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 | RPTA-06 | Date: 14-09-2025

Time: 09:00AM to 12:00PM | JEE-ADV-2022_P1 | Max: Marks: 180

KEY SHEET

MATHEMATICS

1	**6**	2	**1**	3	**5**	4	**6**	5	**14**	6	**0.4**
7	**5**	8	**1**	9	**AD**	10	**ABCD**	11	**BC**	12	**BC**
13	**AC**	14	**AC**	15	**A**	16	**C**	17	**B**	18	**B**

PHYSICS

19	**2**	20	**1.25**	21	**1.60**	22	**8.85**	23	**8**	24	**1.25**
25	**4.25**	26	**0.75**	27	**ABC**	28	**ABCD**	29	**AD**	30	**AC**
31	**ABCD**	32	**ABC**	33	**C**	34	**A**	35	**A**	36	**C**

CHEMISTRY

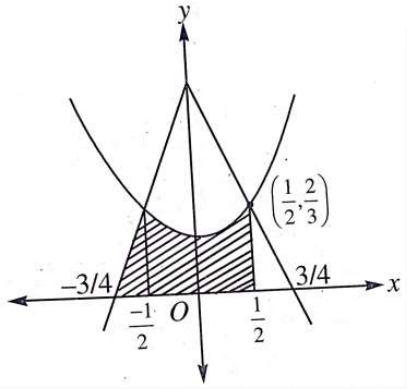
37	**78**	38	**1**	39	**197**	40	**1**	41	**10**	42	**4**
43	**909-911**	44	**6**	45	**CD**	46	**BC**	47	**AC**	48	**BCD**
49	**AC**	50	**BCD**	51	**A**	52	**D**	53	**B**	54	**D**

SOLUTIONS

MATHEMATICS

1. Solving $y = x^2 + \frac{5}{12}$ and $y = 2\left(1 - \frac{4x}{3}\right)$,

we get



$$x^2 + \frac{5}{12} = 2 - \frac{8x}{3} \quad \therefore 12x^2 + 32x - 19 = 0$$

$$\Rightarrow (6x+19)(2x-1) = 0 \Rightarrow x = \frac{1}{2} \Rightarrow y = \frac{2}{3}$$

$\therefore$ Area, $\alpha = 2A_1 + A_2$

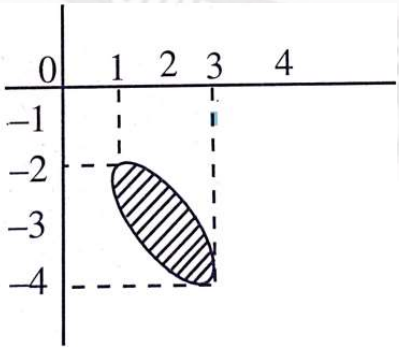
$$= 2\left[\int_0^{1/2}\left(x^2 + \frac{5}{12}\right)dx + \frac{1}{2}\times\frac{1}{4}\times\frac{2}{3}\right]$$

$$= 2\left[\left(\frac{x^3}{3} + \frac{5x}{12}\right)_0^{1/2} + \frac{1}{12}\right]$$

$$= 2\left[\frac{1}{24} + \frac{5}{24} + \frac{1}{12}\right] = \frac{2}{3} \quad \therefore 9\alpha = 6$$

2. Required area $= \int_1^3 \sqrt{(3-x)(x-1)}\,dx = \frac{\pi}{2} = k$

$$\Rightarrow [k] = \left[\frac{\pi}{2}\right] = 1$$



3. $A = \int_0^1 (6 - f(x))\,dx + \int_{-1}^0 [f(x) - (-2)]\,dx$

$$=\int_0^1\left(4-x^3-3x\right)dx+\int_{-1}^0\left(x^3+3x+4\right)dx$$

$$k=\frac{9}{2}[k+1]=5$$

4. $6\int_1^x f(t)dt=3xf(x)-x^3$

$$\Rightarrow f(x)=xf(x)-x^2\Rightarrow y=x\frac{dy}{dx}-x^2$$

$$\Rightarrow\frac{dy}{dx}-\frac{1}{x}y=x$$

$$I.F=e^{\int\frac{-1}{x}dx}=e^{-\ln x}=\frac{1}{x}$$

$$y.\frac{1}{x}=\int x.\frac{1}{x}dx+k=x+k$$

Thus $y(x)=x^2+x, y(2)=2^2+2=6$

5. $y=ae^{3x}+be^{5x}; y^2-8y_1+15y=0;\lambda=15$

6. $\frac{dy}{dx}=(5y+2)(5y-2)\Rightarrow\frac{dy}{25y^2-4}=dx$

Now, $\lim_{x\to\infty}\left|\frac{5f(x)-2}{5f(x)+2}\right|=\lim_{x\to\infty}e^{20x}=0$

