TARGET IIT-JEE

HINT & SOLUTIONS

ANSWER KEY WITH SOLUTION

PAPER-I CLASS XII & XIII (DATE 28-12-09)

MATHEMATICS

1.	D	**2.**	C	**3.**	B	**4.**	A	**5.**	B	**6.**	D	**7.**	A
8.	D	**9.**	B,D	**10.**	A,B,C	**11.**	A,C	**12.**	A,B	**13.**	B	**14.**	B
15.	A	**16.**	D	**17.**	B	**18.**	B						

19. (A) → (Q), (B) → (R), (C) → (P), (D) → (S)

20. (A) → (P), (B) → (P), (C) → (S), (D) → (Q)

PHYSICS

21.	C	**22.**	A	**23.**	D	**24.**	A	**25.**	C	**26.**	D	**27.**	C
28.	A	**29.**	A, C, D	**30.**	A,B,D	**31.**	A,B,C,D	**32.**	A,B,C	**33.**		**34.**	
35.		**36.**	C	**37.**	D	**38.**	C						

39. (A) → Q,R,S ; (B) → P,R ; (C) → Q,R,S; (D) → P,R

40. (A) → R ; (B) → P,R,S ; (C) → Q,R,S; (D) → R

CHEMISTRY

41.	B	**42.**	A	**43.**	D	**44.**	B	**45.**	C	**46.**	D	**47.**	A
48.	C	**49.**	B, D	**50.**	A, C	**51.**	A, C, D	**52.**	A, B	**53.**	D	**54.**	C
55.	C	**56.**	A	**57.**	C	**58.**	C						

59. (A)–Q, R (B)–P,R (C)–S, (D)–P

60. (A)–P (B)–P, Q, R (C)–P, Q (D)–P, Q, R, S

MATHEMATICS

1. D

$[\vec{a}\,\vec{b}\,\vec{c}] = \pm\frac{1}{4}$

$\vec{d} = \lambda(\vec{a}\times\vec{b}) + \mu(\vec{b}\times\vec{c}) + \upsilon(\vec{c}-\vec{a})$

Then $\vec{d}.\vec{a} = \mu[\vec{a}\,\vec{b}\,\vec{c}] = \frac{1}{4}\mu$

$\vec{d}.\vec{b} = \upsilon[\vec{a}\,\vec{b}\,\vec{c}] = \frac{1}{4}\upsilon$

$\vec{d}.\vec{c} = \lambda[\vec{a}\,\vec{b}\,\vec{c}] = \frac{1}{4}\lambda$

$\therefore \quad \lambda+\mu+\upsilon = 4\vec{d}\,.\,[\vec{a}+\vec{b}+\vec{c}]$

2. C

Let a point $(5\cos\theta, 4\sin\theta)$
then equation of normal at this point

$4y\cos\theta - 5x\sin\theta + 9\sin\theta\cos\theta = 0$

if this normal touches the circle $x^2+y^2=r^2$
then perpendicular distance from centre of the circle $= r$

$$\left|\frac{9\sin\theta\cos\theta}{\sqrt{16\cos^2\theta+25\sin^2\theta}}\right| = r$$

the value of r will be minimum at $\cos2\theta = \frac{1}{9}$

then $r_{min} = 1$

3. B

$$I_2 = \int_{1/e}^{\cot x}\frac{dt}{t(1+t^2)} = -\int_{e}^{\tan tx}\frac{z\,dz}{1+z^2}$$

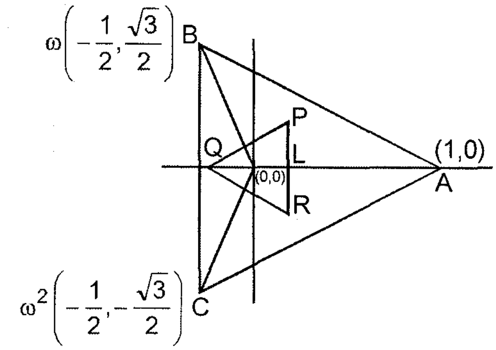
by $t = \frac{1}{z}$

$$\therefore I = \int_{1/e}^{\tan x}\frac{t}{1+t^2}dt + \int_{\tan x}^{e}\frac{t}{1+t^2}dt = \frac{1}{2}\int_{1/e}^{e}\frac{2t\,dt}{1+t^2} = 1$$

