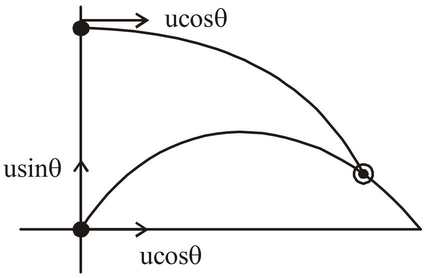
RITS-29
JEE MAINS-2019
ANSWER KEY
Code: 119522

PHYSICS		CHEMISTRY		MATHEMATICS	
1	4	1	1	1	2
2	2	2	1	2	4
3	3	3	3	3	3
4	1	4	2	4	2
5	3	5	2	5	2
6	4	6	3	6	4
7	1	7	1	7	3
8	4	8	4	8	2
9	4	9	4	9	1
10	2	10	2	10	4
11	4	11	2	11	3
12	4	12	3	12	3
13	4	13	4	13	2
14	2	14	1	14	3
15	3	15	4	15	3
16	3	16	3	16	4
17	1	17	3	17	4
18	4	18	4	18	2
19	2	19	2	19	2
20	1	20	2	20	2
21	4	21	2	21	2
22	4	22	1	22	4
23	3	23	2	23	3
24	1	24	4	24	2
25	2	25	2	25	4
26	4	26	3	26	3
27	2	27	2	27	3
28	2	28	4	28	1
29	2	29	3	29	2
30	4	30	4	30	2

SOLUTION

1. Ans. (4)



$$\frac{h}{u\sin\theta} \le \frac{2u\sin\theta}{g} \Rightarrow h \le \frac{2u^2\sin^2\theta}{g} = 4H$$

2. Ans. (2)

Surface Area = 2 [ab + bc + ca]
= 2 [1.5 × 1.5 + 1.5 × 1.0 + 1.5 × 1.0]
= 2 [2.25 + 1.50 + 1.50]
= 2 [2.2 + 1.5 + 1.5]
= 2 × 5.2 = 10.4 cm^2

3. Ans. (3)

$t.u_1\cos\theta_1 = 5 \Rightarrow 5/u_1\cos\theta_1 = t$

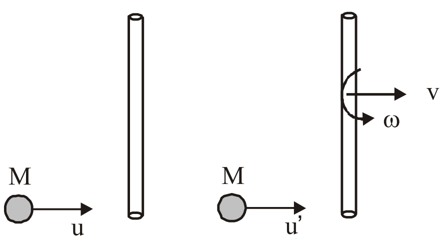
$t.\ u_2\cos\theta_2 = 10$ **;** $t = \dfrac{10}{u_2\cos\theta_2}$

Now

$$F = \frac{\Delta P}{\Delta t} = \frac{2m\left[\frac{5}{t}+\frac{10}{t}\right]}{2t} = \frac{15m}{t^2} = \frac{15\times m}{2h}\times g$$

$$F = \frac{15\times 0.2\times 10}{2\times 2} = 7.5N$$

4. Ans. (1)



Momentum conservation

$Mu = M\nu + Mu'$

$u = \nu + u'$

Angular momentum conservation

$$M.u\frac{\ell}{2} = Mu'\frac{\ell}{2} + \frac{M\ell^2}{12}.\omega$$

$$u - u' = \frac{\omega\ell}{6}$$

For elastic collision $\nu + \dfrac{\omega\ell}{2} - u' = u$

On solving $\nu = \dfrac{2u}{5}; \omega = \dfrac{12u}{5\ell}$

now KE of upper half part

$$= \frac{1}{2}\left(\frac{M}{2}\right)\left(V_{cm}\right)^2 + \frac{1}{2}.I_{cm}.\omega^2$$

$$= \frac{1}{2}\frac{M}{2}.\left[\frac{2u}{5} - \frac{3u}{5}\right]^2 + \frac{1}{2}\frac{\frac{M}{2}.\left(\frac{\ell}{2}\right)^2}{12}\left(\frac{12u}{5\ell}\right)^2$$

$$= \frac{Mu^2}{25}$$

5. Ans. (3)

For the given situation disc will perform translatory motion in radius *l*. Hence case is like simple pendulum (Refer to H.C. V. exercise S.H.M.)

6. Ans. (4)

For speed to be zero.

$$\frac{1}{2}K(S-\ell)^2 = mg(S)$$

$$S^2 + \ell^2 - 2S\ell = \frac{2mg}{K}.S$$

$$\Rightarrow KS^2 - 2\ell KS - 2mgS + K\ell^2 = 0$$

$$S = \frac{(2\ell K + 2mg) \pm \sqrt{4(\ell K + mg)^2 - 4K\ell^2 \times k}}{2K}$$

$$S = \frac{(K\ell + mg) \pm \sqrt{K^2\ell^2 + m^2g^2 + 2\ell Kmg - K^2\ell^2}}{K}$$

$$S = \frac{(K\ell + mg) + \sqrt{2mgK\ell + m^2g^2}}{K}$$

Now maximum speed will be at equilibrium position

$$\frac{1}{2}mv^2 + \frac{1}{2}K\left[\frac{mg}{K}\right]^2 = mg\left(\ell + \frac{mg}{K}\right)$$

$$\frac{1}{2}mv^2 + \frac{1}{2}\frac{m^2g^2}{K} = mg\ell + \frac{m^2g^2}{K}$$

$$\frac{1}{2}mv^2 = mg\ell + \frac{m^2g^2}{2K}$$

$$v = \sqrt{2g\ell + \frac{mg^2}{K}}$$

time of free fall is $\sqrt{\frac{2\ell}{g}}$

and clearly option 4 is wrong.

7. **Ans. (1)**

diameter = 1 × pitch + L.C×C.S.R

$$= 1.5 \text{ mm} + \frac{1.5mm}{100} \times 76 = 2.64mm$$

8. **Ans. (4)**

particle speed = $-v_w$ × slope

$= 2\times(2/1)$ at $\frac{3}{4}$sec.

