AVIRAL CLASSES
CREATING SCHOLARS
FOR JEE (Main & advance), PMTs & FOUNDATION

DATE : 12.02.2017

FINAL TEST SERIES JEE -2017
TEST-06

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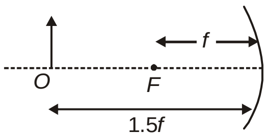
BRANCH OFFICE-2 : GMS Road, Ballupur Chowk, Dehradun (U.K.)

PH: 0135-6557701 / 02 / 03, **MOB.:** 9045062312 / 14 / 15 / 16 / 17 / 18 / 20. **web: www.aviral.co.in**

[PHYSICS]

1. Answer (3)
   Dispersion produced by a thin prism
   $q = (m_v - m_R)A$
   Here $m_v = 1.68$, $m_R = 1.56$ and $A = 18°$
   $q = (1.68 - 1.56)^2 18° = 2.16°$
2. Answer (3)



$$-\frac{1}{1.5f}+\frac{1}{v}=\frac{1}{f}$$
$v = -3f$
$$m=-\frac{v}{\mu}=\frac{-3f}{1.5f}=2$$
$$\frac{h_2}{h_1}=-2 \quad \text{or } h_2 = -2h_1 = -5 \text{ cm}$$
Image 1 is 5 cm long and inverted.
3. Answer (2)
4. Answer (1)
$$L = f_o + f_e = 105 \text{ cm}$$
$$M=\frac{f_o}{f_e}=20$$
$f_o = 100$ cm and $f_e = 5$ cm
5. Answer (3)
   Energy released = (B.E. of product – BE of reactant
   = (80 × 7 + 120 × 8 – 200 × 6.5) = 220 MeV.
6. Answer (4)
$$\sin\theta_2=\frac{2\lambda}{\Delta}=2\sin\theta_1$$
   2sin32° > 1
   which is not possible. Hence there is no second order diffraction.
7. Answer (4)
   Using $\frac{1}{\lambda}=R(z-1)^2\left[\frac{1}{n_2^2}-\frac{1}{n_1^2}\right]$
   For α particle ; $n_1 = 2$, $n_2 = 1$
   For metal A ; $\frac{1875R}{4}=R(Z_1-1)^2\left(\frac{3}{4}\right) \Rightarrow z_1 = 26$
   For metal B ; $675R = R(Z_2-1)^2\left(\frac{3}{4}\right) \Rightarrow z_2 = 31$
   Therefore, 4 elements lie between A and B,i.e. with Z = 27, 28, 29, 30
8. Answer (2)
   Angular width = 60°
$$\sin 30° = \frac{\lambda}{a}$$
$$a=\frac{\lambda}{\sin 30°}=\frac{6000\times10^{-10}}{\frac{1}{2}}=12\times10^{-7}\text{ m}$$
9. Answer (4)
10. Answer (2)
   When sources is fixed and observer is moving towards it
$$V'=\frac{c+a}{c}.V$$
   When source is moving towards observer at rest

$$V'' = \frac{c}{c-a}V' = \frac{c+a}{c-a}V = c\left[\frac{1+\frac{a}{c}}{1-\frac{a}{c}}\right]V$$

$$= c\left[1+\frac{a}{c}\right]\left[1-\frac{a}{c}\right]^{-1}$$

$$V = \left[1+\frac{2a}{c}\right]V$$

$$\Delta V = V' - V = \frac{2aV}{c} = \frac{2a}{\lambda}$$

$$a = \frac{\lambda \Delta V}{2} = \frac{0.5\times 1000}{2} = 250 \text{ m/s} = 900 \text{ km/hr}$$

11. Answer (2) 12. Answer (1) 13. Answer (2)

$$\beta = \frac{\lambda \Delta}{d}$$

$$\beta_1 - \beta_2 = \frac{\lambda(\Delta_1 - \Delta_2)}{d} \text{ or } \lambda = \frac{d(\beta_1-\beta_2)}{\Delta_1 - \Delta_2}$$

$$\lambda = \frac{3\times 10^{-5}\times 10^{-3}}{5\times 10^{2}} = 6000 \text{ Å}$$

14. Answer (1)

After first half hrs $\quad N = N_0 \frac{1}{2}$

for t = $\frac{1}{2}$ to t = $1\frac{1}{2}$ $\quad N = \left(N_0 \frac{1}{2}\right)\left[\frac{1}{2}\right]^4 = N_0\left(\frac{1}{2}\right)^5$

for t = $1\frac{1}{2}$ to t = 2 hrs. for both A and B

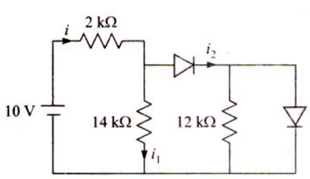
$$\frac{1}{t_{1/2}} = \frac{1}{1/2} + \frac{1}{1/4} = 2+4 = 6$$

$t_{1/2}$ = 1/6 hrs.]

$$N = \left[N_0\left(\frac{1}{2}\right)^5\right]\left(\frac{1}{2}\right)^3 = N_0\left(\frac{1}{2}\right)^8$$

15. Answer (4)

Equivalent circuit can be redrawn as follows



$$i = \frac{10}{2} = mA = i_2$$

$i_1 = 0$

16. Answer (2)

Time t = CR is known as time constant. It is time in which charge on the capacitor decreases to $\frac{1}{e}$ times of it's initial charge (steady state charge).