$$\therefore\lim_{x\to\infty}f(x)=\frac{2}{5}=0.4$$

7. Put $y=vx$ then $x\frac{dv}{dx}=\frac{v-v^3}{1+v_2}$ separating variables and integrate then v get

$$x^2-y^2=\lambda y$$

8. $x^2y-x^3\frac{dy}{dx}=y^4\cos x$

$$\Rightarrow\frac{1}{y^4}\frac{dy}{dx}-\frac{1}{xy^3}=\frac{-\cos x}{x^3}$$

Put $\frac{-1}{y^3}=t;\frac{dt}{dx}+\frac{3}{x}t=-\frac{3}{x^3}\cos x$

$$I.F=e^{\int\frac{3}{x}dx}=x^3, Sol \text{ is } \frac{x^3}{y^3}=3\sin x+c$$

$$f(x)=\sin x; f(\pi/2)=\sin\frac{\pi}{2}=1$$

9. Put $x+2=u$ and $y=v$ leads to $\left(u^2+uv\right)\frac{dv}{du}=v^2$

$\Rightarrow \left(u^2+uv\right)dv = v^2du$

$\Rightarrow u^2dv = v\left(vdu-udv\right)$

we have $\frac{dv}{v} = \frac{vdu-udv}{u^2}$

$\frac{y}{x+2} + \ln|y| - 1 - \ln 3 = 0, x > 0$

$\frac{(x+3)^2}{x+2} + \ln(x+3)^2 - 1 - \ln 3 = 0$

$\frac{(x+3)^2}{x+2} + \frac{\ln(x+3)^2}{3} > 1$

10. $\left(\frac{dy}{dx}\right)^2 + 2y\cot x\frac{dy}{dx} = y^2$

$\frac{dy}{dx} = -y\cot x \pm y\operatorname{cosec} x$

Case – 1: $\frac{dy}{dx} = y\left[\operatorname{cosec} x - \cot x\right]$

$\frac{dy}{y} = \left(\operatorname{cosec} x - \cot x\right)dx$

Integrating $x = 2\cos^{-1}\sqrt{\frac{c}{2y}}$

Case – 2: $\frac{dy}{dx} = y\left(-\cot x - \operatorname{cosec} x\right)dx$

$x = 2\sin^{-1}\sqrt{\frac{c}{2y}}$

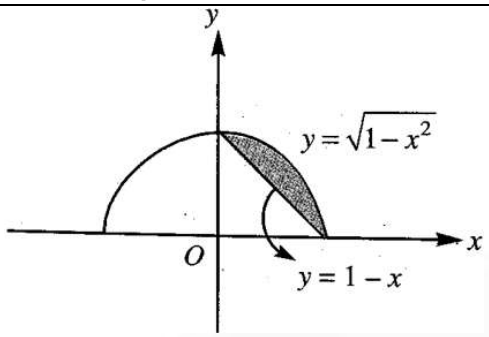
Similarly we get; $y = \frac{c}{1-\cos x}, y = -\frac{c}{1+\cos x}$

11. $f(x) = 1 - 2x + \int_0^x e^{x-t}f(t)dt \ldots (i)$

$\Rightarrow e^{-x}f(x) = e^{-x}(1-2x) + \int_0^x e^{-1}f(t)dt$

$f(x)e^{-2} = \int (2x-3)e^{-2x}dx$

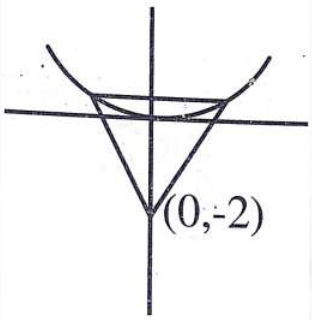
$= (2x-3).\frac{e^{-2x}}{-2} + 2\int \frac{e^{-2x}}{2}dx + \lambda$



$\Rightarrow 1=1+\lambda \quad \therefore \lambda=0 \quad \therefore y=1-x$

12. $A_1=2\int_0^{\sqrt{2}}\left(x^2-2\sqrt{2}x+2\right)dx=\frac{4\sqrt{2}}{3}$

$A_2=4\sqrt{2}-\frac{4\sqrt{2}}{3}=\frac{8\sqrt{2}}{3}$



13. $y=\left(c_1\cos c_2\right)\cos x-\left[c_1\sin c_2-c_5\right]$
$\sin x-\left(c_3e^{c_4}\right)e^{-x}$
3 consonants; Order-3;
$y=l\cos x-m\sin x-ne^{-x}$ Eliminating this constants $y_3+y_2+y_1+y=0$ Degree-1