4. A

$\therefore$ centroid $P\left(\frac{1}{6}, \frac{1}{2\sqrt3}\right)$

$Q\left(-\frac{1}{3}, 0\right) \qquad R\left(\frac{1}{6}, -\frac{1}{2\sqrt3}\right)$



$\therefore \quad$ Area of $\Delta PQR = \frac{1}{2}PR \times QL$

$= \frac{1}{2}\times\frac{1}{\sqrt3}\times\frac{1}{2} = \frac{1}{4\sqrt3} = \frac{1}{\sqrt{48}}$

5. B

Since $\frac{e}{2}$ and $\frac{e'}{2}$ are eccentricities of a hyperbola and its conjugate

$\therefore \quad \frac{4}{e^2}+\frac{4}{e'^2} = 1$ i.e., $4 = \frac{e^2e'^2}{e'^2+e^2}$

line passing through the points (e, 0) and (0, e′)

$e'x + ey - ee' = 0$

it is tangent to the circle $x^2+y^2=r^2$

$\therefore \quad \frac{ee'}{\sqrt{e^2+e'^2}} = r$

$\therefore \quad r^2 = \frac{e^2e'^2}{e^2+e'^2} = 4$

$\therefore \quad r = 2$

6. D

$f(x) = \log_{\sqrt2}\left(2-\log_2\left(16\sin^2x+1\right)\right)$

$1 \le 16\sin^2x + 1 \le 17$

$\therefore \quad 0 \le \log_2(16\sin^2x+1) \le \log_2 17$

$\therefore \quad 2-\log_2 17 \le 2-\log_2(16\sin^2x+1) \le 2$

Now consider

$0 < 2-\log_2(16\sin^2x+1) \le 2$

$\therefore \quad -\infty < \log_{\sqrt2}[2-\log_2(16\sin^2x+1)] \le \log_{\sqrt2} 2 = 2$

$\therefore$ the range is $(-\infty, 2]$

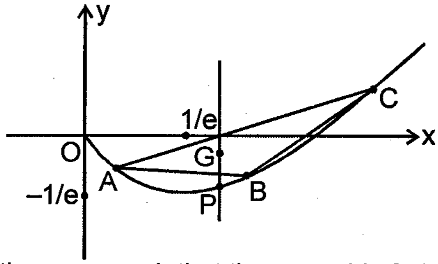
7. A

Let $f(x) = x\ln x$, $f'(x) = 1+\ln x$ and $f''(x) = \frac{1}{x}$

Also $f(0^+) = 0$, $f\left(\frac{1}{e}\right) = -\frac{1}{e}$

(as $f'(x) = 0$ at $x = 1/e$)

The adjoining graph is the grpah of y = x ln x. Consider three points A(a, a ln a), B(b, b ln b) and C(c, c ln c)



on the curve such that the centroid of triangle ABC is

$G\left(\frac{a+b+c}{3}, \frac{a\ln a+b\ln b+c\ln c}{3}\right)$, which always lies above

the point $P\left(\frac{a+b+c}{3}, \frac{a+b+c}{3}\ln\left(\frac{a+b+c}{3}\right)\right)$

Comparing their y co-ordinates we get $a^a b^b c^c \geq \left(\frac{a+b+c}{3}\right)^{a+b+c}$ and equality holds iff a = b = c

