_1 = 6$
2	1	2	$^3C_2.^3C_1.^2C_2 = 9$
1	2	2	$^3C_1.^3C_2.^2C_2 = 9$

Total ways=(48) to fill boxes

Now to arrange a,b,c,d and e

Number of wavs will be 48.5!=5760

6.   1 Captain, 1 vice-captain are already present

$\Rightarrow$ We need to select 8 players such that atleast 3 batsman and bowler must the there

Batsman	Bowler	Number of ways
3	5	$^6C_3.^5C_5 = 20$
4	4	$^6C_4.^5C_4 = 75$
5	3	$^6C_5.^5C_3 = 60$

7.   IITJEE

       2-I'S

       2-E'S

       1-T

       1-J

       2   2   1   -   IIEEI$=\dfrac{5!}{2}$

       2   3   diff   - $\dfrac{^2C_1\times 5!}{2!}=120$

       =30+120=180

8.   1 digited 1

       2 digited 19

       3 digited 280

9.   d=1:012,123,234,….789-8 groups

       d_2=:024,135,246,357,468,579-6groups

       d_3=:036,147,258,369,-4groups

       d_4=:048,149-2 groups

       RNW= $20.3! - 4.2! = 112$

10. $X = 7!, Y = 3*7!$

11. $P = 4!5!$ $Q = 2\times 5!5!$

12.   ad-bc=0

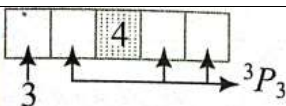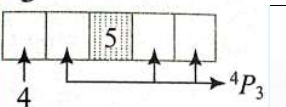   All same elements=3

       3-zeros=8

       2—1's,2-1's=6

       2-0's, in row /column=16

       RNW=33

13.

Middle digit	Digits available for remaining four places	Pattern	Number of ways falling remaining four places
4	0,1,2,3		$3 \times {}^3P_3$
5	0,1,2….,4		$4 \times {}^4P_3$
6	0,1,…,5		$5 \times {}^5P_3$
7	0,1,…..,6	-----	$6 \times {}^6P_3$
8	0,1,…..,7	----	$7 \times {}^7P_3$
9	0,1,…..,8	-----	$8 \times {}^8P_3$

14. $f(x) = x^3 + ax^2 + bx + c$ $= (x^2 + 1)(px + q)(b-1)x + (c-a)$

Since $f(x)$ is divisible by $x^2 + 1$

$\therefore b - 1 = 0 \, and \, c - a = 0 \Rightarrow b = 1, c = a$

Hence 20 such polynomials are possible.

15. INDIANIDOL

INDAOL

IND

I

$n(S) = \dfrac{10!}{3!2!2!}$

$a = n(XX(INDIA)XXX) - n(XX(INDIAN)XX)$

$b = n(XX(INDIAN)XX) - n(XX(INDIAN)(IDOL))$ $= 5! - 2! = 118$

16. $2 \times 18!$

17. $3!(3 + 4 + 5 + 6) = 6 \times 18 = 108$

18. (ABC) DEF-3!

(ABD) CEF-3!

(AC)(BD) E,F-3!=18

19. 123456

1- - - - - - - =5!=120

2- - - - - - -=5!=120-240

31- - - - - - - 4!=24-264

321456   =265

321465   - 266

321546   - 267

20. a) $6^5 - 5^4 = 1296 - 625 = 671$

b) ${}^{10}C_4 = \dfrac{10 \times 90 \times 8107}{24} = 210$

c) $9 \times 10 \times 5 = 450$

d) O included: : ${}^6C_2 \times (4! - 3!)$

O not included : ${}^6C_3 4!$ $15 \times 18 + 20 \times 24 = 270 + 480 = 750$

21. $--P\times\times Q\times\times R--$ $3!^6 C_2 \times^4 C_2 \times 2!2!\times 3.2!$ $18\times 6!$

