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_STERLING BT	**JEE-MAIN**	**Date: 06-09-2025**
Time: 09:00AM to 12:00PM	**RPTM-05**	**Max. Marks: 300**

KEY SHEET

MATHEMATICS

1	**2**	2	**4**	3	**1**	4	**2**	5	**4**
6	**1**	7	**2**	8	**2**	9	**3**	10	**4**
11	**2**	12	**2**	13	**2**	14	**4**	15	**3**
16	**2**	17	**3**	18	**3**	19	**4**	20	**3**
21	**12**	22	**3**	23	**372**	24	**10**	25	**2026**

PHYSICS

26	**3**	27	**3**	28	**2**	29	**3**	30	**2**
31	**1**	32	**4**	33	**3**	34	**4**	35	**3**
36	**4**	37	**2**	38	**3**	39	**4**	40	**2**
41	**3**	42	**1**	43	**2**	44	**2**	45	**4**
46	**0**	47	**12**	48	**4**	49	**5**	50	**17**

CHEMISTRY

51	**4**	52	**1**	53	**3**	54	**2**	55	**3**
56	**1**	57	**3**	58	**2**	59	**1**	60	**1**
61	**2**	62	**1**	63	**4**	64	**1**	65	**1**
66	**3**	67	**3**	68	**3**	69	**1**	70	**1**
71	**253**	72	**8**	73	**1**	74	**4**	75	**8**

SOLUTIONS
MATHEMATICS

01. $f'(x) = x(x^2 - 9x + 20) = x(x-4)(x-5)$, $f(x) = \dfrac{x^4}{4} - 3x^3 + 10x^2$

      $f(1) = \dfrac{29}{4}$, $f(5) = \dfrac{215}{4}$, $f(4) = 32$, $Range = \left[\dfrac{29}{4}, 32\right]$

02. $G.I = 48\displaystyle\int_0^{\frac{\pi}{2}} x^2(1 + \cos 2x)\, dx = 48\int_0^{\frac{\pi}{2}} x^2\, dx + 48\int_0^{\frac{\pi}{2}} (x^2 \cdot \cos 2x)$ (use by parts)

      Simplify we get $\pi\left(2\pi^2 - 12\right)$

03. $0 < x < 1 \Rightarrow \dfrac{x}{2} < \dfrac{x}{1 + x^8} < x$

      $\Rightarrow \displaystyle\int_0^1 \dfrac{x}{2}\, dx < \int_0^1 \dfrac{x}{1 + x^8}\, dx < \int_0^1 x\, dx \Rightarrow \dfrac{1}{4} < J < \dfrac{1}{2}$

04.   Rationalize

05.   Replace $'x'$ with $'-x'$ and then Add

06. $f(x) = \dfrac{2}{3x^2} - \dfrac{x^2}{3} + \dfrac{5}{3}$, $\alpha = \dfrac{11}{9}$, put $x = \dfrac{1}{2}$, $2g\left(\dfrac{1}{2}\right) - 3g\left(\dfrac{1}{2}\right) = \dfrac{1}{2}$

      $\Rightarrow g\left(\dfrac{1}{2}\right) = -\dfrac{1}{2}$, $\beta = 0$

07.   Evaluate each definite integral (using properties)

08.   Let $I_2 = \displaystyle\int_0^1 \left(1 - x^n\right)^{2n+1} 1.dx$ use by parts and simplify

      $n = 24 = 2^3 \times 3$

      Sum of divisors $= \left(1 + 2 + 2^2 + 2^3\right)(1 + 3) = 60$

09.   Use $'a - x'$ property, then add and simplify

10.   Ortho centre $= (a, b) = \left(\dfrac{5}{3}, \dfrac{7}{3}\right)$ and use $a + b - x$ property

11. $G.L = \displaystyle\lim_{n\to\infty} \dfrac{1}{n} \sum_1^n \dfrac{1}{\left(1 + \left(\dfrac{k}{n}\right)^2\right)\left(1 + 3\left(\dfrac{k}{n}\right)^2\right)} = 8\int_0^1 \dfrac{1}{\left(1 + x^2\right)\left(1 + 3x^2\right)}$ simplify