9. **Ans. (4)**

$$C = \frac{Q}{n\Delta T} \quad \frac{\Delta U + W}{n\Delta T} = \frac{nC_V\Delta t + \int_{V_i}^{V_f} PdV}{n\Delta T}$$

$$= C_V + \frac{\alpha}{n\Delta t}.\int_{V_i}^{V_f} VdV$$

$$= \frac{R}{\gamma - 1} + \frac{1}{2}\frac{\alpha V_f^2 - \alpha V_i^2}{n\Delta T}$$

$$= \frac{R}{\gamma - 1} + \frac{1}{2}\frac{P_fV_f - P_iV_i}{n\Delta T}$$

$$= R\left[\frac{1}{\gamma - 1} + \frac{1}{2}\right] = \frac{R}{2}\left(\frac{\gamma + 1}{\gamma - 1}\right)$$

10. **Ans. (2)**

at some distance from centre inside core

$$F = -\left(\frac{G\frac{4}{3}\pi r^3(3\rho)m}{r^2}\right)$$

$$ma = -4\pi G\rho mr$$

$$a = -4\pi G\rho r$$

so $\omega = \sqrt{4\pi G\rho} = \frac{2\pi}{T}$

or $T = 2\pi.\sqrt{\frac{1}{4\pi G\rho}} = \sqrt{\frac{\pi}{G\rho}}$

now time for A to B $\frac{1}{2}\sqrt{\frac{\pi}{G\rho}}$

11. **Ans. (4)**

For energy in radius $r_i = \left|\frac{-GMm}{2r}\right| = nk$

where n is integer k is constant energy , now

$$\frac{GMm}{2R} = nk$$

$$\frac{GMm}{2\left(\frac{3R}{2}\right)} = (n-1)\,k$$

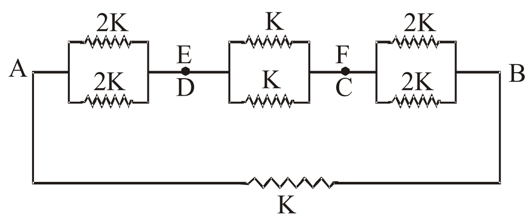
so solving $k = \frac{GMm}{6R}$

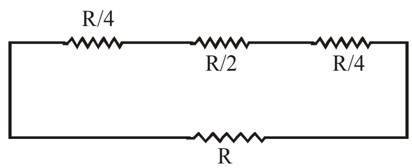
now this implies that for R_{max}

$$\frac{GMm}{2R_{max}} = (1)\frac{GMm}{6R} \Rightarrow R_{max} = 3R$$

12. **Ans. (4)**

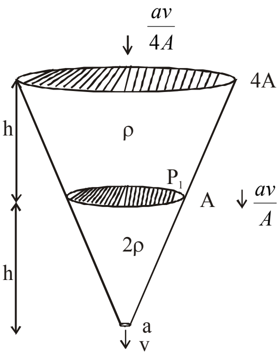
Let $R = \frac{1}{K}.\frac{l}{a}$





$$R_{eq} = \frac{R}{2} = \frac{1}{2}\left(\frac{\ell}{ka}\right)$$

13. Ans. (4)



$$P_0+\frac{1}{2}2\rho v^2=P_1+2\rho gh+\frac{1}{2}(2\rho)\left(\frac{av}{A}\right)^2$$

$$P_0+\frac{1}{2}\rho\left(\frac{av}{4A}\right)^2+\rho gh=P_1+O+\frac{1}{2}\rho\left(\frac{av}{A}\right)^2$$

$$\Rightarrow\ \rho v^2-\frac{\rho}{32}\frac{a^2v^2}{A^2}+\rho gh=2\rho gh+\rho\frac{a^2v^2}{A^2}-\frac{\rho}{2}\frac{a^2v^2}{A^2}$$

$$v^2\left[1-\frac{a^2}{32A^2}-\frac{a^2}{A^2}.v^2+\frac{a^2v^2}{2A^2}\right]=gh$$

$$v=\sqrt{\frac{3gh}{1-\frac{17a^2}{32A^2}}}$$

14. Ans. (2)

$F=(P_0-P_{average}).\ lh$

$$F=\left[\frac{2T}{d}-\frac{\rho gh}{2}\right]\ell h$$

$$h=\frac{2T}{\rho gd}\ \text{ so } F=\frac{2T^2\ell}{\rho gd^2}$$

15. Ans. (3)

$$\text{half time}=\frac{\ln(2)}{\text{rate constant}}=\frac{\ell n(2)}{R/\Delta T_0}=\frac{\ell n(2)\Delta T_0}{R}$$

16. Ans. (3)

current in bulbs B_1 = 1A

max current in B_2 = 2A

For same illumination current should be same in both bulbs

i.e. $i=I(1-e^{-t/\tau})$

$1=2(1-e^{-t/\tau})\Rightarrow e^{-t/\tau}=2$

$$t=\tau\ \ln 2=\frac{L}{R}\ln 2=\frac{20}{2}\ln 2=7\ \text{seconds}$$

Also, angle rotated by wheel in given time,

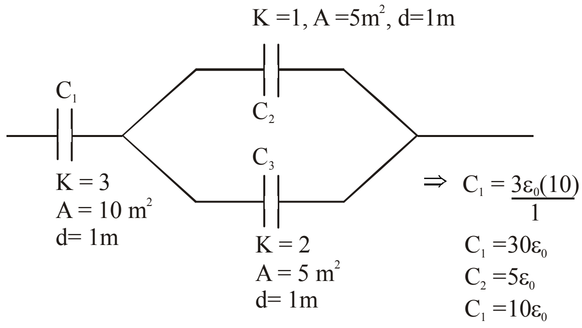
$$\theta=\omega_i t-\frac{1}{2}\propto t^2$$

$$=2.5\pi(7)-\frac{1}{2}(2)(7)^2=6rad=343.7°$$

i.e. wheel is 16.3° short of complete revolution at that instant , so, desired colour is green.

17. Ans. (1)

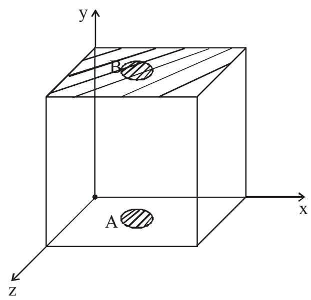
Finally system behaves as shown



$$(\text{net}=\frac{(15\varepsilon_0)(30\varepsilon_0}{45\varepsilon_0}=10\varepsilon_0=8.85\times10^{-11}F\ )$$

18. Ans. (4)

$V=y^3+2$



$$\Rightarrow\ E=\frac{-\delta V}{\delta y}\hat{i}=-3y^2\hat{j}$$

V_A = 2 volt

V_B = 10 volt [$V=y^3+2$]

$$q(V_B-V_A)=\frac{1}{2}mv^2\Rightarrow\frac{1}{2}(8)=\frac{1}{2}(2)V^2$$

$\Rightarrow$ V = 2 m/s

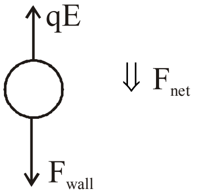
So, velocity of ball before collision = (2m/s)j

So, velocity of ball after collision = –(1.5m/s)j

change in momentum = $m\left(\vec{V}_F-\vec{V}_i\right)=(-7N.S)\,j$

Net force = (–7) /(0.1) = (–70N)j

from FBD of ball during collision



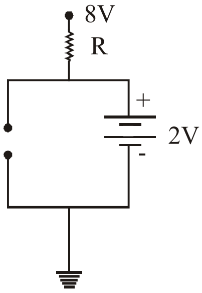
$F_{net} = F_{wall} - qE$

$F_{wall} = F_{net} + qE$

= (70+6) = 76 N

[E at top face = $3y^2 = 3(2)^2 = 12$ N/C]

19. Ans. (2)

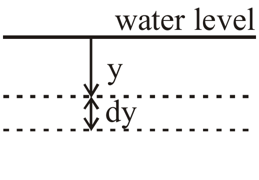


$$i = 20mA = \frac{E - V_{LED}}{R} = \frac{8-2}{R}$$

$$R = \frac{6V}{20mA} = 300\Omega$$

Also reverse voltage across red diode is 2V which is fine for LED with reverse breakdown voltage of 3V.