14. The given differential equation $\frac{dy}{dx}+\alpha y=xe^{\beta x}$
Integrating factor $=e^{\alpha\int dx}=e^{\alpha x}$
$\therefore$ The solution is given by
$ye^{\alpha x}=\int xe^{(\alpha+\beta)x}dx+\lambda$ where λ is a constant
For $\alpha=\beta=1$, we get
$y=(2x-1)\frac{e^x}{4}+\left(e-\frac{e^2}{2}+\frac{e^2}{4}\right)e^{-x}$
$=\left(x-\frac{1}{2}\right)\frac{e^x}{2}+\left(e-\frac{e^2}{4}\right)e^{-x}$, which is option c

15. $a\to r,b\to p,c\to s,d\to q$
16. $a\to q,b\to s,c\to p,d\to r$
17. $a\to q,b\to r,c\to p,d\to s$
18. $a\to s,b\to r,c\to p,d\to q$

PHYSICS

19. 2.00 [CONCEPTUAL]

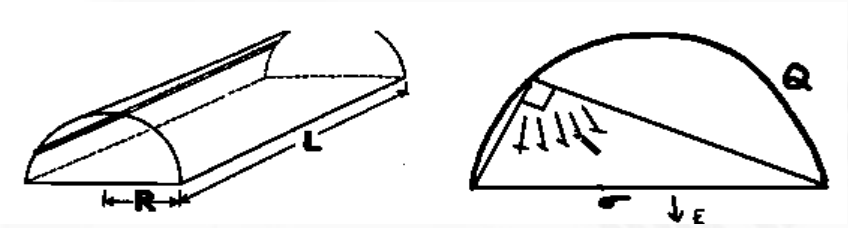
20. $\frac{C}{5}=4\mu F \Rightarrow c=20\mu F$ [According to given data]

$$U_s=\frac{1}{2}C_s\times V_s^2=\frac{1}{2}\times 4\times 10^{-6}\times\left(2\sqrt{5}\right)^2=\frac{1}{2}\times 4\times 10^{-6}\times 20$$

$$U_p=\frac{1}{2}C_p\times V_p^2=\frac{1}{2}\times 5\times 20\times 10^{-6}\times 1^2=\frac{1}{2}\times 5\times 20\times 10^{-6}$$

$$\frac{U_p}{U_s}=\frac{5}{4}=1.25$$

21.



E is due to cylinder's charge on base of plate of charge density σ

So,

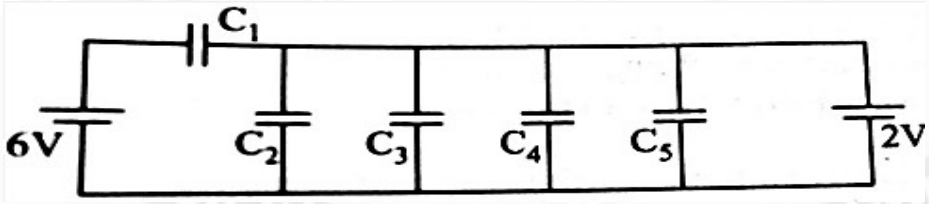
$$F=\int E\,\sigma dA$$

$$=\sigma\int EdA \qquad =\sigma\frac{Q}{4E_o}$$

$$=\frac{q}{L(2R)}\frac{Q}{4E_O}=\frac{Qq}{8E_OLR}$$

22. Capacitance $C=\frac{2\pi\varepsilon_O l}{In(er/r)}=8.85\times 10^{-12}$

23. The circuit can be redrawn as



So, charge stored in C_3 is given as

$Q_3=C_3\times 2V=4\mu F\times 2V=8\mu C$

24. Initial energy stored in capacitor $2\mu F$ $U_i=\frac{1}{2}2(V)^2=V^2=y$

Final voltage after switch 2 is ON $V_f=\frac{c_1v_1}{c_1+c_2}=\frac{2V}{10}=0.2V$

Final energy in both the capacitors

$$U_f=\frac{1}{2}(c_1+c_2)V_f^2=\frac{1}{2}10\left(\frac{2V}{10}\right)^2=0.2V^2$$

Energy dissipated is

$x=0.8V^2$

Therefore 1.25 times of x value is equal to y

25. $\phi_{s'} = 4\phi_s$

$\Rightarrow \frac{q_1+q_2+q_3+Q}{\varepsilon_0} = 4\frac{(q_1+q_2+q_3)}{\varepsilon_0}$

$\Rightarrow Q = 3(q_1+q_2+q_3) = 14.25\mu C$

26. $x^2+y^2+z^2=1$ is equation of a sphere of radius 1 m centred at origin.

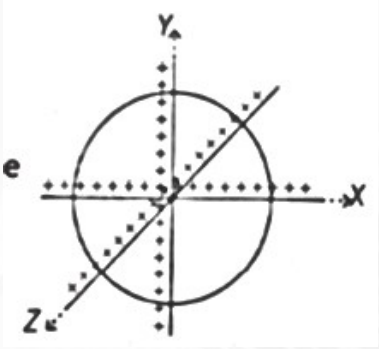
Flux through the complete sphere

$= \frac{q_{enclosed}}{\varepsilon_0}$

$\Rightarrow \phi = \frac{\lambda(2)\times 3}{\varepsilon_0} \Rightarrow \phi = \frac{6\lambda}{\varepsilon_0}$

$x^2+y^2+z^2=1; x>0; y>0; z>0$ is the part of the sphere in the first octant.