12. $f(x)$ is differentiable & continuous $\Rightarrow a = 3, b = 5$

$$G.I = \int_{-2}^{1} \left(x^2 + 3x + 3\right) dx + \int_{1}^{2} (5x + 2) dx$$

13. $f'(1) = \dfrac{1}{\sqrt{3}}$, $f'(3) = 1$, $I = \displaystyle\int_{1/\sqrt{3}}^{1} \left(z^2 + 1\right) dz$ where $f'(t) = z$

14. $f(a) + f(1 - a) = 1$, $M = \displaystyle\int_{f(a)}^{f(1-a)} (1-x)\sin^4\left(x(1-x)\right) dx$

     $\Rightarrow M = N - M \Rightarrow \dfrac{M}{N} = \dfrac{1}{2}$

15. $\displaystyle\int_{1}^{2}(4 - x)\, dx + \int_{2}^{3}(x)\, dx + \int_{3}^{5}(3x - 6)\, dx = 30 - 13 = 17$

16.   Differentiate $y(x)$ by using Leibnitz rule & put $x = \dfrac{1}{\sqrt{2}}$

17.   Use $[t] + [-t] = -1 \ for \ t \in \mathbb{R} - z$

18. $f(x) = \begin{cases} e^{x^2} & x \in [0,1) \\ e^1 & x \in [1,2] \end{cases}$

19. $f(x) = x + x \cdot \displaystyle\int_{0}^{1} f(t)\, dt - \int_{0}^{1} t \cdot f(t)\, dt$

     Let $\displaystyle\int_{0}^{1} f(t)\, dt = A$, $\displaystyle\int_{0}^{1} t \cdot f(t)\, dt = B$

     $f(x) = x(1 + A) - B$ use $\displaystyle\int_{0}^{1} f(t)\, dt = A \Rightarrow A + 2B = 1 \ ------(1)$

     Use $\displaystyle\int_{0}^{1} t \cdot f(t)\, dt = B \Rightarrow 2 + 2A = 9B \ ------(2)$ solving (1) & (2) $A = \dfrac{5}{13}$, $B = \dfrac{4}{13}$

     So $y = f(x) = \dfrac{18}{13}x - \dfrac{4}{13} = \dfrac{18x - 4}{13}$, $y(6) = \dfrac{104}{13} = 8$

20. $f(x)$ is a periodic function of period '$2k$'

     $I_1 = 2n \cdot \displaystyle\int_{0}^{2k} f(x)\, dx$, $I_2 = 2 \cdot \displaystyle\int_{0}^{2k} f(x)\, dx$, $\displaystyle\int_{0}^{k} f(x)\, dx + \int_{0}^{k} f(x + k)\, dx = nk$

     $\Rightarrow \displaystyle\int_{0}^{k} f(x)\, dx + \int_{k}^{2k} f(x + 2k)\, dx = nk$

$$\Rightarrow \int_{0}^{2k} f(x)\, dx = nk \Rightarrow I_1 = 2n^2 k,\ I_2 = 2nk$$

21. $G.L = \dfrac{\displaystyle\lim_{x \to 0} \dfrac{\alpha}{2}\left(\dfrac{1}{1-x^2}\right) + \beta \cos x - \beta x \sin x}{3x^2}$ (by using LH rule & Leibnitz rule)

   Use expansions $\left(1-x^2\right)^{-1}$, $\cos x$, $\sin x$ and simplify

   $\dfrac{\alpha}{2} + \beta = 0$ and $\dfrac{\alpha - 3\beta}{6} = 2$ solving, $\alpha = \dfrac{24}{5},\ \beta = \dfrac{-12}{5}$ then

   $5(\alpha + \beta) = 12$

22. Put $x = \dfrac{1}{t}$, $\ell = \displaystyle\int_{1/2}^{2} \dfrac{\cot^{-1}(t)\, dt}{2t^2 - 3t + 2}$, Add $2\ell = \displaystyle\int_{1/2}^{2} \dfrac{\dfrac{\pi}{2}}{2x^2 - 3x + 2}$

   $\Rightarrow \ell = \dfrac{\pi}{8} \displaystyle\int_{1/2}^{2} \dfrac{dx}{\left(x - \dfrac{3}{4}\right)^2 + \dfrac{7}{16}} = \dfrac{\pi}{2\sqrt{7}} \tan^{-1}\left(3\sqrt{7}\right)$

