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: 14-06-2025

Time: 09.00Am to 12.00Pm | WTM-32 | Max. Marks: 300

KEY SHEET

MATHEMATICS

1	**3**	2	**2**	3	**2**	4	**2**	5	**3**
6	**4**	7	**1**	8	**3**	9	**4**	10	**2**
11	**3**	12	**1**	13	**2**	14	**1**	15	**1**
16	**1**	17	**1**	18	**2**	19	**3**	20	**2**
21	**6**	22	**2**	23	**44**	24	**11**	25	**84**

PHYSICS

26	**1**	27	**2**	28	**3**	29	**3**	30	**3**
31	**2**	32	**4**	33	**3**	34	**4**	35	**2**
36	**2**	37	**4**	38	**2**	39	**1**	40	**2**
41	**4**	42	**1**	43	**4**	44	**1**	45	**2**
46	**9**	47	**3**	48	**1**	49	**6**	50	**1**

CHEMISTRY

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

SOLUTIONS

MATHEMATICS

1. $n(\overline{A}\cap\overline{B})=n(\overline{A\cup B})=n(S)-n(A\cup B)$

$= 7! - [6! + 6! - 5!] = 3720$

2. $n(\overline{A}\cap\overline{B})=n(\overline{A\cup B})=n(S)-n(A\cup B)$

$= 4! - [3!\,.\,2! + 3!\,.\,2! - 2!\,.\,2!\,.\,2!] = 8$

3. $n(\overline{A}\cap\overline{B})=n(\overline{A\cup B})=n(S)-n(A\cup B)$

$= 100 - [n(A) + n(B) - n(A\cap B)]$

$= 100 - [14 + 33 - 4] = 57$

4. $D(5)=(1\to a_2)+(1\to a_3)+(1\to a_4)+(1\to a_5)$

$D(5)=4.K$

$44=4.K$

$11=K$

5. Total – (All go to wrong) – (4 go to wrong)

$= 120 - (D(5)) - (5_{C_1}.D(4))$

$= 120 - 44 - 5(9)$

$= 31$

6. $D(0)+6_{C_5}.D(1)+6_{C_4}.D(2)+6_{C_3}.D(3)$

$= 1 + 0 + 15 + 40 = 56$

7. Number of functions f: A$\to$B is $= n(B)^{n(A)} = 4^3$

8. Number of one – one from A to B $= n(B)_{P_{n(A)}}$

9. n = 4, r = 3

$= r^n - r_{C_1}(r-1)^n + r_{C_2}(r-2)^n - \ldots.$ $= 3^4 - 3(3-1)^4 + 3(3-2)^4 - \ldots..$

10. Make 28 Books into Two groups of 9 and 19

11. $10_{C_1}+10_{C_2}+10_{C_3}+\ldots\ldots\ldots+10_{C_{10}}$

12. $4_{C_1}\left(\frac{5!}{2!}\right)=240$

13. $r^n - r_{C_1}(r-1)^n + r_{C_2}(r-2)^n - \ldots.$

$3^6 - 3_{C_1}(3-1)^6 + 3_{C_2}(3-2)^6 - \ldots.. = 540$

14. **I)** $24 = 2^3.3^1$

$XYZ = 2^3.3^1 \Rightarrow (3+3-1_{C_{3-1}})(1+3-1_{C_{3-1}}) = 5_{c_2}.3_{c_2} = 30$

II) $XYZ = 30 = 2^1.3^1.5^1 \Rightarrow \left(1+3-1_{C_{3-1}}\right)^3 = \left(3_{c_2}\right)^3 = 27$

15. I) $(2+1)(3+1)(4+1)-1=59$

II) $12_{C_3} - 7_{C_3} = 185$

III) Co-efficient of X^{10} in $\left(1+X+X^2+....\right)^4$

$= (1-X)^{-4} = 10+4-1_{C_{4-1}} = 13_{C_3} = 286$

IV) $38808 = 2^3.3^2.7^2.11 = (3+1)(2+1)(2+1)(1+1) = 72$

72 - 2 = 70

16. $n-1_{C_{r-1}} = 19_{C_{13}}$

17. P = X - 1, Q = Y-2, r = Z - 3, S = T – 4

X = P + 1, Y = Q + 2, Z = r + 3, T = S + 4

P + Q + r + S = 19

$(19+4-1)_{C_{(4-1)}} = 22_{C_3}$

18. X + Y+ Z = 5

T + U = 15

$\left(5+3-1_{C_{3-1}}\right)\left(15+2-1_{C_{2-1}}\right) = \left(7_{C_2}\right)\left(16_{C_1}\right) = 336$