20. Ans. (1)



$$h_{app} = \mu_{observer} \sum \left(\frac{h_i}{\mu_i}\right) = \int_0^1 \frac{dy}{y^2+1} = \tan^{-1}(1) = \frac{\pi}{4}$$

21. Ans. (4)

X	Y	Z	$\overline{X.Y}$	$\overline{Y.Z}$	$R = \overline{\overline{X.Y} + \overline{Y.Z}}$
0	0	0	1	1	0
0	1	0	1	1	0
0	0	1	1	1	0
0	1	1	1	0	0
1	0	0	1	1	0
1	1	0	0	1	0
1	0	1	1	1	0
1	1	1	0	0	1

From truth table, answer is AND gate.

22. Ans. (4)

$$B = \frac{E}{C} = \frac{10^{-4}}{3\times10^8} = 3.3\times10^{-13}T$$

23. Ans. (3)

Let E_c be the amplitude of carrier wave and Es is signal amplitude

then $E_C = \left(\frac{V_{max}+V_{min}}{2}\right), E_s = \left(\frac{V_{max}-V_{min}}{2}\right)$

$E_C = mE_C \Rightarrow 4 = m6 \Rightarrow m = \frac{2}{3}$

24. Ans. (1)

$$\varepsilon = \left(\vec{v}\times\vec{B}\right).\vec{\ell}_{eff}$$

$$\varepsilon = \left[2\hat{i}\times\left(3\hat{j}+4\hat{k}\right)\right].\left[3\hat{i}+4\hat{j}\right]$$

$$|\varepsilon| = 32 volt$$

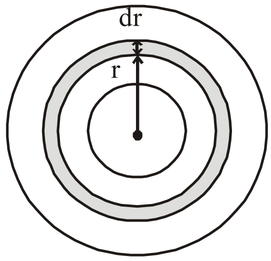
25. Ans. (2)

$$\frac{X_i}{X_f} = \left|\frac{\frac{1}{\omega C_i} - \omega L_i}{\frac{1}{\omega C_F} - \omega L_f}\right|$$

$$= \frac{\frac{\ell}{\omega K\varepsilon_0 A} - \omega\mu_0 n^2 A\ell}{\frac{\ell}{\omega\varepsilon_0 A} - \omega\mu_0\mu_r n^2 A\ell} = \frac{1}{K}\left(\frac{1-K}{1-\mu_r}\right)$$

[Using $\varepsilon_0\mu_0 = \frac{1}{C^2}$] & $[\omega^2 A^2 n^2 = C^2]$

26. Ans. (4)



$$dR = \frac{\rho dr}{4\pi r^2}$$

$$R = \int dR = \frac{\rho}{4\pi}\int_{r_1}^{r_2}\frac{dr}{r^2} \Rightarrow R = \frac{\rho(r_2 - r_1)}{4\pi r_1 r_2}$$

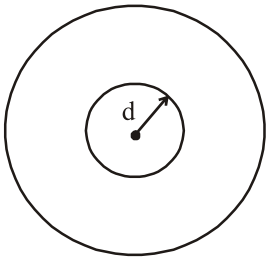
Rate of melting is max when power dissipated in sphere is max. Using maximum power transfer theorem,

R = r. of battery i.e. $\frac{\rho(r_2 - r_1)}{4\pi r_1 r_2} = \frac{2}{\pi}$

$$\rho = \frac{8r_1r_2}{r_2 - r_1} = \frac{8(200)}{10} = \frac{160}{100} \text{(in SI)}$$

Also, $\sigma = \frac{1}{\rho} = \frac{10}{16} = \frac{5}{8}$

27. Ans. (2)



Considering gaussian surface

$$\phi = \frac{q_{in}}{\varepsilon_0} \Rightarrow E\ 4\pi d^2 = \frac{2ed^3}{\varepsilon_0 R^3}$$

$$E = \frac{2edk}{R^3}$$

For equilibrium of charge,

$$\frac{kee}{(2d)^2} = \left(\frac{k2ed}{R^3}\right)e$$

$$\frac{1}{4d^2} = \frac{2d}{R^3} \Rightarrow d^3 = \frac{R^3}{8} \Rightarrow d = R/2$$

28. Ans. (2)

When light enters medium of refractive index μ, its speed decreases, to $\frac{c}{\mu}$.

$\therefore$ wavefront at point P is option (2).

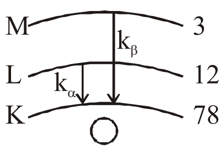
29. Ans. (2)

$$y_{n^{th}} = \frac{n\lambda_1 D}{2d};\ n = 2, 4, 6, 8.....$$

$$y_{m^{th}} = \frac{m\lambda_2 D}{2d};\ m = 2, 4, 6, 8......$$

$y_{n^{th}} = y_{m^{th}} = \frac{d}{2}$ from central fringe.

30. Ans. (4)



$$\frac{\left(\frac{hc}{\lambda_{k_\alpha}}\right)}{\left(\frac{hc}{\lambda_{k_\beta}}\right)} = \frac{(E_k - E_L)}{(E_k - E_m)}$$

$$\Rightarrow \frac{\lambda_{k_\beta}}{\lambda_{k_\alpha}} = \frac{78-12}{78-3} = \frac{22}{25} = \frac{\lambda_{k_\alpha}}{\lambda_{k_\beta}} = \frac{25}{22}$$

31. Ans. (1)

Average atomic mass of carbon

= 0.988 × 12 + 0.0118 × 13 + 0.0002 × 14

= 12.0122

32. Ans. (1)

33. Ans. (3)

In H_2O strength of H-bonding is greater than in NH_3.