   So $\dfrac{\tan\left(\dfrac{2\ell\sqrt{7}}{\pi}\right)}{\sqrt{7}} = 3$

23. $F'(x) = x \cdot f(x)$, $F(t) = t^2 + t^{5/2}$ where $x^2 = t$, $F'(t) = 2t + \dfrac{5}{2} \cdot t^{3/2}$

   $\Rightarrow f(t) = 2 + \dfrac{5}{2} t^{1/2} \Rightarrow f\left(r^2\right) = 2 + \dfrac{5}{2} r$

24. Domain $= (1, 3)$

   $\displaystyle\int_{0}^{2} \left[x^2\right] dx = \int_{0}^{1} 0\, dx + \int_{1}^{\sqrt{2}} 1\, dx + \int_{\sqrt{2}}^{\sqrt{3}} 2\, dx + \int_{\sqrt{3}}^{2} 3\, dx = 5 - \sqrt{3} - \sqrt{2}$

25. $f(x) = \left(7\tan^6 x - 3\tan^2 x\right)\sec^2 x\, dx$, $I_1 = 0$ $(\tan x = t)$

   $I_2 = \displaystyle\int_{0}^{\pi/4} x \cdot \left(7\tan^6 x - 3\tan^2 x\right)\sec^2 x\, dx$ (by parts) $= \dfrac{1}{12}$

PHYSICS

26. For the equilibrium of system the net force on each charge should be zero
27. Water in the glass does not fall out because of water and glass have the same acceleration equal to g towards the centre of earth hence there is no relative motion between them
28. The body must be imparted necessary velocity such that gravitational force is equal to centripetal force to move in an orbit
29. If y is fixed then momentum p of the system is not conserved due to external force, but energy is conserved. If y is free, both P and E are conserved due to external force, but energy is conserved.

    If y is free both P and E are conserved. Electrostatic P.E is maximum at the moment both X and Y will move with equal velocity.

30. Escape velocity $v = \sqrt{\dfrac{2GM}{r}}$

    Angular momentum $L = m\sqrt{GMr}$

    $P.E = \dfrac{-GMm}{r}$

    Time period $T = \dfrac{2\pi r^{\frac{3}{2}}}{\sqrt{GM}}$

31. $V_e = \sqrt{\dfrac{2GM}{r}}$ and $M = \dfrac{4}{3}\pi r^3 \rho$

    $A = 4\pi r^2$

32. $a = \dfrac{GM}{(R+h)^2}$

33. $\dfrac{1}{2}mv_e^2 = -P.E_{system}$ at Point O

34. $F = M_{sphere}.E_{ring}$

35. $\overline{E}_{net} = \sum \overline{E_i}$

    $E = \dfrac{kq}{r^2}$ due to each charge

36. $\tan 37^0 = \dfrac{v_y}{v_x}$

    $\dfrac{3}{4} = \dfrac{v_y}{4} \Rightarrow V_y = 3$

    $V_y = \dfrac{eE.t}{m} = \dfrac{eE}{m}\dfrac{\ell}{V_x}$

    $3 = \dfrac{eE}{m}.\dfrac{1}{4} \Rightarrow E = 12\dfrac{m}{e}$

37.   According to work energy theorem $W_g + W_N + W_E + W_f + W_S = 0$

$$0.2 \times 10 \times 2 + 0 + 10 \times 2(3 + x) - 0.5 \times 0.2 \times 10(1 + x) - \frac{1}{2} \times 400 \times x^2 = 0$$

Solving will get $200x^2 - 19x - 63 = 0$

38. $W_T + W_E = \Delta KE$

$$0 + Eq\frac{\ell}{2} = \frac{1}{2}mV_B^2 - 0$$

$$V_B = \sqrt{\frac{Eq\ell}{m}}$$

At B, $T - Eq = \dfrac{mV_B^2}{\ell} = Eq$

$T = 2Eq$

39. $E_x = -\dfrac{\Delta V}{\Delta x}$

$$E_y = -\frac{\Delta V}{\Delta y}$$

$$\therefore E = E_x \hat{i} + E_y \hat{j}$$

40. $\overline{L} =$ constant as $\tau = 0$ due to electric field

At least separation R^1 particle velocity is perpendicular to line joining two charges.

$$MVR \sin 30^0 = M\frac{V}{\sqrt{3}}R^1 \sin 90^0$$

$$R^1 = \frac{\sqrt{3}}{2}R$$

41. $E_g = \dfrac{2GM}{\pi R^2}$ and $V = \dfrac{-GM}{R}$

42. $mv = \dfrac{m}{2}v^1 + 0$

$v^1 = 2v$ just after explosion

Now the second piece escapes from earth's gravitational field as $v^1 > \sqrt{2}\,v$

i.e escape velocity in that orbit.