19. $100! = 2^{\alpha}.3^{\beta}.5^{\gamma}.7^{\delta}.....$

$\gamma = \left[\frac{100}{5}\right] + \left[\frac{100}{25}\right] + \left[\frac{100}{125}\right] + ...$

$= 20+4+0 = 24$

20. $\frac{100!}{50!.50!} = \frac{2^{\alpha_1}.3^{\beta_1}.5^{\gamma_1}.7^{\delta_1}.....}{\left(2^{\alpha_2}.3^{\beta_2}.5^{\gamma_2}.7^{\delta_2}.....\right)^2}$ $\quad \delta_1 - 2\delta_2 = 16-2(8) = 0$

21. $n-1_{C_{r-1}} = 5-1_{C_{3-1}} = 4_{C_2} = 6$

22. Only Two cases 113, 112

23. $D(5) = 5!\left[1-\frac{1}{1!}+\frac{1}{2!}-\frac{1}{3!}+\frac{1}{4!}-\frac{1}{5!}\right]$

24. $n_{C_2} - n = 44$

$n^2 - 3n - 88 = 0$

25. Total $= (13+3-1)_{C_{(3-1)}} = 19_{C_2} = 105$

Two persons get equal apples (0, 0, 13), (1, 1, 11), …….. (6, 6, 1) = 7×3 = 21

105-21 = 84

PHYSICS

26. $\frac{hc}{\lambda}=\frac{hc}{\lambda_0}+K_m$

27. $ev=\frac{hc}{\lambda}-\frac{hc}{\lambda_0} \quad -(1)$

$\frac{ev}{3}=h\left(\frac{1}{2\lambda}-\frac{1}{\lambda_0}\right) \quad -(2)$

Solve 1 & 2 then $\lambda_0=4\lambda$

28.

I. If intensity changes, then number of photons/time incident on the metal surface change and hence number of photoelectrons liberated change, so saturation photocurrent changes. Stopping potential and KE_{max} will remain the same

II. From $eV_o=hf-\phi$ and $K_{max}=hf-\phi$. If f changes, then V_o and K_{max} change

III. From $eV_o=hf-\phi$ and $K_{max}=hf-\phi$. If target material changes, then ϕ changes, then V_0 and K_{max} change

IV. If we change the potential difference between emitter and collector, then time taken for electrons to eject changes

29. $\frac{hc}{\lambda_1}=2eV+6eV; \quad \frac{hc}{\lambda_2}=2eV+KE_{max}$

But $\lambda_2=\frac{\lambda_1}{2}$

30. K.E., in the range $0\le x\le 1$, $K_1=E_0$

K.E. in the range $x>1$, $K_2=2E_0$

$\frac{\lambda_1}{\lambda_2}=\sqrt{\frac{k_2}{k_1}}=\sqrt{2}$

31. Charge on the sphere after t sec is $=-\frac{\eta}{100}\frac{Pt\lambda e}{hc}$

Electric potential after t sec is $=-\left(\frac{\eta Pt}{100hc}\right)\times\frac{1\lambda e}{4\pi R}$

32. CONCEPTUAL

33. From conservation of linear momentum both the particles will have equal and opposite momentum. The de-Broglie wavelength is given by

$\lambda=\frac{h}{p}$

$\therefore\frac{\lambda_1}{\lambda_2}=1$

34. Momentum imparted $=\frac{2E}{C}$

Now mirror will perform S.H.M with $V_{max}=2E/mC$

But v_{max} = Amplitude $\times \omega$

$$\frac{2E}{mC} = L\theta \times \sqrt{\frac{g}{L}}$$

or $\theta = \frac{2E}{mC\sqrt{gL}}$

35. Radiation pressure = $p = \frac{l}{c}$

Area of hexagon $= \left(\frac{1}{2}\alpha.\frac{\alpha\sqrt{3}}{2}\right)\times 6$

$$F = PA\cos\theta = \frac{l}{c}.\frac{3a^2\sqrt{3}}{2}.\frac{\sqrt{3}}{2} = \frac{9\alpha^2 l}{4c}$$

36. $eV_0 = h\upsilon - W$, Where V_0 is the stopping potential

37. Current depends on the no of photons incident on the surface

$\frac{P}{4\pi R_1^2} = n_1\left(\frac{hc}{\lambda}\right)$, here n_1 is the photons incident per unit time on the surface

38. Force is rate of change of momentum.

Power absorbed is 0.4 P and power reflected is 0.6 P.

