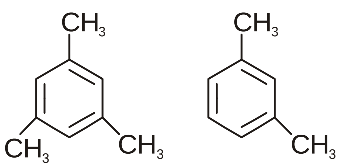
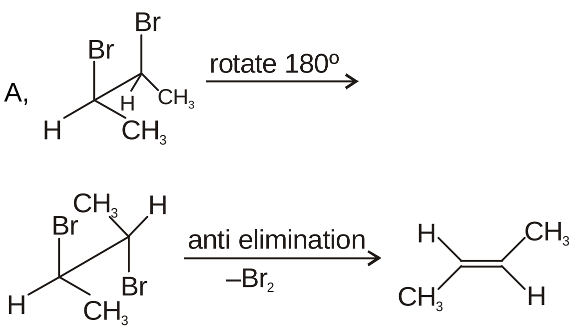
[CHEMISTRY]

46. D
47. B
48. C
49. D
50. C
51. A
52. D, (i) and (iii) have complete octet
    (ii) and (iv) have incomplete octet out of which (ii) is more stable because negative charge is on electronegative atom and positive charge is on electropositive atom
53. C, ∴ (iii) and (iv) follow huckel rule
54. A
55. D
56. A
57. B

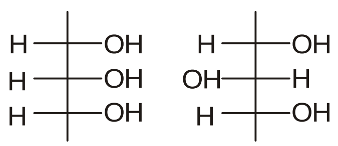


Mesitylene *m*-xylene

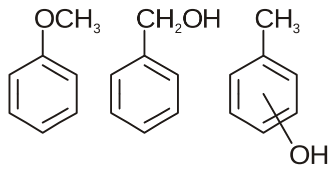
58. D, Terminal alkynes give reaction with ammonical $AgNO_3$
59. B, $C_6H_5CH_3 \xrightarrow{\text{oxidation}} C_6H_5COOH \xrightarrow{\text{NaOH}}$
    $C_6H_5COONa \xrightarrow{\text{soda lime}} C_6H_6$
60. A,



61. A,

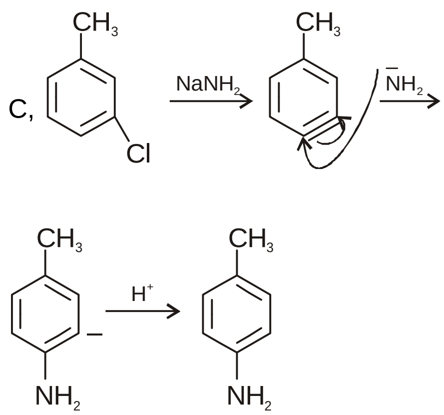


62. C, fully eclipsed structure are most unstable conformers
63. D,

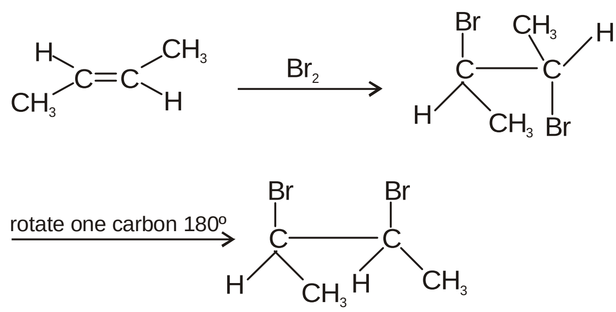


o, p, m

64 C, C does not contain any plane of symmetry
65. C
66. C,

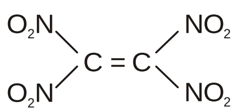


67. C
68. B, ethene is most unstable out of all of these
69. C, Br_2 give antiaddition reaction



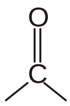
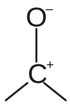
meso form

70. A,



This compound has four electron withdrawing group due to which electron density of double bond can not attack towards electrophiles.