34. Ans. (2)

35. Ans. (2)

36. Ans. (3)

$Ag(CN)_2^-$ is more stable than $Ag(NH_3)_2^+$

37. Ans. (1)

38. Ans. (4)

$$r_c + r_a = \frac{a\sqrt{3}}{2} \Rightarrow 180 = \frac{a\sqrt{3}}{2}$$

$$a = \frac{360}{\sqrt{3}} = 120\sqrt{3}\ \text{pm.}$$

Closest distance between two cation

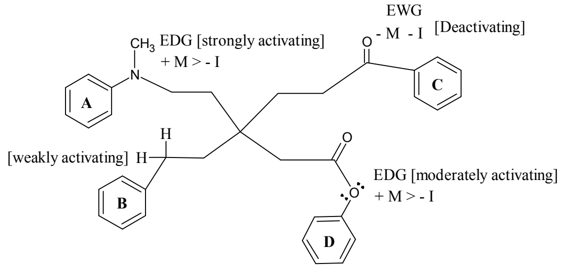
$= a = 120\sqrt{3}$ pm

39. Ans. (4)

40. Ans. (2) $2\lambda_m^\infty(Na^+) + \lambda_m^\infty(SO_4^{2-})$

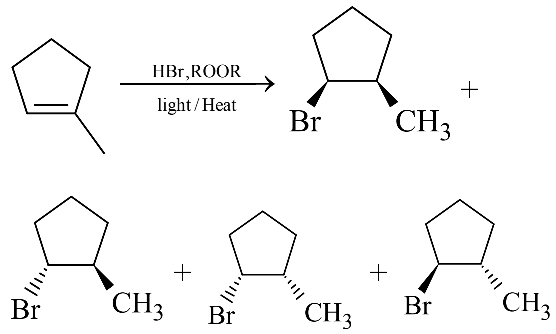
$$= \frac{1000(2.6\times10^{-3})}{0.001} = 260\,Scm^2mol^{-1}$$

41. Ans.(2)



Rate of EAS C < B < D < A

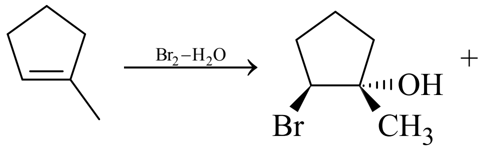
42. Ans.(3)

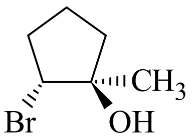
(1) 

Intermediate – Free Radical

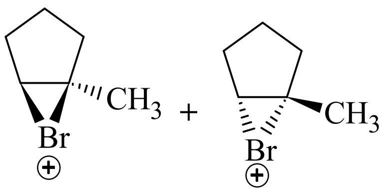
Stereochemistry of addition – (syn + Anti)

Regiochemistry of addition – Antimarkovnikov

(2) 

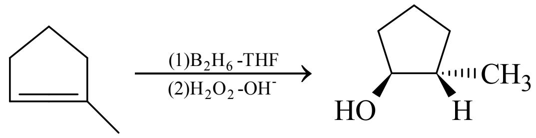


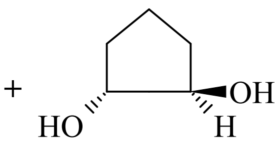
Intermediate



Stereochemistry of addition – Anti

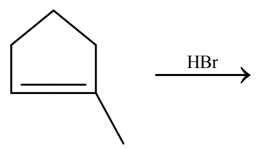
Regiochemistry of addition – Markovnikov like

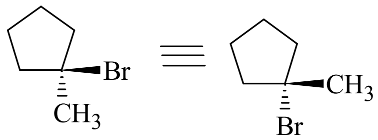
(3) 

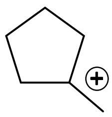


Stereochemistry of addition – Syn

Regiochemistry of addition – Antimarkovnikov

(4) 



Intermediate : 

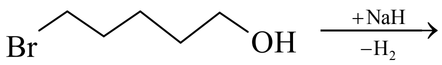
Stereochemistry of addition – (Syn + Anti)

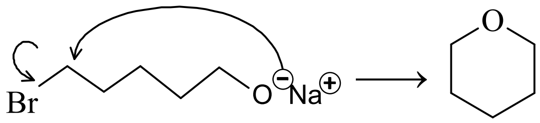
Regiochemistry of addition – Markovnikov

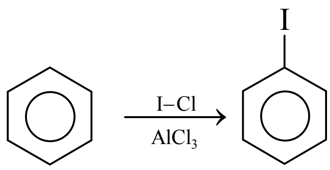
43. Ans. (4)

$SOCl_2 / Py \longrightarrow S_N 2$

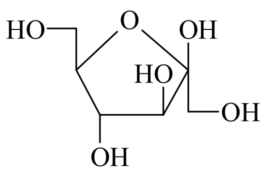
$PBr_3 \longrightarrow S_N 2$



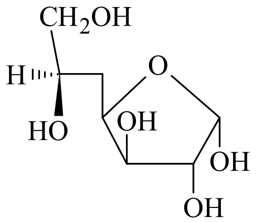




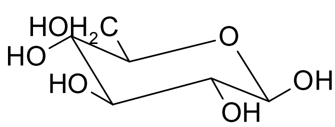
44. Ans. (1)



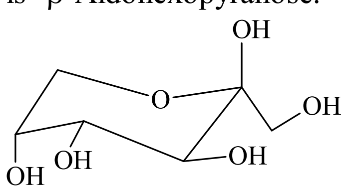
β- ketohexofuranose



has 7(c) atoms hence not hexose sugar.



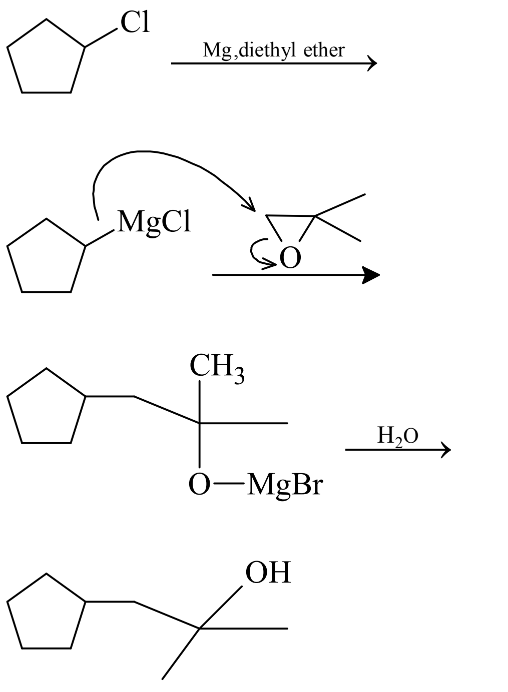
is β-Aldohexopyranose.