Force $F = \frac{0.4\,P}{C} + \frac{2\times 0.6\,P}{C}$ Where C is the velocity of light

39. $P = \frac{nhv}{t} \Rightarrow \frac{n}{t} = \frac{p\lambda}{hc} = F6\times 10^{15}$

$\therefore$ Number of e^{-1}s emitted per second $= 6\times 10^9$

$\therefore i = 1.6\times 10^{-19}\times 6\times 10^9 = 9.6\times 10^{-10}\,A$

40. $hv_1 - hv_0 = \frac{1}{2}mv_1^2$

$hv_2 - hv_0 = \frac{1}{2}mv_2^2$

$\therefore \quad h(v_1 - v_2) = \frac{1}{2}m(v_1^2 - v_2^2) \qquad [\because\ v_1 = f_1\ and\ v_2 = f_2]$

$\therefore \quad v_1^2 - v_2^2 = \frac{2h}{m}(f_1 - f_2)$

41. $\overline{v}_{1c} = \overline{v}_1 - \overline{v}_c\ and\ \overline{v}_{2c} = \overline{v}_2 - \overline{v}_c\ and\ \overline{V}_c = \frac{m_1v_1\hat{i} + m_2v_2\hat{j}}{m_1 + m_2}\ (m_1 = m_2 = m)$

42. $\vec{v} = v_0\hat{i} - \frac{E_o e}{m}t\hat{k}$

$|\vec{v}| = \sqrt{v_0^2 + \frac{E_0^2e^2t^2}{m^2}}$

$\lambda_0 = \frac{h}{mv_0}$

$$\lambda' = \frac{h}{mv_0\sqrt{1+\frac{E_0^2e^2t^2}{v_om^2}}}$$

$$\lambda' = \frac{\lambda_0}{\sqrt{1+\frac{E_0^2e^2t^2}{v_om^2}}}$$

43. $eV_0 = h\nu - \phi$

$$V_0 = \frac{h}{e}\nu - \frac{\phi}{e}$$

M_2 material has higher work function, so **STATEMENT-II** is incorrect

44. Based on the Concept of Davisson - Germer Experiment

45. Work function of a metal is defined as the minimum amount of energy needed for ejection of photoelectron. Therefore, **ASSERTION** is correct.
Incident energy may or may not be completely absorbed by the photoelectron. Therefore, kinetic energy of a photoelectron may be zero even if the incident radiation has energy greater than work function.

46. $\beta = \frac{D\lambda}{d} \Rightarrow \lambda = 4000A^\circ$ $\qquad v_s = \left(\frac{12400}{\lambda} - w_o\right) = 0.9V$

47. $\frac{1}{2}mv^2 = vq \quad \lambda = \frac{h}{p} = \frac{h}{mv} = \frac{h}{\sqrt{2mvq}}$

$$\lambda_p = \frac{h}{\sqrt{2m\,eV}} \qquad \lambda_\alpha = \frac{h}{\sqrt{2(4m)(2e)V}} = \frac{\lambda_p}{2\sqrt{2}}$$

$$\frac{\lambda_p}{\lambda_\alpha} = \frac{\lambda_p}{\left(\frac{\lambda_p}{2\sqrt{2}}\right)} = 2\sqrt{2} \approx 3$$

48. Let n photons (each of frequency f) per second are emitted from source. Then power of source is $P = nhf$
But only 30% of the photons go towards mirrors
Then force exerted on mirror is, $F = 2\left[\frac{30}{100}n\right]\frac{h}{\lambda} = \frac{3}{5}\frac{nhf}{c} = \frac{3}{5}\frac{P}{c}$ and this force should be equal to weight of mirror, so $\frac{3}{5}\frac{P}{c} = 20\times10^{-3}\,g$