71. A
72. D, In HOCl chlorine acts as electrophile and OH^- acts as nucliophile
73. C
74. D
75. D
76. D

77. A,  this group can also exist as 

78. B

79. C

80. D

81. C

82. A, SeO_2 give allylic hydroxy substitution

83. D

84. D

85. D

86. A

87. D

88. A

89. C

90. D

[MATHEMATICS]

61. Answer (3)

Taking cross product

$2\vec{a}\times\vec{b} = 3\vec{c}\times\vec{a}, \vec{a}\times\vec{b} = 3\vec{b}\times\vec{c}$

$\therefore\ \vec{a}\times\vec{b}+\vec{b}\times\vec{c}+\vec{c}\times\vec{a} = \left(1+\frac{1}{3}+\frac{2}{3}\right)(\vec{a}\times\vec{b})$

$= 2\vec{a}\times\vec{b}$

$\boxed{k=2}$

62. Answer (3)

Since, $(\bar{a}+\bar{b}+\bar{c})^2 \ge 0$

$\Rightarrow\ 3+2\Sigma\vec{a}\cdot\vec{b} \ge 0$

$-2\Sigma\vec{a}\vec{b} \le 3$

$\therefore\ |\vec{a}-\vec{b}|^2+|\vec{b}-\vec{c}|^2+|\vec{c}-\vec{a}|^2 = 6-2\Sigma\vec{a}\vec{b} \le 9$

= 9.

63. Answer (2)

$L_1 = \vec{r}.(-\hat{i}-2\hat{j}-\hat{k})+\lambda(3\hat{i}+\hat{j}+2\hat{k})$

$L_2 = \vec{r}.(2\hat{i}-2\hat{j}+3\hat{k})+\mu(\hat{i}+2\hat{j}+3\hat{k})$

Both are perpendicular

$$\begin{vmatrix} \hat{i} & \hat{j} & k \\ 3 & 1 & 2 \\ 1 & 2 & 3 \end{vmatrix} = -i-7\hat{j}+5\hat{k}$$

Unit vector $= \frac{1}{5\sqrt{3}}(-\hat{i}+7\hat{j}+5\hat{k})$

64. Answer (1)

Required plane

$2x + y - 3z + 2 + \lambda(x + y + z + 1) = 0$

It passes through (1, 1, 1)

then $4 + 2\lambda = 0$

$\lambda = -2$

$\Rightarrow$ Plane will be $x - 4z + 3 = 0$

65. Answer (3)

Point on first line $A(1 + 2t, -1 + 3t, 1 + 4t)$

Point on second line $B(3 + s, k + 2s, s)$

A and *B* are identical

$1 + 2t = 3 + s, -1 + 3t = k + 2s, 1 + 4t = 5$

On solving $t = -\frac{3}{2}, s = -5, k = \frac{9}{2}.$

66. Answer (1)

S divides *OG* in ratio 3 : 1 (externally)

$S = \left(\frac{9+3}{2,}, \frac{-5+9}{2}, \frac{-3-1}{2}\right) = (6, 2, -2)$

67. Answer (1)

Now, $\vec{p}\times\vec{q} = \{3ax^3+2b(x-1)^2\}\,K = f(x)K$

Where $f(0)f(1) = 6ab < 0\ [\because ab < 0]$

By intermediate theorem, there is atleast one point between [0, 1] at which $f(x) = 0$.

68. Answer (2)

$\vec{a}.\vec{r}$

$|\vec{a}| = 1$

$\vec{b} = \vec{r}+\vec{r}\times\vec{a}$

Cross product with $\vec{a}$

$(\vec{a}.\vec{r})\vec{a}-|\vec{a}|^2\,\vec{r}+\vec{b}-\vec{r} = \vec{b}\times\vec{a}$