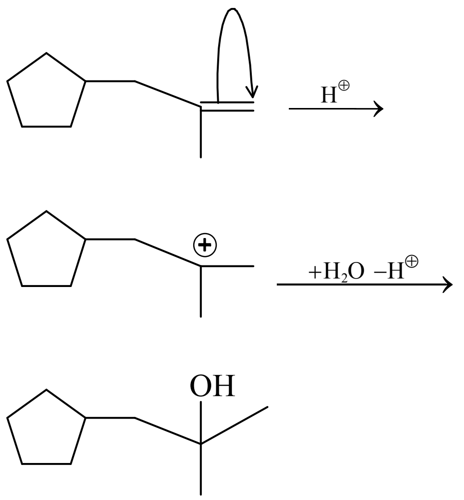
β-Ketohexopyranose

45. Ans.(4)

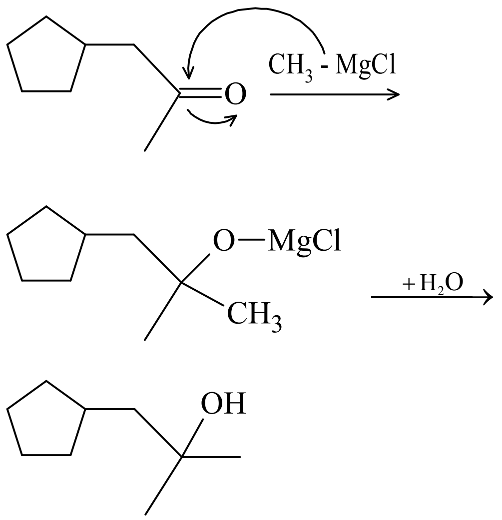
(1)



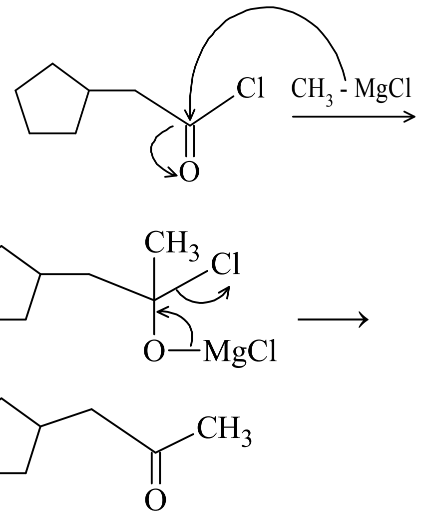
(2)



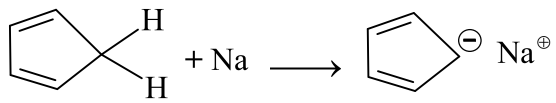
(3)



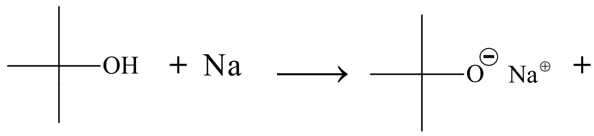
(4)



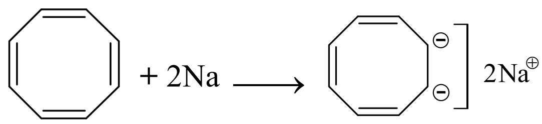
46. Ans. (3)



$+ \frac{1}{2}H_2 \uparrow$



$\frac{1}{2}H_2 \uparrow$



$CH_3-COOH + Na \longrightarrow$

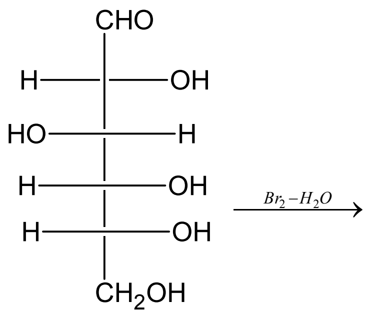
$CH_3COO^{\ominus}\overset{\oplus}{Na} + \frac{1}{2}H_2$

47. Ans. (3)

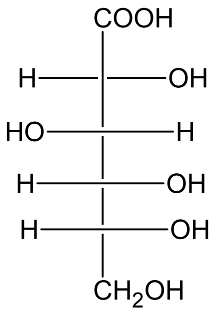
$CH_3CHO \xrightarrow[-I_2]{NaOH} CHI_3 \downarrow + HCOO^-$

$PhCHO \xrightarrow{Tollen's\ Reagent} PhCOO^- + Ag \downarrow$

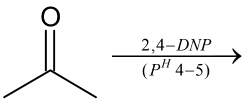
$CH_3CHO \xrightarrow{Tollen's\ Reagent} CH_3COO^- + Ag \downarrow$

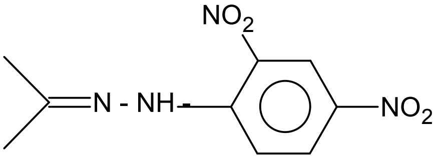


glucose

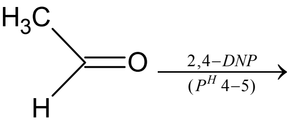


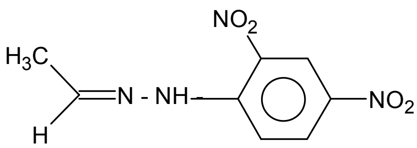
$Fructose \xrightarrow{Br_2-H_2O} No\ Reaction$





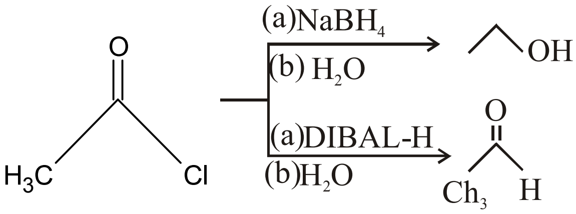
yellow/ orange/red



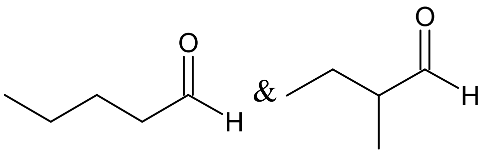


yellow/ orange/red

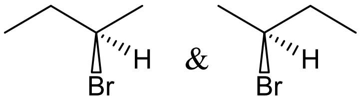
48. Ans. (4)



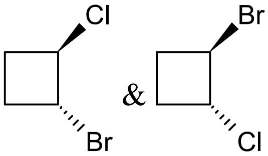
49. Ans. (2)

(1) 

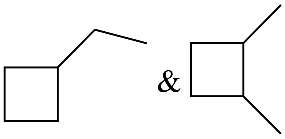
⇒ chain isomers

(2) 

⇒ enantiomers

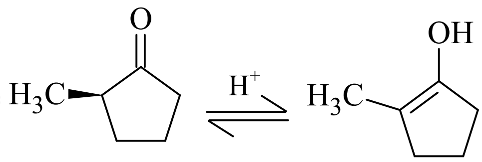
(3) 

⇒ identical

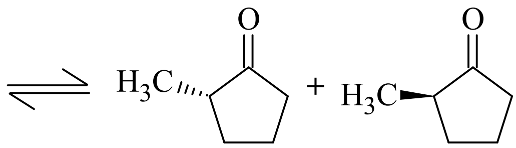
(4) 

⇒ chain isomers

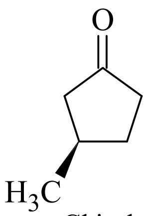
50. Ans. (2)

I = 

Chiral

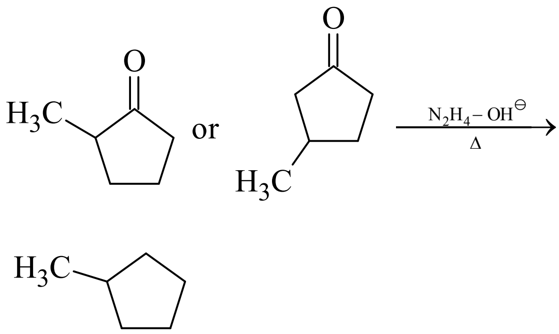


enantiomers

II = 

Chiral

no racemization under acidic condition



51. Ans. (2)

The correct of order of bond energy in halogens is $I_2 < F_2 < Br_2 < Cl_2$

52. Ans. (1)

Bond order in the four cases is 1, 1.33, 1.5 and 2 respectively.