$K.E + P.E = cons\tan t$

$$\frac{1}{2}\frac{m}{2}(2v)^2 - \frac{GMm/2}{r} = \frac{1}{2}\frac{m}{2}V_\infty^2 + 0$$

$$mv^2 - \frac{rv^2 m}{2r} = \frac{m}{4}V_\infty^2, \text{ as } V = \frac{-GM}{r}$$

$$\frac{mv^2}{2} = \frac{m}{4}v_\infty^2$$

$$\frac{mv^2}{2} = \frac{m}{4}v_\infty^2$$

$$v_\infty = \sqrt{2}v$$

43. $E = \dfrac{GM}{R^2}$ and $V = \dfrac{-GM}{R}$

$V = -E\,R$

44. Net force acts on dipole to the left as field increases in that direction.

45. Find the vector sum of three dipole moments.

46. The electric field is perpendicular to the path. Hence the work done is zero by the field.

47. $\omega_{rel} = \omega_E + \omega_S$

$$\frac{2\pi}{T} = \frac{2\pi}{T_E} + \frac{2\pi}{T_S}$$

$$\therefore T = \frac{T_E T_S}{T_E + T_S}$$

Here $T_S = T_E = 24\ hrs$

48. $W_{ext} + W_{gravity} = \Delta KE$

Minimum work required is corresponding to no. change in KE

$$\therefore W_{ext} - m(V_f - V_i) = 0$$

$$W_{ext} - 10(-4 - 0) = 0$$

$$W_{ext} = -40\ J$$

$$-10P = -40 \Rightarrow P = 4$$

49. $mR\omega^2 = \dfrac{GMm}{R^{\frac{3}{2}}}$

$$\omega^2 \propto \frac{1}{R^{5/2}}$$

$$\frac{4\pi^2}{T^2} \propto \frac{1}{R^{5/2}} \Rightarrow T^2 \propto R^{5/2}$$

50. $g_e = g_p - R\omega^2$ at equator

$$o = g - R\omega^2$$

$$\omega = \sqrt{\frac{g}{R}} = \sqrt{\frac{10}{6400 \times 10^3}} = \frac{1}{800}\ rad/s$$

At present $\omega_0 = \dfrac{2\pi}{T} = \dfrac{2\pi}{86400}\,rad/s$
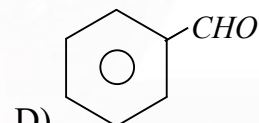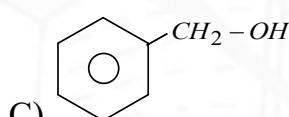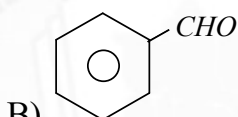
$$\frac{\omega}{\omega_0} = 17$$

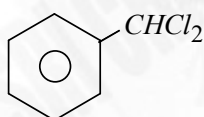# CHEMISTRY

51.

$$\underset{\text{Ph}}{\bigcirc}\!-\!\overset{\overset{O}{\|}}{C}\!-\!\overset{\alpha}{CH_3}$$

52. 1) $\text{CH}_3(CH_2)_5 - OH \xrightarrow{PCC} \text{CH}_3(CH_2)_4 - CHO$

2)

$$\underset{\text{(OH)}}{\bigcirc} \xrightarrow{K_2Cr_2O_7/H^+} \underset{\text{(=O)}}{\bigcirc}$$

3)

$$\underset{F}{\overset{CH_3}{\bigcirc}} + CrO_3 + CH_3 - \overset{O}{\underset{\|}{C}} - O - \overset{O}{\underset{\|}{C}} - CH_3 \xrightarrow{273-283\,K} \underset{F}{\overset{CH(OCOCH_3)_2}{\bigcirc}} \xrightarrow[\Delta]{H_3O^{\oplus}} \underset{F}{\overset{CHO}{\bigcirc}}$$