Flux $= \frac{1}{8}\left(\frac{6\lambda}{\varepsilon_0}\right) = \frac{3\lambda}{4\varepsilon_0}$



27. ABC
28. ABCD
29. $PQ = (2)R\sin 60^\circ$

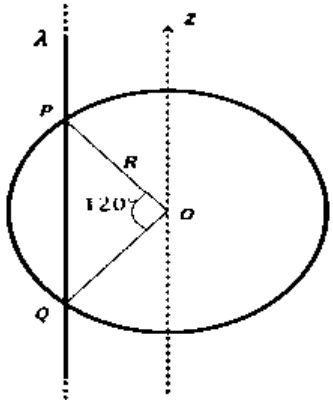
$= (2R)\frac{\sqrt{3}}{2} = \left(\sqrt{3}R\right)$

$q_{enclosed} = \lambda\left(\sqrt{3}R\right)$

We have, $\phi = \frac{q_{enclosed}}{\varepsilon_0}$

$\Rightarrow \quad \phi = \left(\frac{\sqrt{3}\lambda R}{\varepsilon_0}\right)$

Also, electric field is perpendicular to wire, so z-component will be zero.

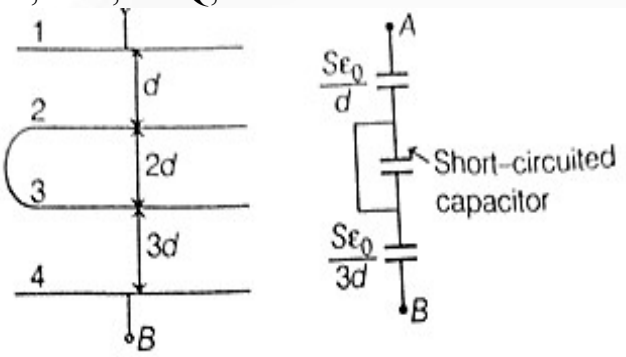


30. $V_{Ccommon} = \frac{C_1 - C_2V_2}{C_1 + C_2} = \frac{15-5}{4} = 2.5V$ SS

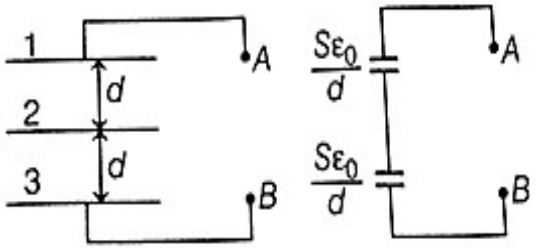
Loss of energy $= \frac{1}{2}\ \frac{C_1C_2}{C_1 + C_2}(V_1 + V_2)^2$

$= 37.5\mu J$

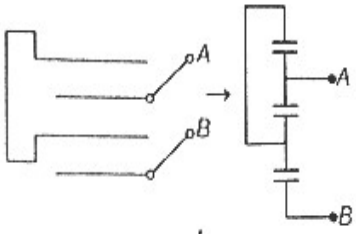
31. (ABCD) Conceptual
32. (ABC) Conceptual
33. I- T, II- Q , III- R, IV- S
34. I- T, II- R , III- S, IV- P
35. I- S, II- R, III- Q, IV- P
36. I- R, II- S, III- Q, IV- P

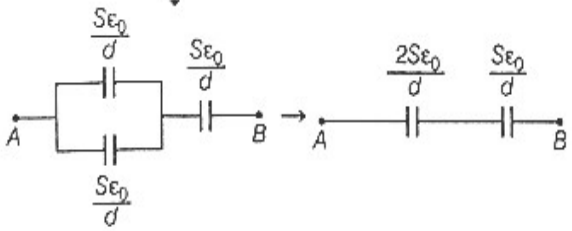


$$\frac{1}{C_{eq}} = \frac{1}{\frac{S\varepsilon_0}{d}} + \frac{1}{\frac{S\varepsilon_0}{3d}} \Rightarrow C_{eq} = \frac{S\varepsilon_0}{4d}$$

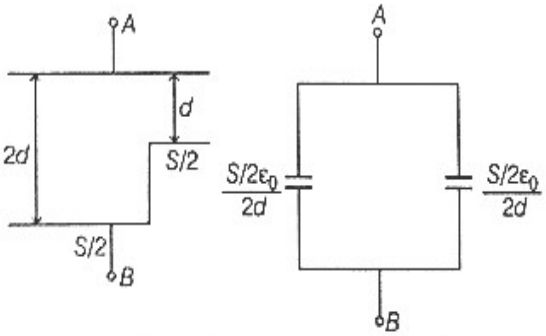


$$\frac{1}{C_{eq}} = \frac{1}{\left(\frac{S\varepsilon_0}{d}\right)} + \frac{1}{\left(\frac{S\varepsilon_0}{d}\right)} \Rightarrow C_{eq} = \frac{S\varepsilon_0}{2d}$$