53. Ans. (2)

$$KNO_3 \xrightarrow{\Delta} KNO_2 + O_2$$

54. Ans. (4)

55. Ans. (2)

56. Ans. (3)

It has two geometric isomers and two optical isomers.

57. Ans. (2)

58. Ans. (4)

59. Ans. (3)

$2\,CuSO_4 + 4KI \rightarrow K_2SO_4 + Cu_2I_2 + I_2$

60. Ans. (4)

$$Mg_3N_2 + 6H_2O \rightarrow 3Mg(OH)_2 + 2NH_3$$

$$NaNO_3 + 4Zn + 7NaOH \rightarrow$$

$$4Na_2ZnO_2 + NH_3 + 2H_2O$$

$$CaNCN + 3H_2O \rightarrow CaCO_3 + 2NH_3$$

61. Ans. (2)

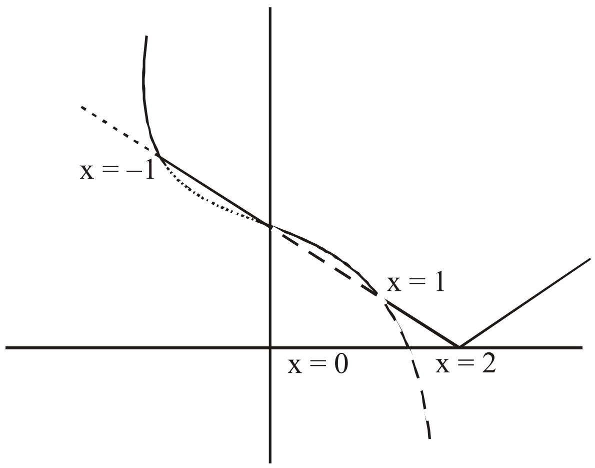
x coty y dy + ln siny dx + ln cosx dy–y tan x dx=0

$$\int d(x \ln \sin y) + \int d(y \ln \cos x) = \int 0$$

x ln sin y + y ln cos x = c

$(\sin y)^x \cdot (\cos x)^y = c$

62. Ans. (4)



63. Ans. (3)

$$f(x) = 2 + \frac{3}{x^4 - 7x^2 - 4x + 23}$$

Let $h(x) = x^4 - 7x^2 - 4x + 23$

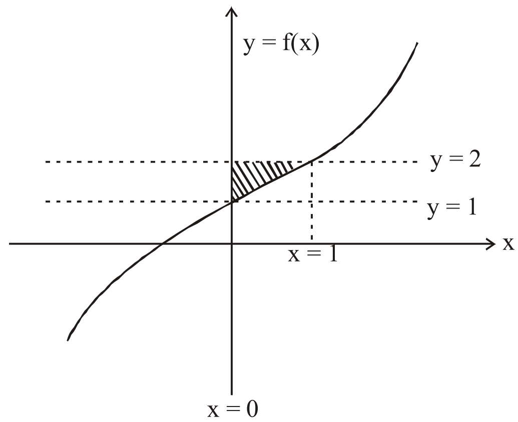
$$= (x^2 - 4)^2 + (x - 2)^2 + 3$$

$h(x) \geq 3$

Range of h(x) is $[3, \infty)$

$\Rightarrow$ Range of f(x) is (2, 3]

64. Ans. (2)



$$A = \int_0^1 2 - (x^3 - 3x^2 + 3x + 1)$$

$$A = \int_0^1 (-x^3 + 3x^2 - 3x + 1)\,dx$$

$$A = -\frac{x^4}{4} + x^3 - \frac{3x^2}{2} + x \Big|_0^1 = \frac{1}{4}$$

65. Ans. (2)

Given $f\left(\frac{5x - 3y}{5 - 3}\right) = \frac{5f(x) - 3f(y)}{5 - 3}$

Which satisfies section formula for abscissa on L.H.S. and ordinate on R.H.S.

Hence f(x) must be linear function

let f(x) = ax + b

f(0) = b = 1 $\Rightarrow$ f(x) = 2x + 1

f'(0) = a = 2

period of sin (2x + 1) is π

66. Ans. (4)

$$= 12k.\frac{12^{11}}{k}\ C_{k-1}\ {}^{11}C_{k-1}$$

$$\sum_{K=1}^{n} 12.K\ {}^{12}C_K \cdot {}^{11}C_{K-1} = 12^2 \sum_{K=1}^{12} \left({}^{11}C_{K-1}\right)^2$$

$$= 12^2 . \frac{22!}{11!\,11!}$$

$$= 12.\frac{21.19.17......3}{11!} 2^{12}.6 \Rightarrow p = 6$$

67. Ans. (3)

We have, z = 0 for the point where the line intersects the curve

$\therefore \dfrac{x-2}{3}=\dfrac{y+1}{2}=\dfrac{0-1}{-1}$

$\Rightarrow$ x = 5 and y = 1

Putting these values in $xy = c^2$

$\Rightarrow 5 = c^2 \Rightarrow c=\pm\sqrt{5}$

68. Ans.(2)

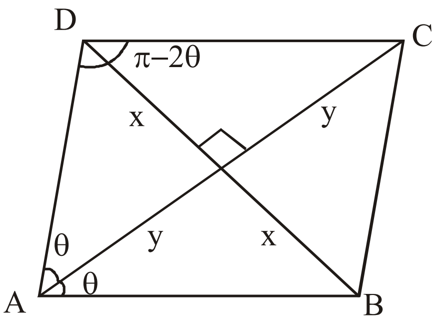
Put $x=y-\dfrac{1}{y}$

$\Rightarrow 1 \Rightarrow \int_{-\infty}^{\infty} f\left(y-\dfrac{1}{y}\right)\left(1+\dfrac{1}{y^2}\right)dy$

$=\int_{-\infty}^{0} f\left(y-\dfrac{1}{y}\right)dy+\int_{-\infty}^{0} f\left(y-\dfrac{1}{y}\right)\dfrac{dy}{y^2}$

Putting $z=-\dfrac{1}{y}=\int_{-\infty}^{0} f\left(y-\dfrac{1}{y}\right)dy+\int_{0}^{\infty} f\left(z-\dfrac{1}{z}\right)dz=1$