8. D

2ABC is not defined

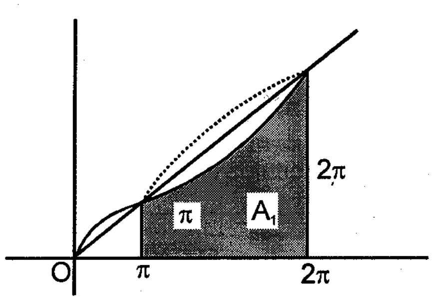
∴ there is no solution

9. B,D

f(x) = x + sin x

$$A_1 = \int_{\pi}^{2\pi}(x+\sin x)dx$$

$$= \left(\frac{x^2}{2} - \cos x\right)\Bigg|_{\pi}^{2\pi} = 2\pi^2 - \frac{\pi^2}{2} - \cos 2\pi + \cos\pi$$



$$= \frac{3\pi^2}{2} - 2 = 3\pi^2 - A_1$$

$$A_2 = A_1 + 2\left(\frac{3\pi^2}{2} - A_1\right) = \frac{3\pi^2}{2} + 2$$

$$A_3 = \frac{3\pi^2}{2} - \left(\frac{3\pi^2 - 4}{2}\right) = 2$$

$A_4 = 2$

clearly $A_3 + A_4 < A_1$

10. A,B,C

(A) $f(x) = \frac{1}{1+2^{1/x}}$ at x = 0

$$RHL = \lim_{x\to 0^+} \frac{1}{1+2^{1/x}} = 0$$

$$LHL = \lim_{x\to 0^-} \frac{1}{1+2^{1/x}} = \lim_{h\to 0} \frac{1}{1+2^{-1/h}} = \lim_{h\to 0} \frac{1}{1+\frac{1}{\infty}} = 1$$

Here RHL = 0 and LHL = 1, so at x = 0 : f(x) has non-removable discontinuity.

(B) $f(x) = \tan^{-1}\left(\frac{1}{x}\right)$ at n = 0

$$RHL = \lim_{x\to 0^+} \tan^{-1}\left(\frac{1}{x}\right) = \lim_{h\to 0} \tan^{-1}\left(\frac{1}{h}\right) = \frac{\pi}{2}$$

$$LHL = \lim_{x\to 0^+} \tan^{-1}\left(\frac{1}{x}\right) = \lim_{h\to 0} \tan^{-1}\left(-\frac{1}{h}\right) = -\frac{\pi}{2}$$

non removable

(C) $f(x) = \frac{e^{1/x}-1}{e^{1/x}+1}$ at x = 0

$$LHL = \lim_{x\to 0^-} \frac{e^{1/x}-1}{e^{1/x}+1} \quad RHL = \lim_{x\to 0^+} \frac{e^{1/x}-1}{e^{1/x}+1}$$

$$= \lim_{h\to 0} \frac{e^{-1/h}-1}{e^{-1/h}+1} = \lim_{h\to 0} \frac{e^{1/h}-1}{e^{1/h}+1} = -1$$

= 1 Non removable.

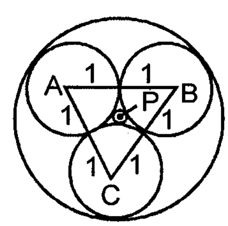
(D) $f(x) = \frac{1}{\ell n|x|}$ at x = 0

$$\lim_{x\to 0} \frac{1}{\ell n|x|} = 0$$ Removable discontinuity

11. A,C

$AP = 1 . \sec 30° = \frac{2}{\sqrt{3}}$

⇒ radius of the small circle



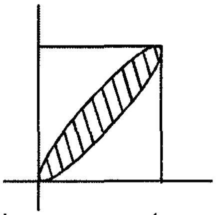
$$x = \frac{2}{\sqrt{3}} - 1 = \frac{2-\sqrt{3}}{\sqrt{3}}$$

radius of the outer circle = x + 2 = $\frac{2+\sqrt{3}}{3}$

12. A,B

Area of the shaded region

$$= \int_0^1 \left(\sqrt{x} - x^2\right)dx = \left[\frac{2}{3}x^{3/2} - \frac{x^3}{3}\right]_0^1 = \frac{2}{3} - \frac{1}{3} = \frac{1}{3}$$



Area of the square = 1

$\therefore$ Probability = 1/3

$A \cup B$ = whole of the region enclosed in $0 \le x \le 1,\ 0 \le y \le 1$

$\therefore$ A and B are exhaustive events.