4) $CH_3 - C \equiv N \xrightarrow[\;(2)\;H_2O\;]{(1)\;DIBAL-H} CH_3 - CHO$
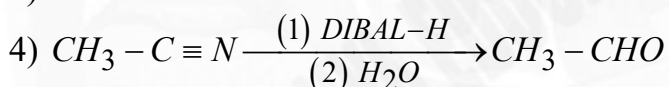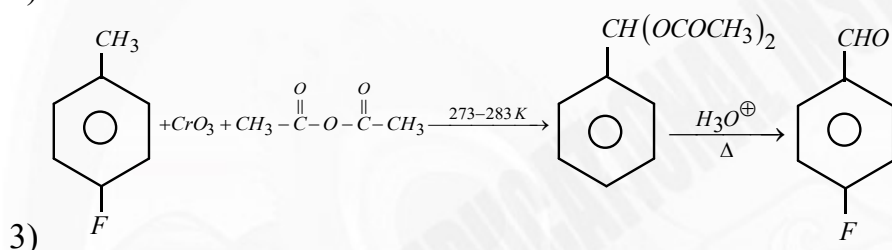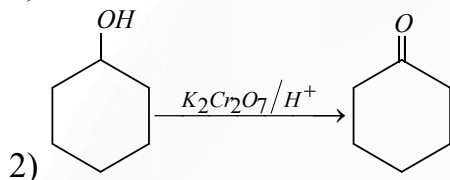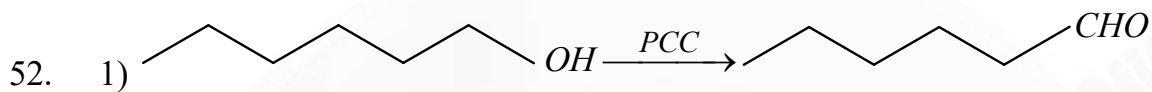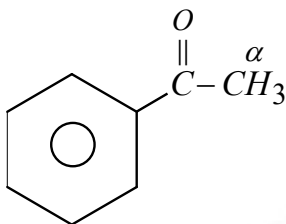
53. Conceptual

54. Conceptual

55. *Rate of NAR $\propto$ EWG*

A) $\underset{}{\overset{CHCl_2}{\bigcirc}}$ B) $\underset{}{\overset{CHO}{\bigcirc}}$ C) $\underset{}{\overset{CH_2-OH}{\bigcirc}}$ D) $\underset{}{\overset{CHO}{\bigcirc}}$

56. A)   B)   C)   D)

57. Conceptual

58. $R - CN \longrightarrow R - CHO$

59. Conceptual

60.

$$OHC - \underset{EWG}{\bigcirc} - C \equiv C - \underset{EDG}{\bigcirc} - OCH_3 + H_2O \xrightarrow{Hg^{+2}/H^+} OHC - Ph - CH = C - Ph - OCH_3$$
$$\underset{OH}{}$$