22. Max=7

X=sum of first two digit

X=7	0	7	6	1
			3	4
			2	5
X=8	17		2	6
			3	5
X=9	27		4	5
			3	6
X=10	37		4	6
X=11	47		5	6

RNW=2.9.2.2=72

23.
7	-	-	-	-	=625
5	-	-	-	-	=625
3	7	-	-	-	=125
3	5	7	-	-	=25
3	5	5	-	-	=25
3	5	3	7		=5
3	5	3	5		=5
3	5	3	3	7	=1

RNW=1436

24. $2^a + 3^b + 5^c \quad = 2^a + (4-1)^b + (4+1)^c \quad = 2^a + 4K + (-1)^b + 4K + 1$

b is even $=1\times 2\times 5 = 10$

b is odd$= 3\times 4\times 5 = 60$

25. All digits are different, divisible

By 3: 4!=24

3333-1

9999-1

3399- $\dfrac{4!}{2!2!} = 6$

3339 $2\times\dfrac{4!}{3!} = 8$

9993

2223or9 $2\times\dfrac{4!}{3!} = 8$

7773 or 9=8

2799 =12

2799=12

2277=6

RNW=86

PHYSICS

26. Conservation of energy

27. Optical path in air $= \mu x$

Phase diff $= \dfrac{2\pi}{\lambda}$ (path diff)

28. When reflection happens at the boundary of denser medium reflected light has a Phase diff of π

29. Light rays are shifted parallel towards the central line of YDSE

30. $\beta = \dfrac{\lambda D}{d} \Rightarrow \Delta\beta = \dfrac{\lambda(\Delta D)}{d}$

31. $y_{nB} = \dfrac{n\lambda D}{d} \Rightarrow \dfrac{d}{2} = \dfrac{n\lambda D}{d} \Rightarrow \lambda = \dfrac{d^2}{2n\lambda}$

32. angle of incidence, $1° = 60°$ and angle of refraction, $r = 30°$

$\mu_1 \sin i = \mu_2 \sin r$

33. Path diff, $\Delta x = d\cos\theta$, θ is the angle made by radius line of detector with AB

$d\cos\theta = n\lambda \Rightarrow \cos\theta = \dfrac{n\lambda}{d}$ and $\cos\theta \le 1$

34. Path diff $= n\lambda \Rightarrow$ maxima, Path diff $= (2n-1)\dfrac{\lambda}{2} \Rightarrow \min ima$

35. For bright spot, $\Delta x = n\lambda$

Light is a combination of time varying electric and magnetic fields

36. Intensity on the screen is a function of $\cos^2\phi$

37. Conceptual

38. Conceptual

39. For bright Spots to coincide $n_1\lambda_1 = n_2\lambda_2$ and $y = \dfrac{n\lambda D}{d}$

40. Conceptual

41. Position of 1st dark $= \dfrac{\lambda D}{2d}$

Position of 2nd bright $= \dfrac{2\lambda D}{d}$

Gap between them $= \dfrac{\lambda D}{d}\left(2 - \dfrac{1}{2}\right) (or) \dfrac{\lambda D}{d}\left(2 + \dfrac{1}{2}\right)$ $= 1.8$ mm $= 3$ mm

42. $\lambda^1 = \dfrac{\lambda}{\mu}$ $\beta = \dfrac{\lambda D}{d}$

43. Direction of propagation of light ray is normal to wave front

44. Phase diff $=$ initial phase diff $+$ phase diff due to path

$\phi = \pi + \dfrac{2\pi}{\lambda}\left(\dfrac{3\lambda}{2}\right)$

$I_R = 4I_0 Cos^2 \dfrac{\phi}{2}$

45. Shift $= (\mu - 1)\dfrac{tD}{d}$

46. Shift $= (\mu - 1)\dfrac{tD}{d}$

47. Path diff $\Delta x = d\cos\theta$

$d = 4\lambda$

For maxima, $\Delta x = \eta\lambda$

$4\lambda\cos\theta = \eta\lambda$

$\cos\theta = \dfrac{\eta}{4}$

and $\cos\theta \leq 1 \Rightarrow \mu \leq 4$

48. Shift due to sheet-1 $\qquad S_1 = \left(\dfrac{\mu_1}{\mu_w} - 1\right)t_1\dfrac{D}{d}$

And due to sheet 2, $\qquad S_2 = \left(\dfrac{\mu_2}{\mu_w} - 1\right)t_2\dfrac{D}{d}$