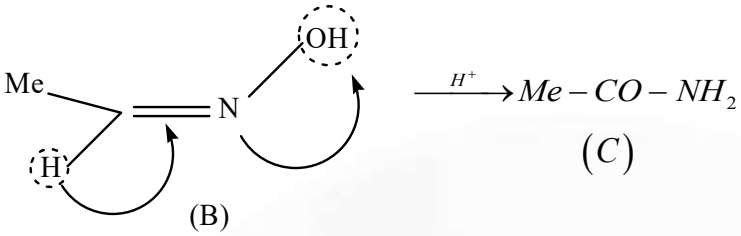
$$\Rightarrow P = \frac{5\times3\times10^8\times20\times10^{-3}\times10}{3} = 10^8\ \text{W}$$

49. Based on the Concept of **Photo electric Equation**

50. Force acting on the Mirror is = $\frac{2IA}{C}$

CHEMISTRY

51. Anti-elimination of H and OH from oxime occurs with HCOONa



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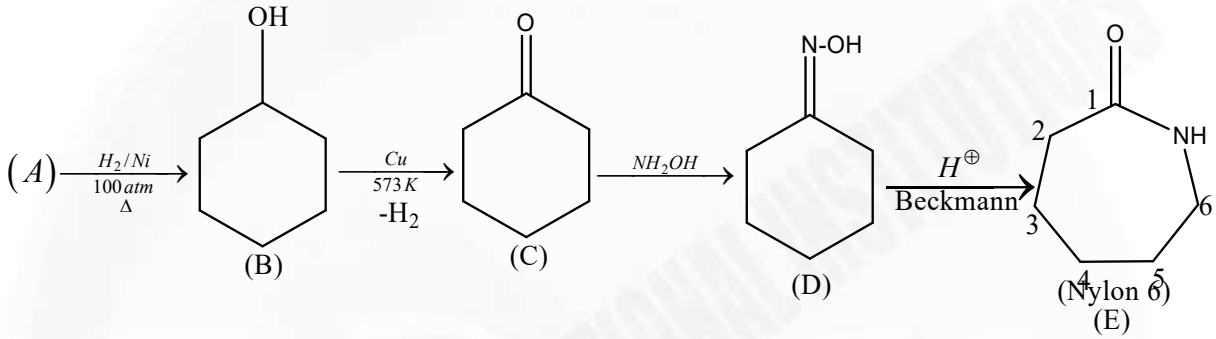
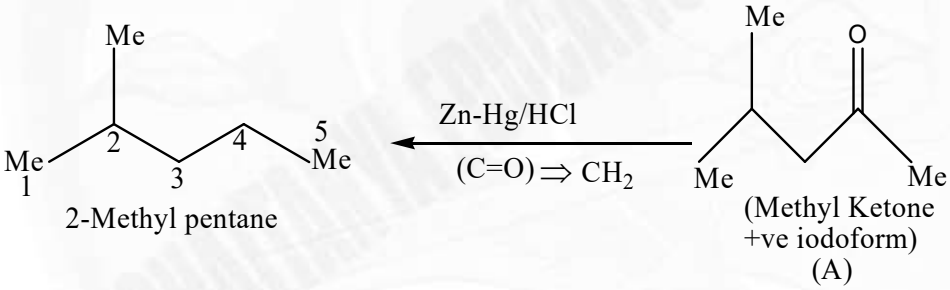


53. Proceed reverse from the Clemmensen reduction.



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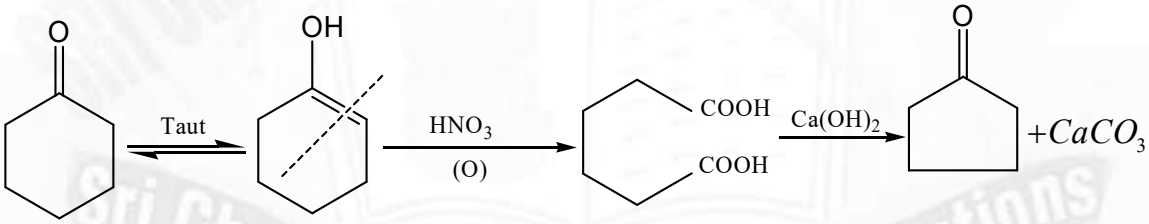