13. B

$AP^2 + BP^2 + CP^2 = |z - z_1|^2 + |z - z_1|^2 + |z - z_3|^2$

$= 3|z|^2 + |z_1|^2 + |z_2|^2 + |z_3|^2 - z(\bar{z}_1 + \bar{z}_2 + \bar{z}_3) - \bar{z}(z_1 + z_2 + z_3)$

$\therefore$ ΔABC is equilateral

$\therefore$ $|z_1| = |z_2| = |z_3| = 2$

$$\therefore \frac{z_1 + z_2 + z_3}{3} = \frac{\bar{z}_1 + \bar{z}_2 + \bar{z}_3}{3} = 0$$

also $|z| = 1$ ($\therefore$ circumradius is 2)

$\therefore$ $AP^2 + BP^2 + CP^2 = 3 \times 1 + 12 = 15$

14. B

$$\frac{1}{z_d} + \frac{1}{z_f} = \frac{2}{z_2}$$

$$\Rightarrow \frac{1}{z_d} + \frac{1}{z_e} = \frac{2}{z_3}$$

$$\frac{1}{z_e} + \frac{1}{z_f} = \frac{2}{z_1}$$

$$\Rightarrow \frac{1}{z_d} + \frac{1}{z_e} + \frac{1}{z_f} = \frac{1}{z_1} + \frac{1}{z_2} + \frac{1}{z_3} = -\frac{i}{\sqrt{2}}$$

$$\therefore \operatorname{Re}\left(\frac{1}{z_d} + \frac{1}{z_e} + \frac{1}{z_f}\right) = 0$$

15. A

$$Z_Q = \frac{-z_2 z_3}{z_1} = -\sqrt{2}(1+i)$$

16. **16.(D), 17.(B), 18.(B)**

$9 + 8 + 6 + 5 + 4 = 32$

= set P (A, B, C, D, E, F) = (2, 3, 4, 5, 6, 8, 9)

$n(S) = {}^7c_5\ 5!$

Total numbers divisible by $5 = {}^6C_4\ 4!$

Total numbrs divisible by $3 = {}^3C_1\ 5! + {}^3C_2\ 5! = 6!$

For total number of numbers divisible by 4, the digits in unit and tens palace can be filled in $(3 \times 2 + 2 \times 2 + 1 + 1)$ ways

So, total number of numbers thus formed $= 60 \times 12 = 720$

19. (A) $\to$ (Q), (B) $\to$ (R), (C) $\to$ (P), (D) $\to$ (S)

(A) when $x \ge 1$, then $t \le x$

$$\therefore\ I = \int_0^1 (x - t)\cos \pi t\, dt$$

$$= (x - t)\left.\frac{\sin \pi t}{\pi}\right|_0^1 - \int_0^1 (-1)\frac{\sin \pi t}{\pi}dt$$

$$= \frac{1}{\pi}\int_0^1 \sin \pi t\, dt = \frac{1}{\pi}\left(\frac{-\cos \pi t}{\pi}\right)_0^1$$

$$= \frac{1}{\pi^2} + \frac{1}{\pi^2} = \frac{2}{\pi^2}$$

(B) $\displaystyle \underset{n\to\infty}{\text{Limit}} \frac{\sum r(n+1-r)}{\sum r^2}$

$$\underset{n\to\infty}{\text{Limit}} \left(\frac{3(n+1)}{2n+1} - 1\right)$$

$$\underset{n\to\infty}{\text{Limit}} \left(\frac{3}{2} - 1\right) = \frac{1}{2}$$