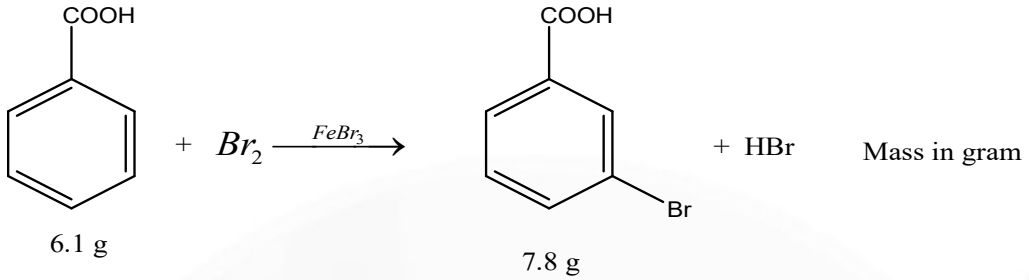
$$\frac{1}{C_{eq}}=\frac{1}{\left(\frac{2S\varepsilon_0}{d}\right)}+\frac{1}{\left(\frac{S\varepsilon_0}{d}\right)} \Rightarrow C_{eq}=\frac{2}{3}\frac{S\varepsilon_0}{d}$$



$$C_{eq}=\frac{S\varepsilon_0}{4d}+\frac{S\varepsilon_0}{2d} \Rightarrow C_{eq}=\frac{3}{4}\frac{S\varepsilon_0}{d}$$

CHEMISTRY

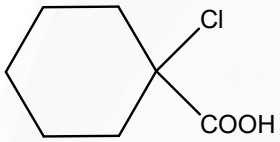
37.



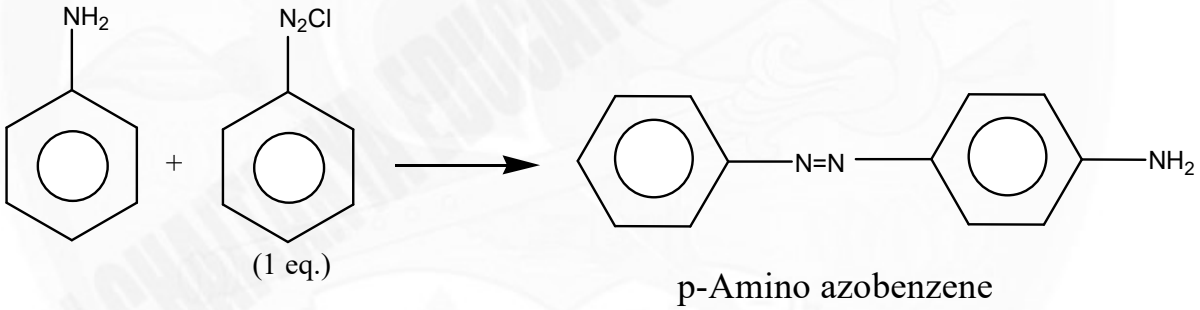
$Moles \frac{6.1}{122} = 0.05$ $\frac{7.8}{201} = 0.039$

Percentage yield $= \frac{0.039}{0.05} \times 100 = 77.61\% \approx 78\%$

38.



39.



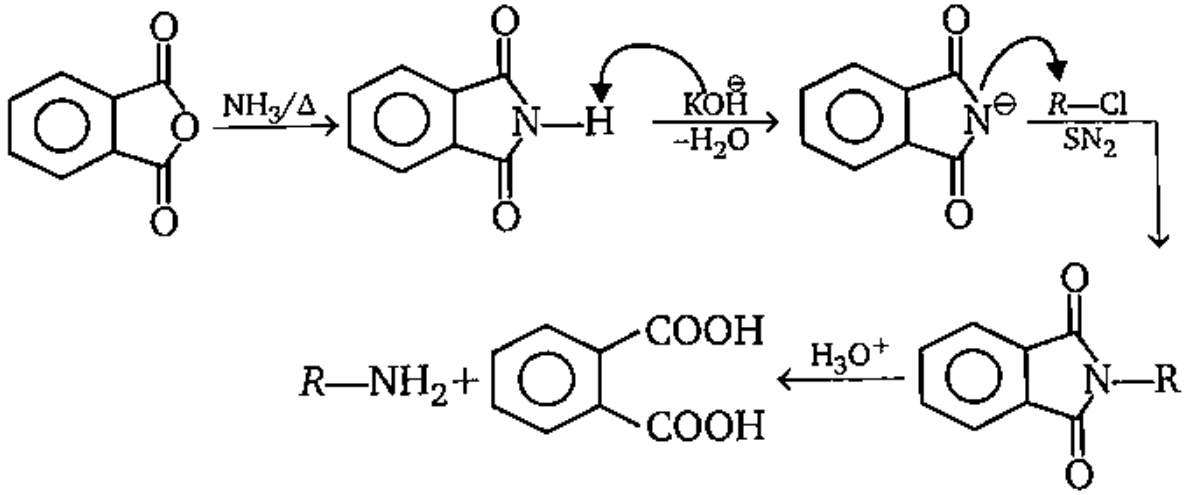
p-Amino azobenzene
(yellow dye)
(Aniline yellow)