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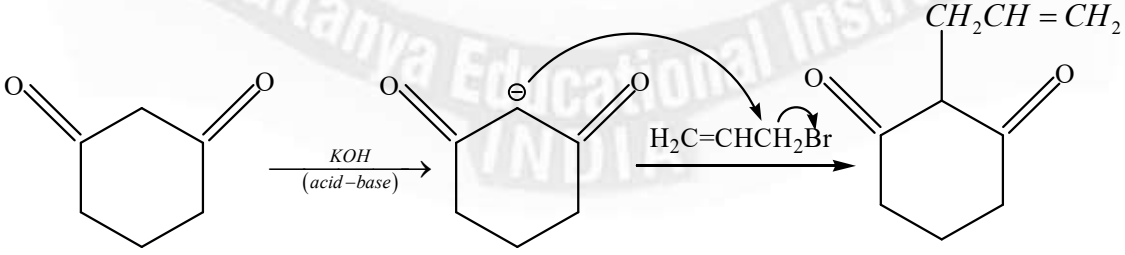

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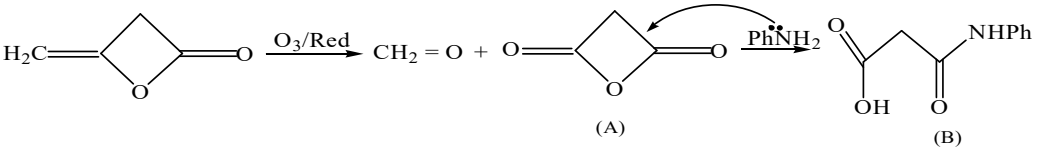

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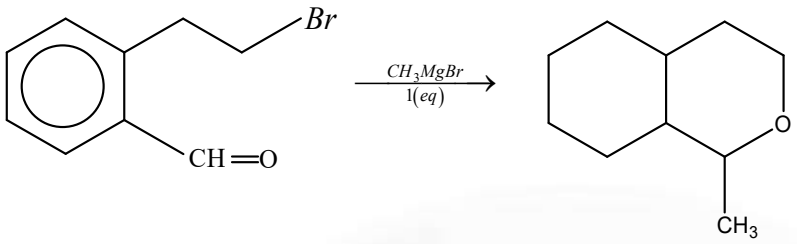

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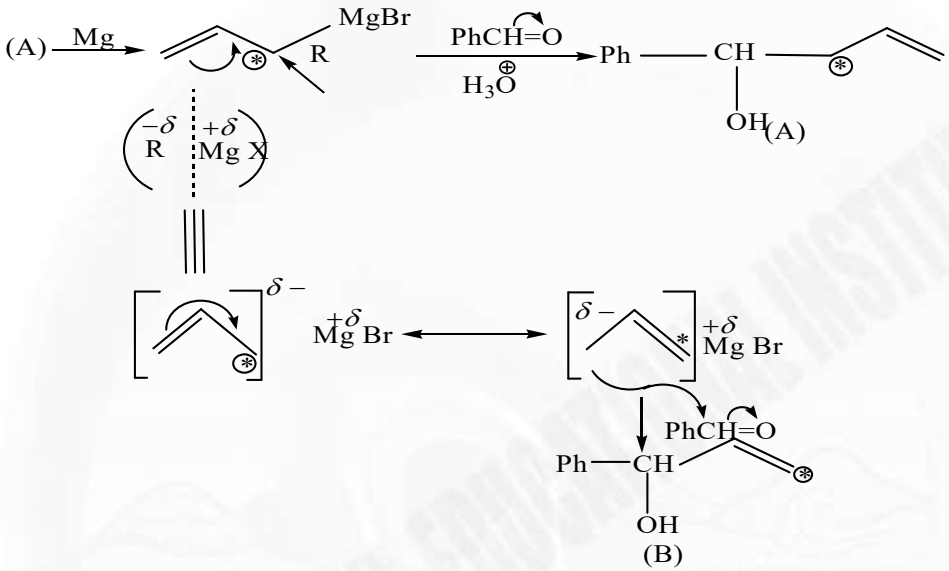
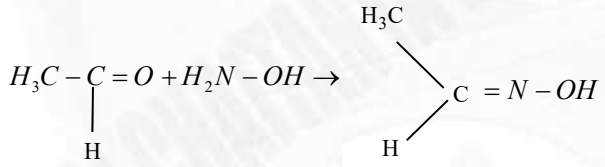


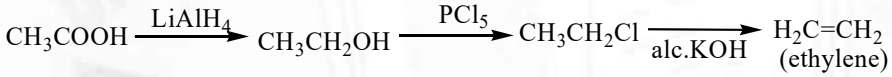
59. Reduction of Carbonyl compounds



60.