(C) $x^2 . y^3 = (x + y)^n$

diff. both sides w.r.t x

$$2x\,y^3 + 3x^2y^2\frac{dy}{dx} = n(x + y)^{n-1}\left(1 + \frac{dy}{dx}\right)$$

$$\text{i.e. } \frac{dy}{dx} = \frac{2xy^3 - n(x+y)^{n-1}}{n(x+y)^{n-1} - 3x^2y^2} = \frac{y}{x} \text{ (given)}$$

$\therefore$ $2x^2y^3 - nx(x + y)^{n-1} = ny(x + y)^{n-1} - 3x^2y^3$

$5x^2y^3 = n(x + y)^n = n\,x^2y^3$

$\therefore$ $n = 5$

(D) $(z + \alpha\beta)^3 = \alpha^3$

$(z + \alpha\beta)^3 = \alpha^3(\cos 2\pi + i \sin 2\pi)$

$z = \alpha(\cos 2\pi + i \sin 2\pi)^{1/3} - \alpha\beta$

$$z = \pi\left(\cos\frac{2k\pi}{3} + i\sin\frac{2k\pi}{3}\right) - \alpha\beta$$

Here k = 0, 1, 2

$$z_1 = \alpha - \alpha\beta, \qquad z_2 = \alpha\left(-\frac{1}{2} + i\frac{\sqrt{3}}{2}\right) - \alpha\beta$$

$$z_3 = \alpha\left(-\frac{1}{2} - i\frac{\sqrt{3}}{2}\right) - \alpha\beta \ \therefore\ z_1 - z_2 = \alpha\left(\frac{3}{2} - i\frac{\sqrt{3}}{2}\right)$$

$$|z_1 - z_2| = \alpha\sqrt{\frac{9}{4} + \frac{3}{4}} = \sqrt{3}\,|\alpha|$$

20. (A) → (P), (B) → (P), (C) → (S), (D) → (Q)

(A) $I = \int_{-10}^{10} x.e^{x\left[x+\frac{1}{2}\right]}dx = \int_{-10}^{10}(-x)e^{-x\left(\left[-x+\frac{1}{2}\right]\right)}dx$

Now $\left[-x+\frac{1}{2}\right] = \left[-\left(x+\frac{1}{2}\right)+1\right] = -\left[x+\frac{1}{2}\right]$ if x ≠ odd multiple of $\frac{1}{2}$,

$\Rightarrow \ I = \int_{-10}^{10} -x.e^{x\left[x+\frac{1}{2}\right]}dx = -1 \Rightarrow I = 0$

(B) $y = mx - 2am - am^3$ is normal to parabola it touches $x^2 - y^2 = a^2$ if $e^2 = a^2m^2 - a^2$

$\Rightarrow (-2am - am^3)^2 = a^2m^2 - a^2$

$\Rightarrow m^6 + 4m^4 + 3m^2 + 1 = 0$ which has no real solution.

(C) Equation of circle

$(x - at_1^2)(x - at_2^2) + (y - 2at_1)(y - at_2) = 0$

$\Rightarrow x^2 - xa\,(t_1^2 + t_2^2) - 2ay\,(t_1 + t_2) - 3a^2 = 0$

Let it intersects the parabola at $(at^2, 2at)$

$(at^2)^2 - a^2t^2(t_1^2 + t_2^2) - 4a^2t(t_1 + t_2) - 3a^2 = 0$

It is four degree equation in 't' whose four roots are t_1, t_2, t and T

$t_1t_2\,t\,T = -3$

$tT = 3$ (because $t_1t_2 = -1$)

(D) $f'(x) > 0 \Rightarrow f(x)$ is increasing

$f(-\infty) = -\infty$ and $f(\infty) = \infty$

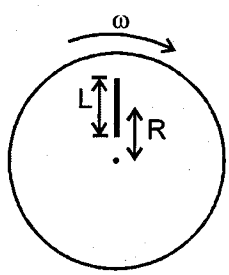
$\Rightarrow f(x) = 0$ has exactly one real root.