$$\xrightarrow{Tautomerisation} OHC - Ph - CH_2 - \overset{\overset{}{\underset{\|}{}}}{C} - Ph - OCH_3$$
$$\underset{O}{\|}$$
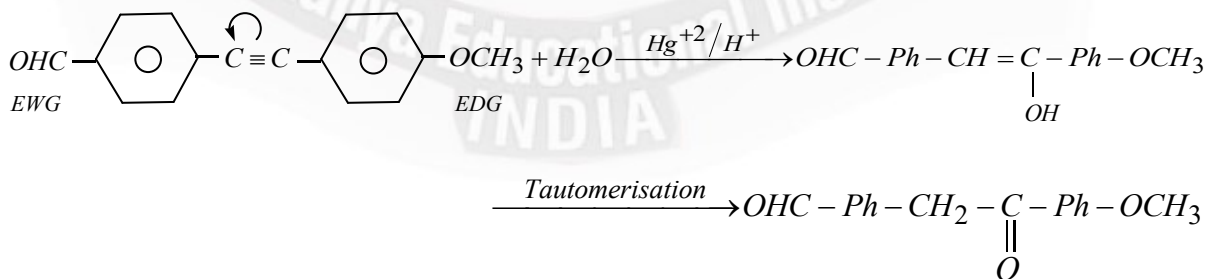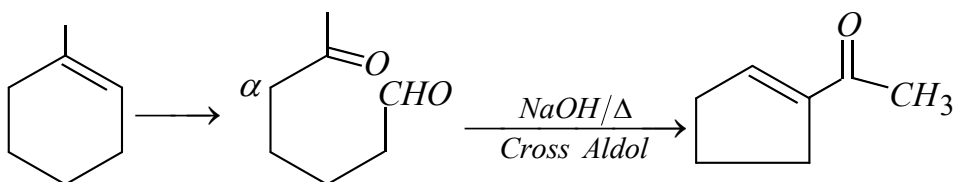
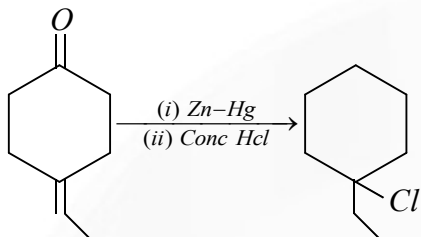61. Conceptual

62.

63.

Markovnikov's rule follows

64.

65. Conceptual

66.

67.

$$CH_3 - CH_2 - \underset{\underset{OH}{|}}{CH} - CH_3 \xrightarrow{(O)} CH_3 - CH_2 - \underset{\underset{O}{||}}{C} - CH_3$$
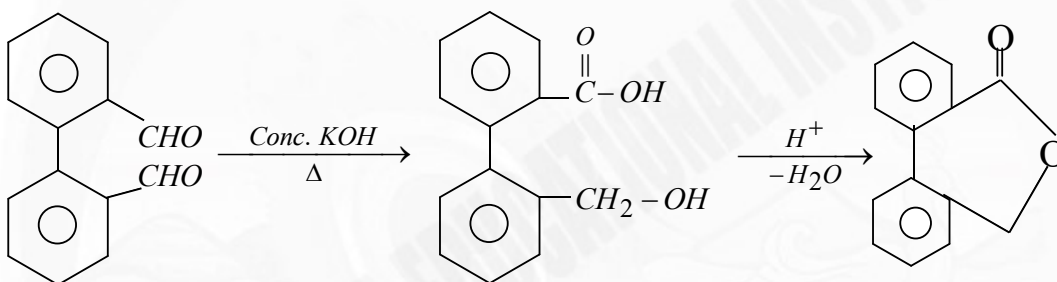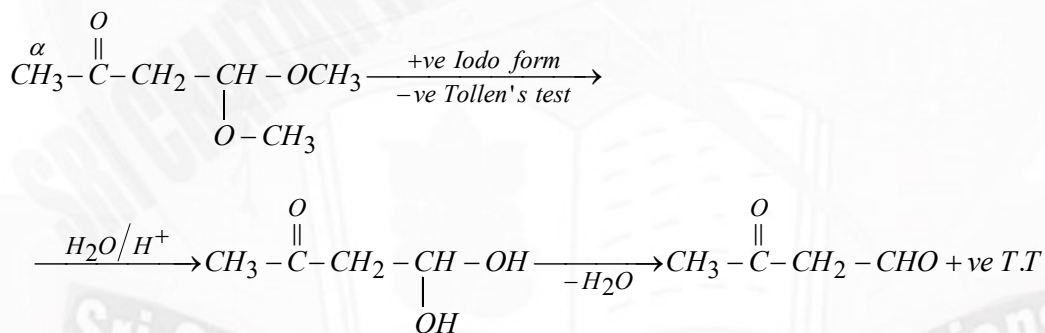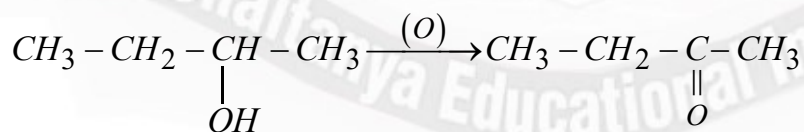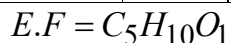
68. Option (1), (2) & (4) will react with both. Fehling's solutions reacts with only aliphatic aldehydes

69.