Moles of aniline $= \frac{279}{93} = 3$ moles

As benzenediazonium chloride (leq.) is limiting reagent here.
Mole of aniline yellow formed = 1 mole
Amount of aniline yellow formed = 197 g.

40. Conceptual

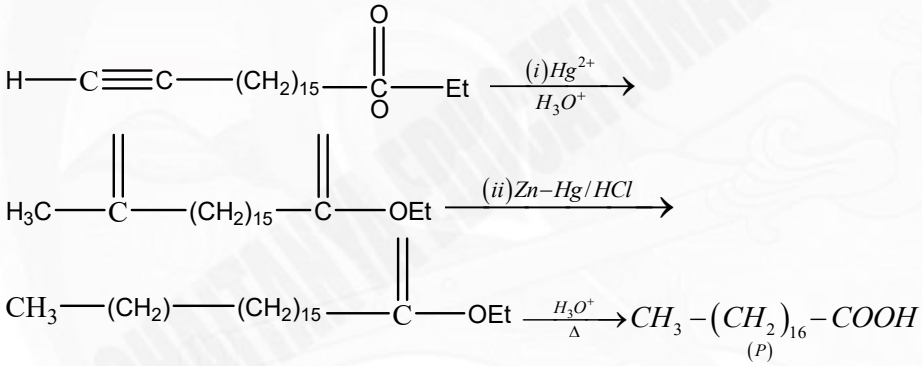
41.

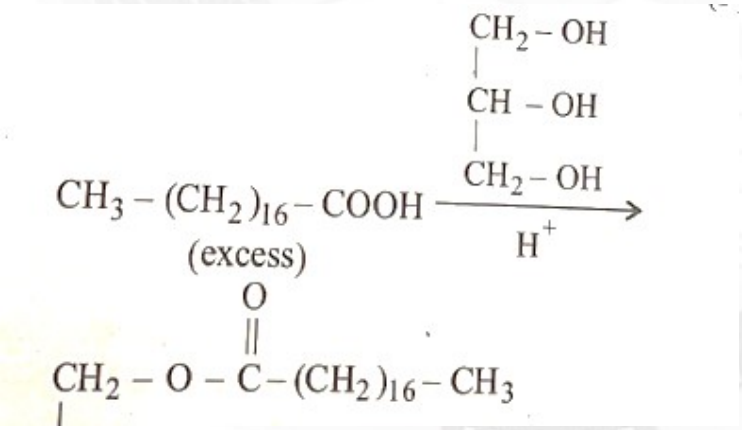


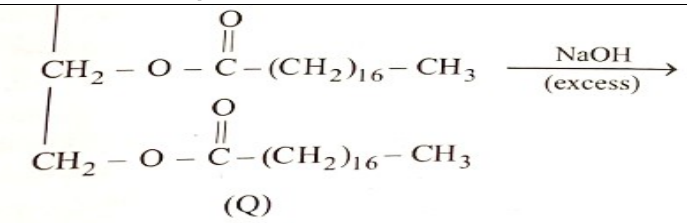
$$y = \frac{6+23}{3} = \frac{29}{3} = 9.6$$

42. All carboxylic acids and phenols are soluble in aqueous NaOH. Thus, four compounds are soluble in aqueous NaOH.

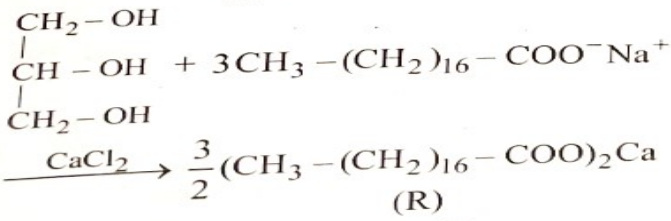
43. Reactions involves are:







(Q)

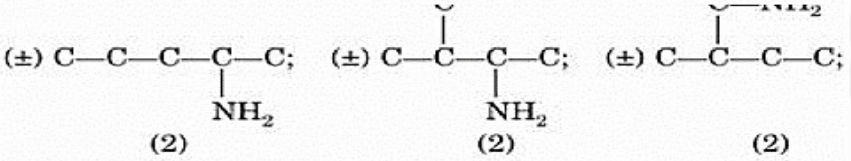


(R)

1 mole of Q will 1.5 mole of R.