Net shift, $S = S_1 - S_2$

Phase diff, $\phi = 2\pi\dfrac{S}{\beta}, \beta = \dfrac{\lambda}{\mu_w}\dfrac{D}{d}$ $\qquad I_R = 4I_0\cos^2\dfrac{\phi}{2}$

49.

$y' = \dfrac{d}{2}$ at point P exactly infront of S_1

$\therefore \Delta x = \dfrac{yd}{D} + \dfrac{d^2}{2D'}$

For minimum intensity $\therefore \Delta x = (2n-1)\dfrac{\lambda}{2} \ (n = 1)$

Putting the value we get

$(0.5\sin\pi t)\times 10^{-6} + 0.25\times 10^{-6} = \dfrac{500}{2}\times 10^{-9}$ $\qquad 0.5\sin\pi t + 0.25 = \dfrac{0.5}{2}$

$\sin\pi t = 0 \Rightarrow \pi t = 0, \pi, 2\pi, ... \Rightarrow t = 1s$

50. Let $I = 100$

Intensity of light after reflecting from 1st plate

$I_1 = 25$

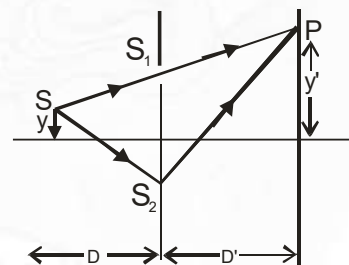Amplitude $A_1 = \sqrt{I_1} = 5\,units$

After reflecting from 2nd surface intensity $= \dfrac{75\times 25}{100} = \dfrac{75}{4}$

75% of this light pass through 1 after reflection .

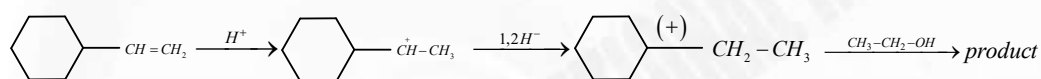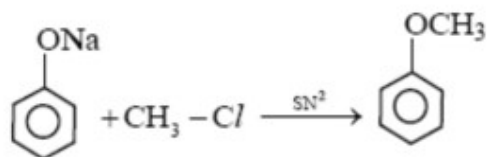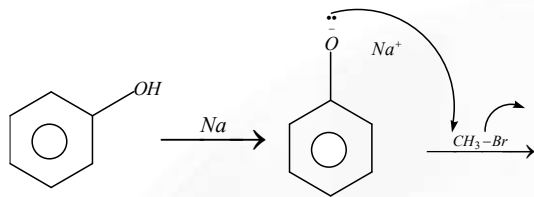$\therefore I_2 = \dfrac{75}{4}\times\dfrac{75}{100} = \dfrac{225}{16}$
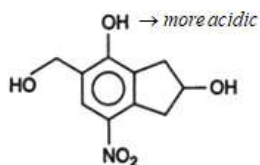
$A_2 = \sqrt{\dfrac{225}{16}} = \dfrac{15}{4} = 3.75$

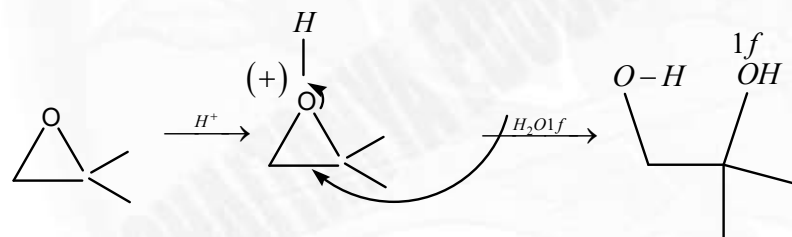$\dfrac{I_{max}}{I_{min}} = \left(\dfrac{5+3.75}{5-3.75}\right)^2 = 49 : 1$