Element	A.W	%	% /A.W	Simple ratio	Whole No. ratio
C	12	69.77	$\dfrac{69.77}{12} = 5.81$	5	5

| H | 1 | 11.63 | $\dfrac{11.63}{1} = 11.63$ | 10 | 10 |
| O | 16 | 18.60 | $\dfrac{18.6}{16} = 1.16$ | 1 | 1 |

$E.F = C_5H_{10}O_1$

$n = \dfrac{86}{86} = 1$

$MF = C_5H_{10}O_1$
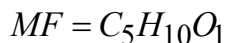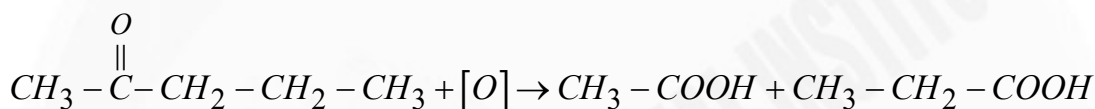
It gives bisulphate indicating carbonyl compound. It does not reduce "T.R". So it does not contain aldehyde it is ketone. It gives Iodo form test so it is a methyl ketone the
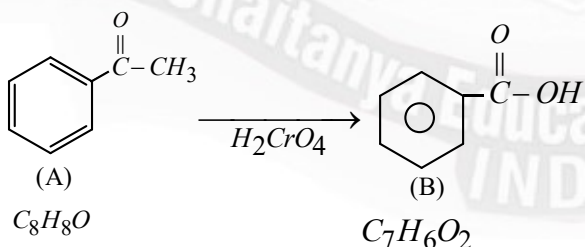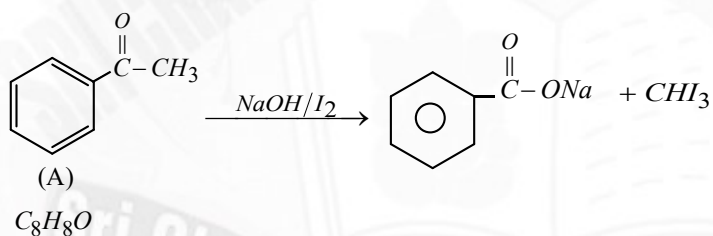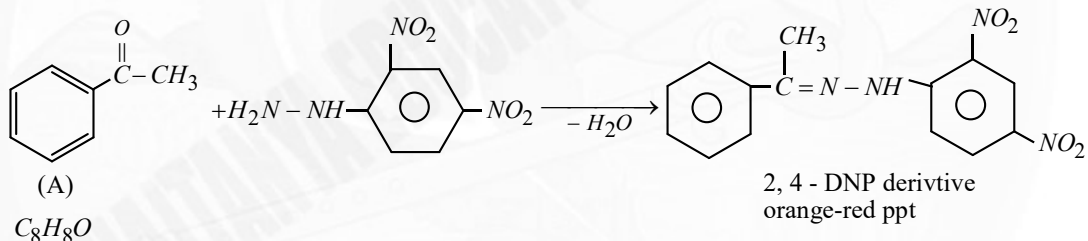
compound may be $CH_3 - \overset{\overset{\displaystyle O}{\|}}{C} - CH_2 - CH_2 - CH_3$ [Pantan-2-one]

$CH_3 - \overset{\overset{\displaystyle O}{\|}}{C} - CH_2 - CH_2 - CH_3 + [O] \rightarrow CH_3 - COOH + CH_3 - CH_2 - COOH$

70. Conceptual

71. $CHBr_3$

72.

73.

$$R - CHO + 2\left[Ag(NH_3)_2\right]^+ + 3OH^- \rightarrow R - COO^- + 2Ag + 2H_2O + 4NH_3$$

$$x = 1 \qquad\qquad\qquad\qquad x = 0$$

Change of O.S $= 1$

74.

$$CH_3 - CHO + CH_3 - CH_2 - CHO \xrightarrow[\Delta]{NaOH} CH_3 - CH = CH - CHO + CH_3 - CH_2 - CH = \underset{\underset{CH_3}{|}}{C} - CHO$$

$$CH_3 - CH = \underset{\underset{CH_3}{|}}{C} - CHO + CH_3 - CH_2 - CH = CH - CHO$$

75.