So, mass of R produced = 606 g × 1.5 = 909 g

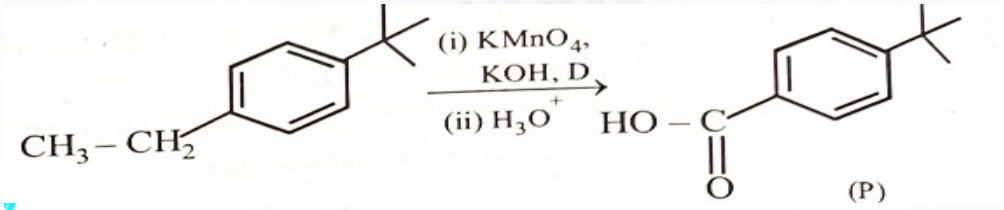
44.



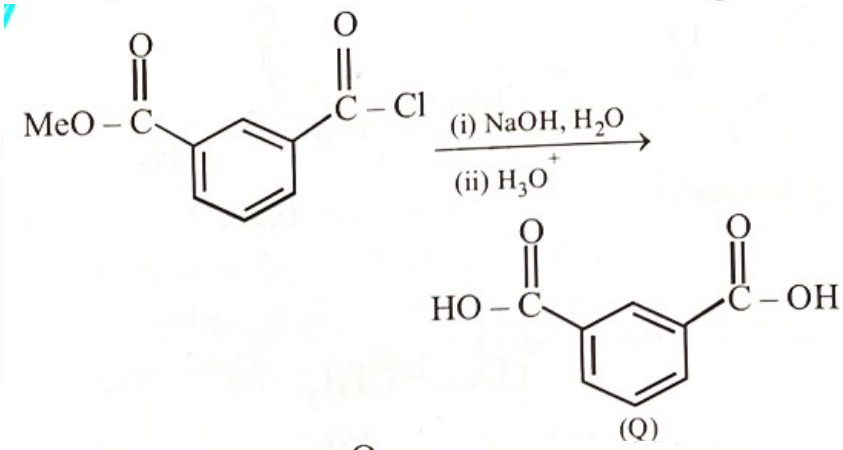
(2) (2) (2)

Total = 6.

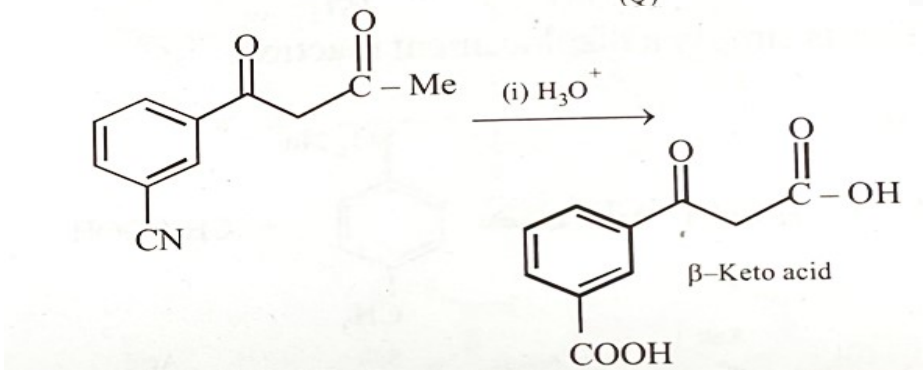
45.



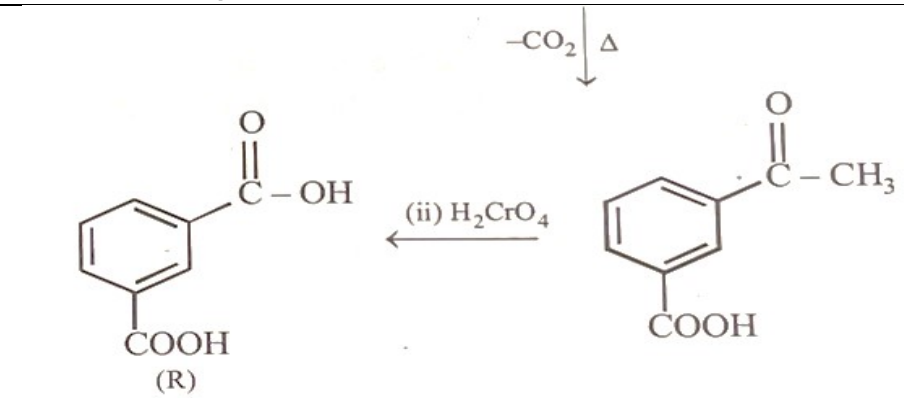
(P)