PHYSICS

21. C

$$\frac{d^2a}{dt^2} = \frac{1}{m}\frac{d^2F}{dt^2} = \frac{1}{m}\left(2 - \frac{kd^2x}{dt^2}\right) = -\frac{k}{m}\left[a - \frac{2}{k}\right] = -\omega^2(a - a_0)$$

22. A



Moment of inertia of the rod w.r.t the axis thorugh centre of the disc is (by parallel axis theorem).

$I = \frac{mL^2}{12} + mR^2$ & K.E. of rod w.r.t disc = $\frac{1}{2}I\omega^2$

$$= \frac{1}{2}m\omega^2\left[R^2 + \frac{L^2}{12}\right]$$

23. D

$\varepsilon = \frac{d\phi}{dt}$

$I = \frac{\varepsilon}{R} = \left(\frac{1}{R}\right)\left(\frac{d\phi}{dt}\right)$

$\Rightarrow \frac{dQ}{dt} = \left(\frac{1}{R}\right)\left(\frac{d\phi}{dt}\right)$

$\Rightarrow \ dQ = \left(\frac{1}{R}\right)d\phi$

or, $\Delta Q = \frac{1}{R}\Delta\phi$ [No role of velocity]

24. A

$P = \rho\left(\frac{Gm}{r^2}\right)h$ and $PM = \rho RT \Rightarrow \ T = \frac{mGMh}{Rr^2}$

25. C

26. D

For decay (i)

$Q = [230.033927 - 229.033496 - 1.008665] \times 931.5$
$= -7.7$ MeV

For decay (ii)

$Q = [230.033927 - 299.032089 - 1.007825] \times 931.5$
$= -5.6$ MeV

∴ Q is negative for both the decay, so none of the decays are allowed.

27. C

$TV^{\gamma-1} = C$ (C is a constant)

$\Rightarrow \ \frac{dT}{dV} = (1-\gamma)CV^{-\gamma}$ (–ve)

$\frac{d^2T}{dV^2} = (1-\gamma)(-\gamma)CV^{\gamma-1}$ (+ve)

28. A

Current leads emf so circuit is R – C.

$\tan\phi = x_c/R$, $\phi = 45°$, $R = 1000\ \Omega$, $\omega = 100$

C = ?

Since $\tan 45° = \frac{1}{\omega CR}$ so $C = 10\ \mu F$

29. **(A), (C), (D)**

$\vec{r} = (\hat{i} + 2\hat{j}) A \cos \omega t$

This is combination of S.H.M. along x and y axis having equations

$x = A \cos \omega t$ & $y = 2 A \cos \omega t$

This is equation of S.H.M. along a straight line

$$y = 2x$$

$\vec{r} = (\hat{i} + 2\hat{j}) A \cos \omega t$

30. **A,B,D**

Increasing the accelerating voltage fmeans increasing speed of the electron, thereby decreasing time spent between the plates. It will reduce X

Increasing deflecting voltage means increasing electric field between the plates, making acceleration of electron greater.

Increasing distance once again will change electric field between the plates.

31. **A,B,C,D**

$V_0 = I_0 R = 10 \times 10 = 100$ volts (since, $I_0 = 10$ amp from figure)

Also $I = I_0 e^{-t/RC}$

Taking log ; $\log\left(\frac{I_0}{I}\right) = \frac{t}{RC} \Rightarrow C = \frac{t}{R\log(I_0/I)}$