CHEMISTRY

51.
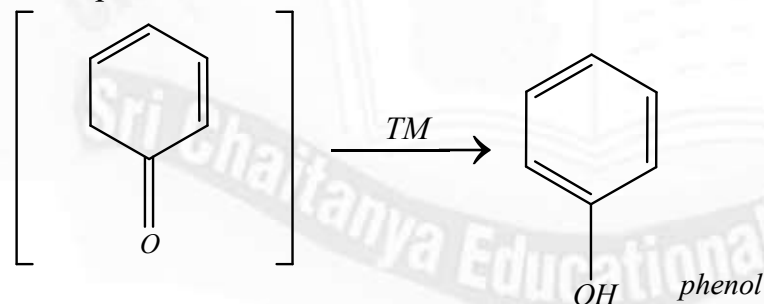

OH → more acidic

52.

$$\text{Phenol} \xrightarrow{Na} \text{Sodium phenoxide} \xrightarrow{CH_3-Br}$$

53.
54.

ONa

$+CH_3-Cl \xrightarrow{SN^2}$ OCH$_3$

55. Conceptual

56.

$$\text{epoxide} \xrightarrow{H^+} \xrightarrow{H_2O\,1f} \text{product}$$

57. Through SN$_1$ mech
58. Williumson synthesin (conceptual)
59. Conceptual

60.

$$\xrightarrow{TM}$$ phenol

61. Ar sn reaction (Conceptual)
62. Conceptual
63. Conceptual
64. Conceptual

65.

ortho & para directions group
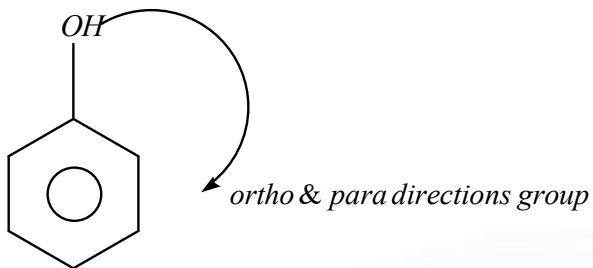
66. SN_1 mechanism $\left((CH_3)_3 C^+, Carbocation\right)$

67. less the pKa, more is the acidic nature

68. Conceptual

69. $H_2 / pd - BaSO_4$, reduce triple bond and acid halides

70.

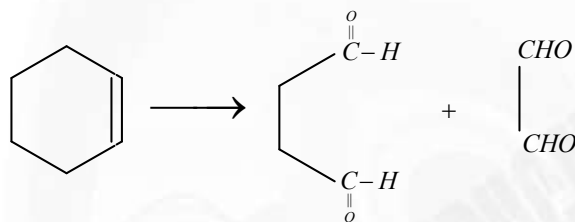$$H_3C-C\equiv CH \xrightarrow{Hg^{2+}/H_2O} H_3C-CH_2-\overset{O}{\underset{}{C}}-CH_3$$

71.
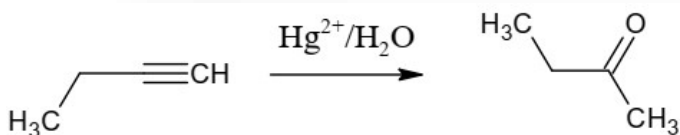
72. no clearage by HI

73. Conceptual

74.

75. Cu mene hydro peroxide re arrangement

$$ph - \overset{C}{\underset{C}{\overset{|}{C}}} - O - O - H \xrightarrow{H^+} CH_3 - \overset{O}{\overset{||}{C}} - CH_3 + Ph - OH$$

                                          Acctone   *phenol*

                                        (A) (B)