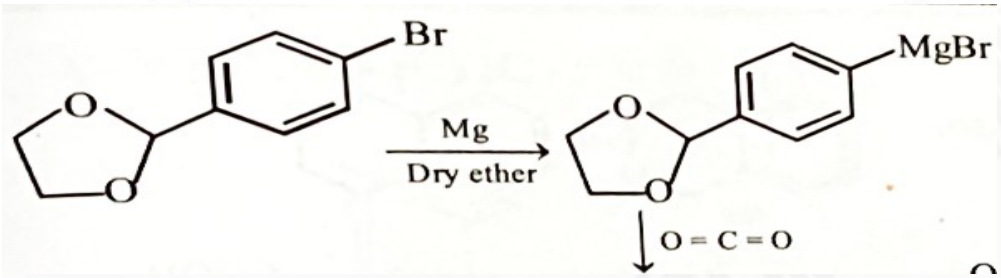


(Q)

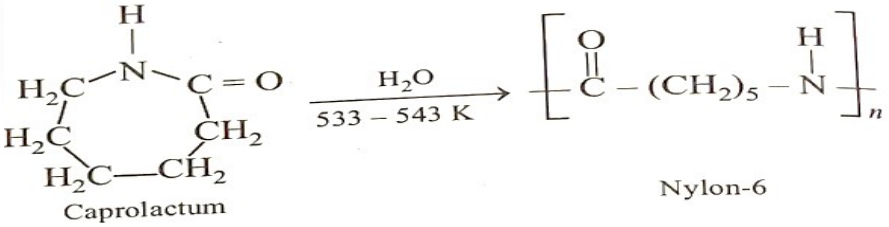


β–Keto acid





46. Conceptual
47. Conceptual
48. Conceptual
49. (a) Nylon-6. It is obtained by heating caprolactam with water at high temperature and have amide linkage.



(b) Cellulose has only $\beta - D - glu\cos e$ units that are joined by glycosidic linkages between $C-1$ of one glucose unit and $C-4$ of the next glucose unit.
(c) Teflon is prepared by heating tetrafluoroethene in presence of a persulphare catalyst at high pressure.

$$\underset{Tetrafluoroethene}{CF_2 = CF_2} \xrightarrow[\text{High pressure}]{Catalyst} \underset{Teflon}{\left[CF_2 - CF_2\right]_n}$$

(d) Natural rubber is a linear polymer of isoprene (2-methyl-1, 3-butadiene) containing c is alkane units. It is also called cis-1, 4-polyisoprene.

50. Condensation polymers are formed by condensation of a diol or diamine with a dicarboxylic acid.

Hence, X may be $-\overset{O}{\overset{\|}{C}}-OR$ or $-\overset{O}{\overset{\|}{C}}-NH_2$ or $-C\equiv N$

$$H_3CO-\overset{O}{\overset{\|}{C}}-(CH_2)_4-\overset{O}{\overset{\|}{C}}-OCH_3 \xrightarrow{H_2/Ni(y)} OHH_2C-(CH_2)_4-CH_2OH$$

$$\xrightarrow{HO-\overset{O}{\overset{\|}{C}}-(CH_2)_4-\overset{O}{\overset{\|}{C}}-OH} \text{Polyester}$$

(b) $$H_2N-\overset{O}{\overset{\|}{C}}-(CH_2)_4-\overset{O}{\overset{\|}{C}}-NH_2 \xrightarrow{H_2/Ni(y)} H_2NCH_2-(CH_2)_4-CH_2NH_2$$

$$\xrightarrow{HO-\overset{O}{\overset{\|}{C}}-(CH_2)_4-\overset{O}{\overset{\|}{C}}-OH} \text{Polyamide}$$

$Br_2/OH^-, \Delta$ (y)
Hofmann bromamide reaction

(c) $H_2N-(CH_2)_4-NH_2$

$$\xrightarrow{HO-\overset{O}{\overset{\|}{C}}-(CH_2)_4-\overset{O}{\overset{\|}{C}}-OH} \text{Polyamide}$$

(d) $$N\equiv C-(CH_2)_4-C\equiv N \xrightarrow{H_2/Ni/\Delta(y)} H_2NCH_2-(CH_2)_4-CH_2NH_2$$

$$\xrightarrow{HO-\overset{O}{\overset{\|}{C}}-(CH_2)_4-\overset{O}{\overset{\|}{C}}-OH} \text{Polyamide}$$

51. Conceptual
52. Conceptual
53. (A): (p) and (s) Cellulose is a natural polymer and has a $C_1-C_4\beta-gly\cos idic$ linkage.
(B): (q) and (r) Nylon-6, 6 is a synthetic polymer of hexamethylenediamine and adipic acid and amide linkages.
(C): (p) and (r) Proteins are natural polymers of α amino acids joined by amide linkages (peptide bonds).
(D): (s) Sucrose is a disaccharide of $\alpha-D$ glucose and $\beta-D-fructose$ and has an $\alpha,\beta-gly\cos idic$ linkage.
54. Conceptual