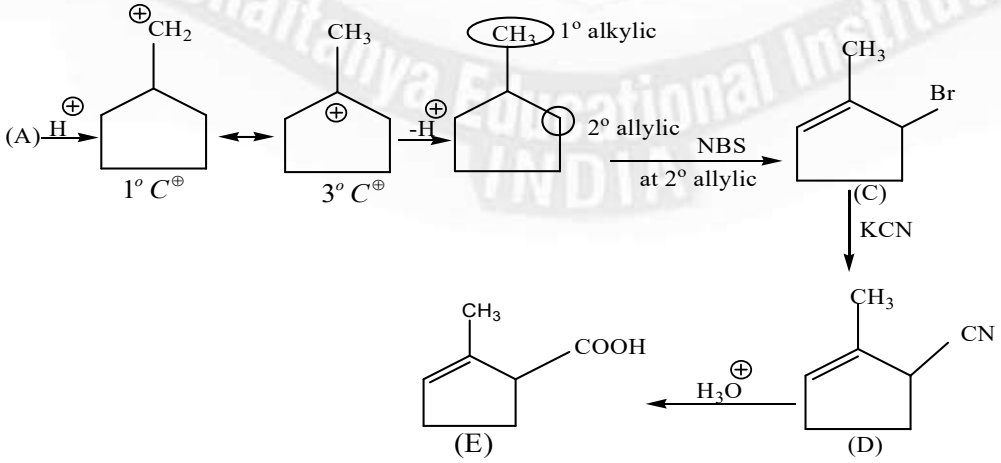
61. Decarboxylation

62.



63. **HVZ** Reaction

64.

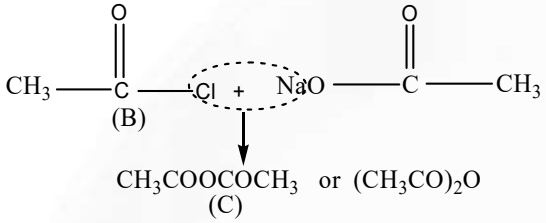


65. Grignard reagent method is best method than cyanide method. Given alkyl halide is 3°, So with $\overset{\ominus}{C}N$ elimination can occur. Moreover, RX with NaCN can give $R-C\equiv N$ (major) and $R-\overset{\oplus}{N}\equiv\overset{\ominus}{C}$ (minor)

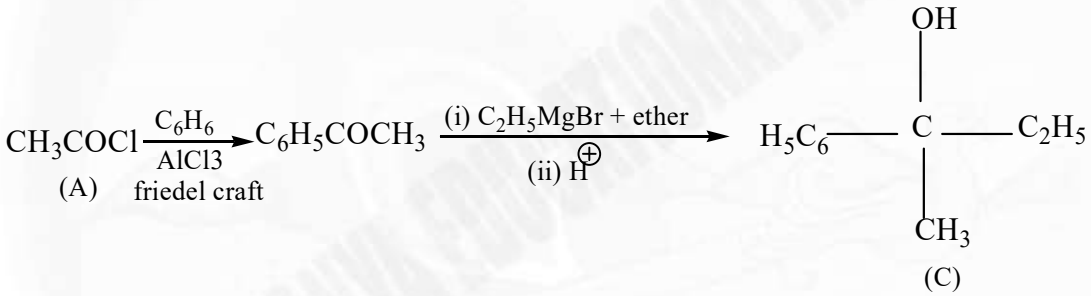
$$RCN \xrightarrow{H_3O^{\oplus}} RCOOH$$