At ; t = 2 sec, I = 2/5 A

$$C = \frac{2}{10\log\left(\frac{10}{2.5}\right)}$$

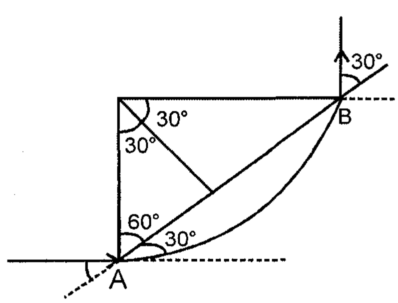
$$C = \frac{2}{10\log 4} = \frac{2}{10 \times 2\log 2} = \frac{1}{10\ell n2}$$

$C = \frac{1}{10\ell n2}$. Heat produced

$= \frac{1}{2}CV^2 = \frac{1}{2}\left(\frac{1}{10\ell n2}\right)(100^2) = \frac{500}{\ell n2}$ joules.

Hence (C) is correct

32. **A,B,C**



$$\text{Arc AB} = \frac{\pi}{3}r = \frac{\pi mV}{3qB}$$

$$\text{Time 't'} = \left(\frac{I}{2\pi}\right)\left(\frac{\pi}{3}\right) = \frac{T}{6} = \frac{\pi m}{3qB}$$

Sol.

33. Ignition point of air gasoline mixture is b

34. $r = \frac{V_s}{V_b}$

35. $T_b = T_s\left(\frac{V_a}{V_b}\right)^{\gamma-1} = 614.3K$

Sol.

36. (C) Equivalent resistance

$$R = \frac{V}{I} = \frac{16V}{2\times10^{-6}A} = 8 \times 10^6\ \Omega$$

37. (D) $P = \frac{nhC}{\lambda}$

where n = no. of photons incident per unit time

Also, $I = ne$

$$\Rightarrow P = \frac{IhC}{e\lambda} \Rightarrow \lambda = \frac{(2\times10^{-6})(6.6\times10^{-34})(3\times10^{8})}{(4\times10^{-6})(1.6\times10^{-19})}$$

$$= \frac{9.9}{1.6}\times10^{-7}m = \frac{9900}{1.6}Å = 6187\ Å$$

Which came in the range of organge light.

38. (C) The range of wavelength for red light is beyound the wavelength of incident light.

39. **(A) → Q,R,S ; (B) → P,R ; (C) → Q,R,S; (D) → P,R**

40. **(A) → R ; (B) → P,R,S ; (C) → Q,R,S; (D) → R**

41. B

$$x = 2 \times \frac{1}{N_A} + 1.78 \times 10^{-22} + \frac{12}{N_A} \times 2 + 1.25 \times 10^{-22}$$

$$= \frac{1}{N_A}[2 + 107.2 + 24 + 75.28]$$

$$= \frac{208}{N_A} \text{ gm} = 208 \text{ amu}$$

42. A

$N_2 + 3H_2 \rightleftharpoons 2NH_3$

Due to addition of inert gas at constant pressure equilibrium will proceed in the direction in which more numbers of gaseous moles are formed.

43. D

$Fe \rightarrow Fe^{2+} + 2e^-$ $\quad E^o = 0.44$ V

$\Delta G^o_1 = -2 \times F \times 0.44$

$Fe^{3+} + 3e^- \rightarrow Fe$ $\quad E^o = -0.036$ V

$\Delta G^o_2 = 3 \times F \times 0.036$

$Fe^{3+} + e^- \rightarrow Fe^{2+}$

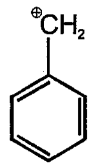
$\Delta G^o_3 = -x \times F \times E^o$

$-2 \times F \times 0.44 + 3 \times F \times 0.036 = -x \times F \times E^o$

$E^o = 0.771$ V

44. B

All resonating structures are aromatic.



More resonating structures but non aromatic.