69. Ans.(1)



In $\Delta ABD\ \dfrac{\sin 2\theta}{2x}=\dfrac{1}{2R_1}$

$x=25\sin\theta\cos\theta$,

In $\Delta ACD\ \dfrac{\sin 2\theta}{2y}=\dfrac{1}{2R_2}$

$y=50\sin\theta\cos\theta$

$\tan\theta=\dfrac{x}{y}=\dfrac{1}{2}\Rightarrow y=50.\dfrac{1}{\sqrt5}.\dfrac{2}{\sqrt5}=20$

and x = 10

Area of rhombus = 2xy= 400

70. Ans.(4)

$|z|^2 - |z| - 2 < 0$

$\Rightarrow (|z|-2)(|z|+1)<0 \Rightarrow |z|<2$

Now $|z^2+z\sin\theta|\le|z|^2+|z\sin\theta|\le|z|^2+|z|<4+2=6$

71. Ans. (3)

$\because$ a = 0 and $y = bx^2 + cx + d$ is symmetric about $x=-\dfrac{c}{2b}$

$\therefore$ x = k = $-\dfrac{c}{2b}\Rightarrow k+\dfrac{c}{2b}=0$

$\Rightarrow a+\dfrac{c}{2b}+k=0$

72. Ans. (3)

$\left(\tan^{-1}x-2\right)\left(\cot^{-1}x-1-\dfrac{\pi}{2}\right)>0$

$\Rightarrow\left(\tan^{-1}x+1\right)\left(\tan^{-1}x-2\right)<0$

$\Rightarrow -1<\tan^{-1}x<2$

$\Rightarrow -\tan 1<x<\tan 2$

73. Ans.(2)

$\log_2\left(1+\sqrt{6x-x^2-8}\right)\ge 0$

$\Rightarrow 1+\sqrt{6x-x^2-8}\ge 1\Rightarrow 6x-x^2-8\ge 0$

$\Rightarrow x^2-6x+8\le 0$

$\Rightarrow (x-2)(x-4)\le 0$

$\Rightarrow 2\le x\le 4$.

Now $f'(x) = x^2 + 2x + 2 > 0\ \forall\ x\in R$

$\Rightarrow$ f(x) is strictly increasing in [2, 4]

$f(x)=\dfrac{x^3}{3}+x^2+2x$

$a=f(2)=\dfrac{8}{3}+4+4=\dfrac{32}{3}$

$b=f(4)=\dfrac{64}{3}+16+8=\dfrac{136}{3}$

$a+b=56$

74. Ans. (3)

D.R's of normal to plane x + y + z–1 =0 and x + ky + 3z–1 = 0 is (1, 1, 1) and (1, k, 3) respectively

$\Rightarrow$ D.R. of normal to a plane perpendicular to given planes

$=\begin{vmatrix}\hat i & \hat j & \hat k\\ 1 & 1 & 1\\ 1 & k & 3\end{vmatrix}=\hat i(3-k)-\hat j(2)+\hat k(k-1)$

$$\Rightarrow \frac{1+2\lambda}{3-k} = \frac{2+\lambda}{-2} = \frac{1+3\lambda}{k-1}$$
$$\Rightarrow -2-4\lambda = 6+3\lambda-2k-\lambda k$$
$$-4-10\lambda = 4+2\lambda \Rightarrow 12\lambda = -8 \Rightarrow \lambda = -\frac{2}{3}$$
$$\Rightarrow -2+\frac{8}{3} = 6-2-2k+2-k = 3$$
$$\Rightarrow \frac{2}{3}-4 = -\frac{4}{3}k \Rightarrow -\frac{10}{3} = -\frac{4}{3}k \Rightarrow k = \frac{5}{2}$$

75. Ans. (3)

g(x) = x $|x|^3$ has 4 repeated roots

$\therefore$ g''(x) is cont. and diff. at x = 0

$\therefore$ consider f(x) = $x^p \sin\frac{1}{x}$ $x \neq 0$

0   x = 0

$$f'(0^+) = \lim_{h\to 0} \frac{h^p \sin\frac{1}{h}}{h} = 0 \quad \text{if } p > 1$$

$\therefore f'(0) = 0$ for p > 1

$$\therefore f'(x) = p\,x^{p-1}\sin\frac{1}{x} - x^{p-2}\cos\frac{1}{x} \quad x \neq 0$$

0   x = 0

$$f''(0^+) = \lim_{h\to 0} \frac{p\,h^{p-1}\sin\frac{1}{h} - h^{p-2}\cos\frac{1}{h}}{h} = 0$$

if p > 3

$$\therefore f''(x) = \left(p(p-1)x^{p-2} - x^{p-4}\right)\sin\frac{1}{x} + \left(2x^{p-3}\right)\cos\frac{1}{x}$$

for $x \neq 0$

= 0   for x = 0

$\therefore$ f''(x) to be continuous $p \in (4, \infty)$

76. Ans. (4)

$$\lim_{x\to\frac{1}{2}} \frac{ax^2+bx+c}{(2x-1)^2} = \frac{1}{2}$$
$$\Rightarrow ax^2+bx+c = \frac{1}{2}(2x-1)^2$$
$$\Rightarrow ax^2+bx+c = 2x^2-2x+\frac{1}{2}$$
$$\therefore a = 2, b = -2, c = \frac{1}{2}$$
$$\therefore \lim_{x\to 2} \frac{(x-2)(x+2)\left(x-\frac{1}{2}\right)}{x-2} = 4\times\frac{3}{2} = 6$$

77. Ans. (4)

$$\frac{2x^3+3x^2+x-3}{x^2+x-2} = (2x+1) + \frac{1}{x-1} + \frac{3}{x+2}$$
$$\frac{d}{dx}\left[\frac{2x^3+3x^2+x-3}{x^2-x-2}\right] = 2 - \frac{1}{(x-1)^2} - \frac{3}{(x+2)^2}$$

$\therefore$ A = 2, B = –1, C = –3

$\therefore$ A + B + C = 0

78. Ans. (2)

PA × PB = $(PT)^2$

where PT = length of tangent

$(PT)^2 = (-1)^2 + 3^2 - 2(-1) + 4(3) - 8 = 16$

P(A) P(B) = 16

$\therefore$ AM $\geq GM$

$PA + PB \geq 8$

79. Ans. (2) $[(n+1)n-(n-1)]n!$

$$T_n = (n^2+1)\underline{|n} = n\underline{|n+1} - (n-1)\underline{|n}$$
$$\therefore S_n = n\underline{|n+1}$$
$$\frac{T_{10}}{S_{10}} = \frac{101\underline{|10}}{10\underline{|11}} = \frac{101}{110}. \quad \therefore\ b-a = 9$$

80. Ans. (2)

Since f''(x) > 0

$\Rightarrow f'(x)$ is always increasing

g'(x) = 2f'($2x^3-3x^2$)×($6x^2-6x$) + f'($6x^2-4x^3-3$)($12x-12x^2$)

= $12(x^2-x)$ (f '($2x^3-3x^2$)–f '($6x^2-4x^3-3$))

= $12x(x-1)$][f '($2x^3-3x^2$)–f '($6x^2-4x^3-3$))]