$$RNC \xrightarrow{H_3O^{\oplus}} RNH_2 + HCOOH$$

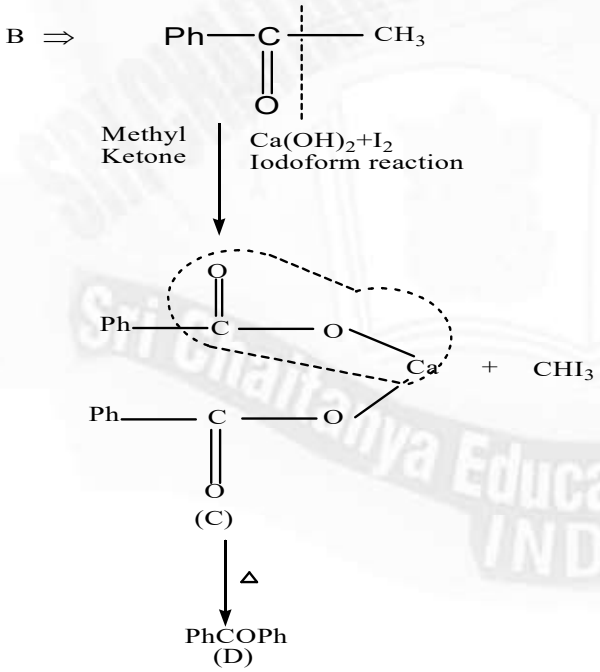
66.



67.



68.

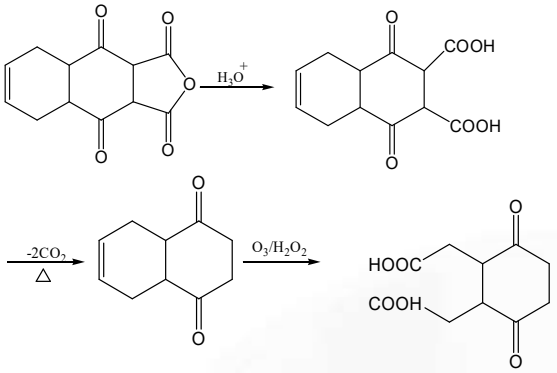


69. -ME

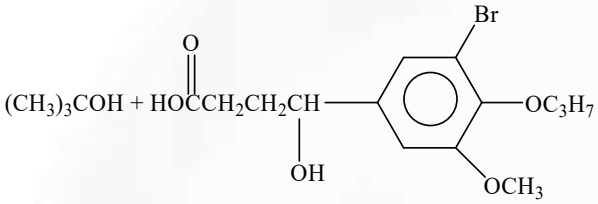
70. Ozonolysis of Alkyne

71. (II, IV , VI and VIII). These are acidic in character and hence soluble in aqueous NaOH.

72.

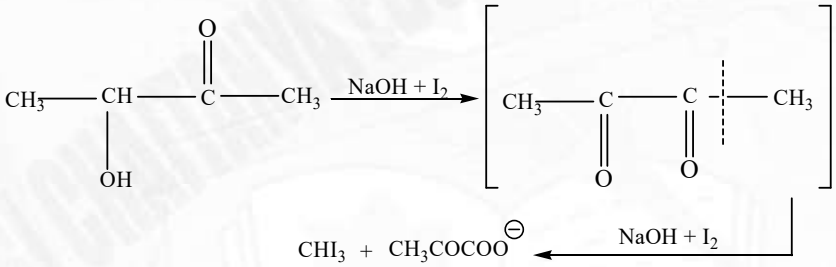


73. Ether will not react in basic medium.

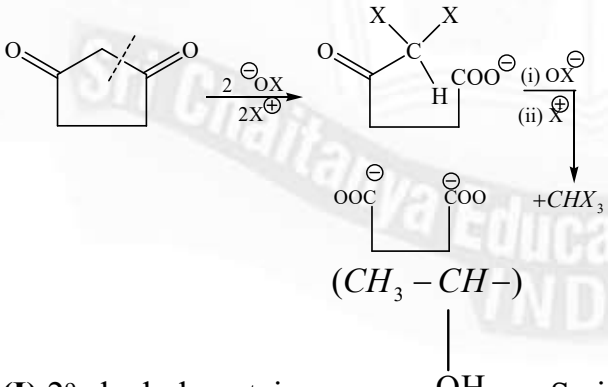


74. **9** compounds (1, 3, 4, 6, 7, 8, 9, 11 and 12), gives positive iodoform test.
(a), (c), (d) are methyl ketone.

(f) is CH_3CHO. (Only aldehyde which gives this test)
(g) CH_3CH_2Br in basic medium of reagent gives CH_3CH_2OH which gives this test.
(h) α-hydroxy ketone and (9) α,β-diketone both gives this test.



(k) is exceptional case, cyclic 1, 3 – diketone gives this test.



(I) 2° alcohol contains , So it gives this test.
(j) Does not give this test, althrough it is methyl ketone but it is sterically hindered by 3 Ph – groups.

75. (a, d, e, f **and** h)