$CH_2 = CH - \overset{\oplus}{C}H_2 \leftrightarrow \overset{\oplus}{C}H_2 - CH = CH_2$

only two resonating structures

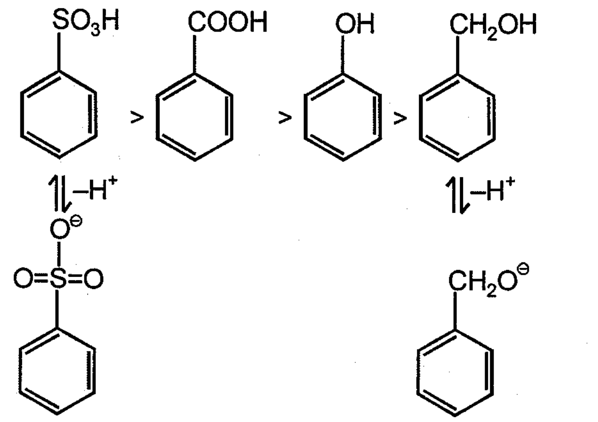
$CH_2 = \overset{\oplus}{C}H$ +ve on more EN C, less stable

45. C

Corner	Faces	Edges	centre
4A	2B	4C	C
$\times \frac{1}{8}$	$\times \frac{1}{2}$	$\times \frac{1}{4}$	$\times 1$

$\equiv AB_2C_4$

46. D



More resonating structures more stable inter mediate So, Acid is more acidic

No Resonance less stable inter mediate less acidic

47. A

48. C

49. B, D

50. A, C

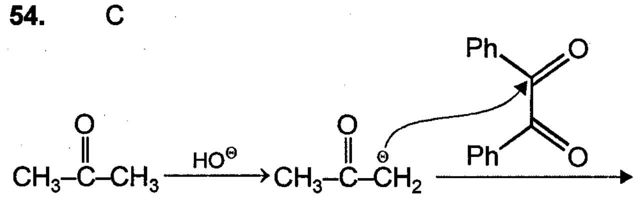
51. A, C, D

52. A, B

A and B are inner orbital complexes and d^2sp^3 hybridisation.

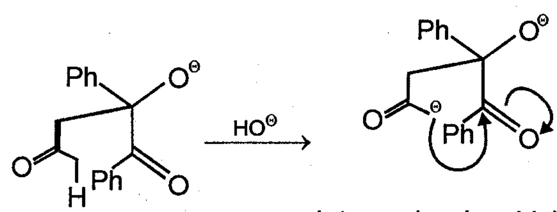
53. D

54. C

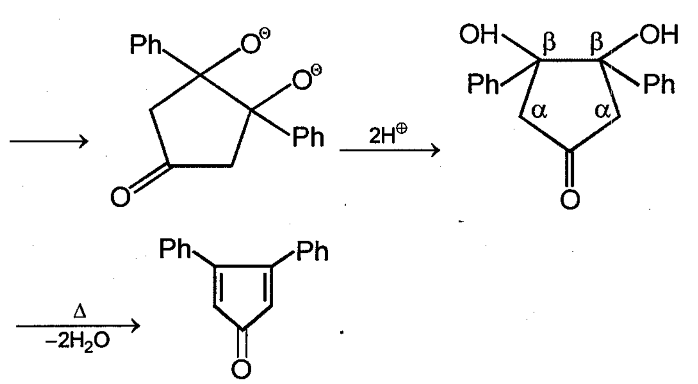


6α − H

Inter molecular aldol reaction



Intra molecular aldol reaction



55. C

56. A

57. C

58. C

59. (A)–Q, R (B)–P,R (C)–S, (D)–P

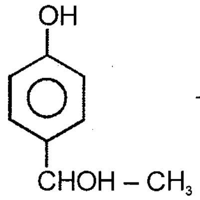
(A) $CH_3–CH_2–CHO \rightarrow$ Tollen test and aldol condensation.

(B) $CH_3–\underset{\underset{O}{\|}}{C}–CH_2–CHO \rightarrow$

Haloform test aldol condensation.

(C) $CH_3–COOH \rightarrow$

Haloform test, Tollen test Aldol condensation

(D) 

$\rightarrow$ Haloform test.

60. (A)–P (B)–P, Q, R (C)–P, Q (D)–P, Q, R, S