$\Rightarrow\ \vec{r} = \frac{1}{2}(\vec{a}\times\vec{b}+2\vec{a}+\vec{b})$

69. Answer (3)

$\overrightarrow{CA}\cdot\overrightarrow{CB} = 0$

$\overrightarrow{CA} = (2-a)\hat{i}+2\hat{j}$

$\overrightarrow{CB} = (1-a)\hat{i}-6\hat{k}\ \Rightarrow\ (1-a)(2-a) = 0$

$a = 1, 2.$

70. Answer (1)

The required vector $\vec{r} = \lambda(a+b)$

$r = \frac{\lambda}{9}(\hat{i}-7\hat{j}+2\hat{k})$

Since $(\vec{r})^2 = 54$

$\frac{\lambda^2}{81}(1+49+4) = 54 \to \lambda = \pm 9$

So vector is $\vec{r} = \pm(\hat{i}-7\hat{j}+2\hat{k})$

71. Answer (1)

When vector are mutually orthogonal

$\vec{a}.\vec{b} = 2-4+2 = 0$ on solving

$\mu = 2, \lambda = -3$

$\vec{a}.\vec{c} = \lambda-1+2\mu = 0$

$\vec{b}.\vec{c} = 2\lambda+4+\mu = 0$

72. Answer (4)

The new plane $(x - 2y + 3z) + \lambda(x + y + z - 1) = 0$

$(1 + \lambda)x + (\lambda - 2)y + (\lambda + 3)z - \lambda = 0$

It is perpendicular to $x + y + 2 - 1 = 0$

$\therefore \quad 1 + \lambda + \lambda - 2 + \lambda + 3 = 0$

$\lambda = -\frac{2}{3}$ so plane $\Rightarrow x - 8y + 7z = -2$

73. Answer (4)

Shortest distance

$$= \frac{(1+2)(-1)+(2-2)(-7)+(1+3)(5)}{5\sqrt{3}} = \frac{17}{5\sqrt{3}}$$

$$\frac{(a_1 - a_2)\cdot(\vec{b}_1 \times \vec{b}_2)}{|\vec{b}_1 \times \vec{b}_2|}$$

74. Answer (1)

$\vec{n}_1 = 3\hat{i} - \hat{j} + \hat{k}, \vec{n}_2 = \hat{i} + 4\hat{j} + 2\hat{k}$

The vector parallel to line of intersection will be

$\vec{n}_1 \times \vec{n}_2 = (3\hat{i} - j + \hat{k}) \times (\hat{i} + 4\hat{j} - 2\hat{k})$

$= -2\hat{i} + 7\hat{j} + 13\hat{k}$

75. Answer (1)

$$\overrightarrow{OA} \times \overrightarrow{OB} = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 1 & 2 & 1 \\ 2 & 1 & 3 \end{vmatrix} = 5\hat{i} - \hat{j} - 3\hat{k}$$

$$\overrightarrow{AB} \times \overrightarrow{AC} = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 1 & -1 & 2 \\ -2 & -1 & 1 \end{vmatrix} = \hat{i} - 5\hat{j} - 3\hat{k}$$

If θ is angle between planes

$$\cos\theta = \frac{5+5+9}{\sqrt{35}\sqrt{35}} = \frac{19}{35}$$

76. Answer (1)

The number of ways = coefficient of x^8 in

$(1 + x + x^2 + \ldots. x^6)$

$= (1 - x^7)^4 (1 - x)^{-4}$

$= (1 - 4x^7) \left(1 + \left({}^4C_1\right)x + \left({}^5C_2\right)x^2 + \ldots.\right)$

$= {}^{11}C_8 - 4.{}^4C_1 = 165 - 16 = 149$

Required probability $= \frac{149}{7^4} = \frac{149}{2401}$

77. Answer (3)

Doubles are (1, 1), (2, 2)...(6, 6), $P = \frac{6}{36} = \frac{1}{6}$

$\therefore$ Required probability

$= {}^5C_3 P^3 q^2 + {}^5C_4 P^4 q + {}^5C_5 P^5$

$= \frac{1}{6^5}[250 + 25 + 1] = \frac{23}{648}$

78. Answer (3)

Required probability $= \dfrac{2\binom{n}{2}\binom{n}{1}}{\binom{2n}{3}} = \dfrac{6}{7}$

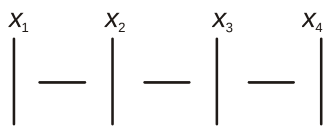
$\Rightarrow \frac{3n}{2(n-1)} = \frac{6}{7} n = 4$

79. Answer (2)

$P(A/B) = P(B/A)$

$\Rightarrow \frac{P(A \cap B)}{P(B)} = \frac{P(B \cap A)}{P(A)} \Rightarrow P(A) = P(B)$

80. Answer (2)



$x_1 + x_2 + x_3 + x_4 = 7$, $x_2, x_3 > 0$

$\Rightarrow$ Number of ways

$= \frac{{}^8C_3 \times 3! \times 7!}{10!} = \frac{7}{15}$

81. Answer (3)

$(\vec{u} - \vec{v}) \times (\vec{v} - \vec{w}) = \vec{u} \times \vec{v} + \vec{v} \times \vec{w} + \vec{w} \times \vec{u}$

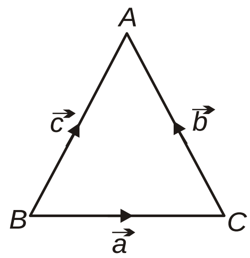
$\therefore (\vec{u} + \vec{v} - \vec{w}) \cdot (\vec{u} - \vec{v}) \times (\vec{v} - \vec{w})$