For increasing g'(x) > 0

Case-I x < 0 or x > 1

$\Rightarrow$ f($2x^3-3x^2$) > f '($6x^2-4x^3-3$)

$\Rightarrow$ $2x^3-3x^2 > 6x^2-4x^3-3$

$(\because f'(x)$ is increasing$)$

$$\Rightarrow (x-1)^2\left(x+\frac{1}{2}\right) > 0 \Rightarrow x > -\frac{1}{2}$$
$$\therefore\ x \in \left(-\frac{1}{2}, 0\right) \cup (1, \infty)$$

Case II : If $0 < x < 1$

$f'(2x^3-3x^2) < f'(6x^2-4x^3-3)$

$$(x-1)^2\left(x+\frac{1}{2}\right)<0$$

$\Rightarrow x < -\frac{1}{2}$, so there is no solution

$$x<-\frac{1}{2}$$

$\Rightarrow$ Hence the values are $x\in\left(-\frac{1}{2},0\right)\cup(1,\infty)$

81. Ans. (2)

$$0<x<\frac{\pi}{6}$$

$\cos x > x \Rightarrow \frac{\cos x}{x} > 1$

$$\int_0^{\pi/6}\frac{\cos x}{x}dx > \int_0^{\pi/6}1.dx$$

$I > \frac{\pi}{6}$; $\frac{\pi}{3} < x < \frac{\pi}{2}$

$\cos x < x$

$$\frac{\cos x}{x} < 1 \Rightarrow \int_{\pi/3}^{\pi/2}\frac{\cos x}{x}dx < \int_{\pi/3}^{\pi/2}dx \Rightarrow J < \frac{\pi}{6}$$

82. Ans. (4)

$ax + by + c = 0$

$a + c = 2b \Rightarrow a - 2b + c = 0$

$x = 1, y = -2$

$(1, -2) = (\alpha, \beta)$

$(x-1)^2 + (y+2)^2 = \gamma$

$\Rightarrow x^2+y^2-2x+4y+5-\gamma=0$

it is orthogonal to $x^2+y^2-4x-4y-1=0$

$\Rightarrow 4-8=5-\gamma-1$

$\gamma = 8$

$\alpha+\beta+\gamma=1-2+8=7$

83. Ans. (3)

$|A-\lambda I|=0$

$$\begin{vmatrix}1-\lambda & 1 & 2\\ 0 & 2-\lambda & 1\\ 1 & 0 & 2-\lambda\end{vmatrix}=0$$

$$(1-\lambda)\left[(2-\lambda)^2-0\right]-(0-1)+2\left(0-(2-\lambda)\right)=0$$

$$(1-\lambda)(2-\lambda)^2+1-4+2\lambda=0$$

$$(1-\lambda)\left(\lambda^2-4\lambda+4\right)-3+2\lambda=0$$

$$\lambda^2-4\lambda+4-\lambda^3+4\lambda^2-4\lambda-3+2\lambda=0$$

$$\lambda^3=5\lambda^2-6\lambda+1=(5\lambda-1)(\lambda-1)$$

$$A^3=(5A-I)(A-I)$$

a = 5, b = 1 or a = 1, b = 5

$\Rightarrow$ a + b = 6

84. Ans. (2)

p	q	p∧q	(p∧q)→p	~q	q∧~q	[(p∧q)→p] →(q∧~q)
T	T	T	T	F	F	F
T	F	F	T	T	F	F
F	T	F	T	F	F	F
F	F	F	T	T	F	F

Given compound statement is always false. So it is a contradiction.

85. Ans. (4)

$n_1 = 10, n_2 = 10$

average $m_1 = 60, m_2 = 40$

$\sigma_1 = 4, \sigma_2 = 6$

Standard deviation of combined series

$$\sigma=\sqrt{\frac{n_1\sigma_1^2+n_2\sigma_2^2}{n_1+n_2}+\frac{n_1n_2(m_1-m_2)^2}{(n_1+n_2)^2}}$$

$$=\sqrt{\frac{10\times16+10\times36}{10+10}+\frac{10\times10(60-40)^2}{(10+10)^2}}$$

$$=\sqrt{8+18+100}=\sqrt{126}=11.2$$

86. **Ans. (3)**

Problem is same as arranging 8 things out of which 5 identical i.e. $\frac{8!}{5!}$ which gives total number of ways of selecting block and distributing them away 3 children i.e. $\frac{8!}{5!}3!$.

87. **Ans. (3)**

For $\left[\vec{a}\ \vec{b}\ \vec{c}\right]$ to be greatest $\vec{a}$ must be perpendicular to both $\vec{b}$ and $\vec{c}$ i.e. collinear with $\vec{b}\times\vec{c}$.

$$\vec{b}\times\vec{c} = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ -1 & 4 & 6 \\ 2 & -7 & -10 \end{vmatrix} = 2\hat{i}+2\hat{j}-\hat{k}$$

$$\therefore \vec{a} = \frac{2\hat{i}+2\hat{j}-\hat{k}}{3}$$

88. **Ans. (1)**

The normal at the extremities of focal chord meet at right angle. So orthocentre is the point of intersection of normals.

If $P\left(at_1^2, 2at_1\right), Q\left(at_2^2, 2at_2\right)$ then $t_1t_2 = -1$,.

Point of intersection of normals

$$h = a\left(t_1^2 + t_2^2 + t_1t_2 + 2\right)$$

$$k = -at_1t_2\left(t_1 + t_2\right)$$

89. **Ans. (2)**

2 cases arise (i) P_1 & P_2 are in same pair & one loses $p = \frac{1}{11}$

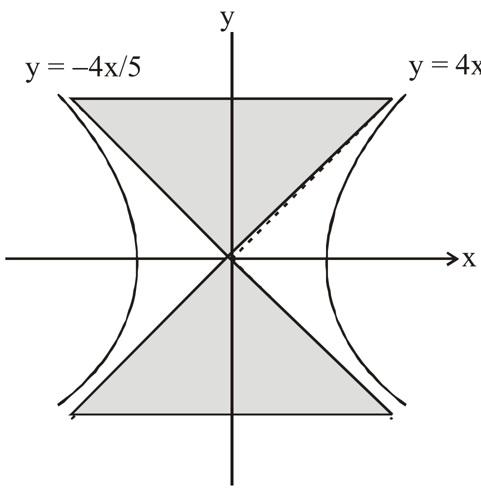
(ii) P_1 & P_2 are in different pairs & one loses

$$\rightarrow p = \frac{10}{11}\times\left(\frac{1}{2}\times\frac{1}{2}+\frac{1}{2}\times\frac{1}{2}\right) = \frac{5}{11}$$

$\therefore$ required probability = $\frac{6}{11}$.

90. **Ans. (2)**

Region where 2 tangents to two different branches can be drawn.



$\therefore$ (1, 6), (1, 3)

But from (1, 6) 2 tangents to circle can be drawn

$\therefore$ Ans. (1, 3)