$= (\vec{u} + \vec{v} - \vec{w}) \cdot (\vec{u} \times \vec{v} + \vec{v} \times \vec{w} + \vec{w} \times \vec{v})$

$= \vec{u} \cdot \vec{v} \times \vec{w}$

82. Answer (2)

Since $\vec{a} + \vec{b} + \vec{c} = 0$, taking cross product $\vec{a}$



$\vec{a}\times\vec{b}+\vec{a}\times\vec{c}=\vec{0}$

or $\vec{a}\times\vec{b}=\vec{c}\times\vec{a}$

So, $\vec{a}\times\vec{b}=\vec{b}\times\vec{c}=\vec{c}\times\vec{a}$

83. Answer (4)

The lines are $\frac{x-b}{a}=\frac{y}{1}=\frac{z-d}{c}$

and $\frac{x-b'}{a'}=\frac{y}{1}=\frac{z-d'}{c'}$ lines are perpendicular if $aa'+1+cc'=0\cdot$

84. Answer (1)

According to condition, $1-\left(\frac{3}{4}\right)^n\geq\frac{9}{10}$

$\left(\frac{3}{4}\right)^n\leq 1-\frac{9}{10}=\frac{1}{10}\Rightarrow\left(\frac{4}{3}\right)^n\geq 10$

$n[\log 4-\log 3]\geq\log_{10}10=1$

$n\geq\frac{1}{\log_{10}4-\log_{10}3}.$

85. Answer (3)

Total noumber of cases = 3^3

Favourable cases = 3 (All three can apply for either *A* or *B* or *C* house).

Required probability $=\frac{3}{3^3}=\frac{1}{9}.$

86. Answer (2)

If $\vec{a}=\vec{b}$, then $|\vec{a}|=|\vec{b}|$

$\vec{a}.\vec{b}=\vec{a}.\vec{a}=|\vec{a}|^2$

$\vec{a}.\vec{b}=\vec{b}.\vec{b}=|\vec{b}|^2$

$\therefore\quad\vec{a}.\vec{b}=|\vec{a}|^2=|\vec{b}|^2$

But it is true, if $|\vec{a}|=|\vec{b}|$ does not implies that $\vec{a}=\vec{b}.$

87. Answer (3)

Statement-1

Given the two planes

$2x-y-z-3=0$ and $3x+y+z-5=0$

Hence line lies on the plane $5x+2z-8=0$

If $\begin{vmatrix}5 & 0 & 2\\ 2 & -1 & 1\\ 3 & 1 & 1\end{vmatrix}=0$

Hence statement-1 is correct.

Statement-2

$\left(\frac{7}{5},-\frac{3}{5},\frac{7}{5}\right)$ will be the point of intersection.

88. Answer (1)

$(x+y+z-6)+\lambda(2x+3y+4z+5)=0$ ...(1)

It passes through (4, 4, 4), then $\lambda=-\frac{6}{41}$

From (1), $29x+23y+17z=276$.

89. Answer (1)

Probability of appearing exactly five heads

$={}^{12}C_5\left(\frac{1}{2}\right)^5\left(\frac{1}{2}\right)^7$

Probability of appearing exactly 7 heads.

$={}^{12}C_7\left(\frac{1}{2}\right)^7\left(\frac{1}{2}\right)^5$

$\therefore$ Probability of appearing exactly 7 heads = Probability of appearing exactly 5 heads.

$[\because {}^{12}C_7={}^{12}C_5]$

90. Answer (4)

If $P(H_i\cap E)=0$, then $P\left(\frac{H_i}{E}\right)=P\left(\frac{E}{H_i}\right)=0$

If $P(H_i\cap E)\neq 0$ for $\forall\ i=1,2...n$

$P\left(\frac{H_i}{E}\right)=\frac{P(H_i\cap E)}{P(H_i)}\times\frac{P(H_i)}{P(E)}$

$=\frac{P\left(\frac{E}{H_i}\right)\times P(H_i)}{P(E)}>P\left(\frac{E}{H_i}\right), P(H_i)\ [0<P(E)<1]$

$\therefore\ P\left(\frac{H_i}{E}\right)\geq P\left(\frac{E}{H_i}\right)\cdot P(H_i)$

Statement-2 is correct as H_1, H_2, ...H_n are exhaustive events.