In figure (i) PN junction diode is in forward bias, so current will flow the circuit i.e., charge on the capacitor decrease and in time t it becomes

$Q = \frac{1}{e}(Q_0)$; where Q_0 = CV $\Rightarrow Q = \frac{CV}{e}$

In figure (ii) P-N junction diode is in reverse bias, so no current will flow through the circuit. Hence, change on capacitor will not decay and it remains same i.e. CV after time t.

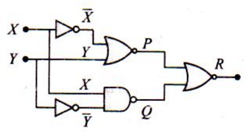
17. Answer (3)

$$eVB = \frac{mv^2}{r}$$

$$r = \frac{mv}{eB} = \frac{\sqrt{2mE}}{eB}$$

$$r = \frac{\sqrt{2\times 9.1\times 10^{-31}\times 880\times 1.6\times 10^{-19}}}{1.6\times 10^{-19}\times 2.5\times 10^{-9}} = 4 \text{ cm}$$

18. Answer (3)



The truth table can be written as

X	Y	$\bar{X}$	$\bar{Y}$	$P=\bar{X}+Y$	$Q=\overline{X\bar{Y}}$	$R=\overline{P+Q}$
0	1	1	0	1	1	0
1	1	0	0	1	1	0
1	0	0	1	0	0	1
0	0	1	1	1	1	0

Hence X = 1, Y = 0 gives output R = 1

19. Answer (1)

$$A_Z = \frac{A_V}{A_R} = \frac{2800}{3000} = 0.93$$

20. Answer (4)

$$r_i = \frac{\Delta V_{EB}}{\Delta I_e} = \frac{1.05}{2.1\times 10^{-3}} = 500\ \Omega$$

21. Answer (3)

$$\beta = \frac{\alpha}{1-\alpha} = \frac{0.98}{1-0.98} = 49$$

22. Answer (4)

For 2nd line of Balmer series in hydrogen spectrum

$$\frac{1}{\lambda} = \mathrm{R}(1)\left(\frac{1}{2^2}-\frac{1}{4^2}\right) = \frac{3}{16}\mathrm{R}$$

For Li^{2+} : $\frac{1}{\lambda} = \mathrm{R}(3)^2\left(\frac{1}{6^2}-\frac{1}{12^2}\right) = \frac{3}{16}\mathrm{R}$

Which is satisfied by only(4)

23. Answer (4)

$$\frac{1}{2}\mathrm{mv}^2 = \frac{\mathrm{hc}}{\lambda} - \phi$$

$$\frac{1}{2}\mathrm{mv}^2 = \frac{\mathrm{hc}}{(3\lambda/4)} - \phi = \frac{4\mathrm{hc}}{3\lambda} - \phi$$

Clearly $\mathrm{v}' > \sqrt{\frac{4}{3}}\mathrm{v}$

24. Answer (3)

$$\mu_A = \sqrt{\mu_1^2+\mu_2^2+\mu_3^2} = \sqrt{0.36+0.25+0.16} = 0.87$$

25. Answer (1)

Population covered = $P \times \pi d^2$, $d = \sqrt{2Rh}$

$$= P\times\pi\times 2Rh = 1000\times\frac{22}{7}\times 2\times 6.37\times 10^6\times 100\times 10^{-6}$$

$= 4 \times 10^{-6}$

26. Answer (4)

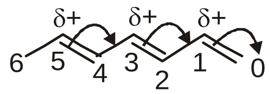
27. Answer (2)

28. Answer (1)

29. Answer (1)

30. Answer (1)

31. Answer (1)



32. Answer (3)

Options (3) is the weakest base and hence it is the best leaving group.

33. Answer (1)

Options (1) represents meso-form which contains plane of symmetry as well as centre of symmetry.

34. Answer (3)

It is S_E reaction.

35. Answer (3)

(I) is chiral but (II) is achiral so, these are diastereomers.

36. Answer (4)

Glycine is α-amino acetic acid, so it cannot give iodoform test.

37. Answer (3)

CH_2-OH / $CH-OH$ / CH_2-OH $\xrightarrow{5HI}$ $(CH_3)(H_3C)CH-I$

CH_2-OH / $CH-OH$ / CH_2-OH $\xrightarrow{3HCl}$ CH_2-Cl / $CH-Cl$ / CH_2-Cl

38. Answer (2)

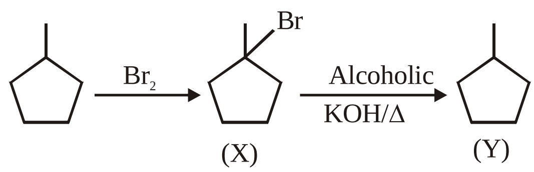
$CH_3-CH(OH)-CH_2-CH_3 \xrightarrow[-H_2O]{H^+/\Delta}$ $\left[\begin{array}{c} CH_3-CH=CH-CH \\ \text{(cis + trans)} \\ + \\ CH_3-CH_2-CH=CH_2 \\ (X) \end{array}\right]$

cis $\xrightarrow{Br_2}$ Racemic mix.

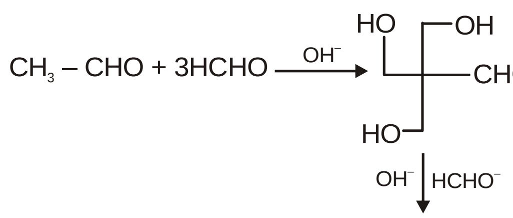
trans $\xrightarrow{Br_2}$ Meso

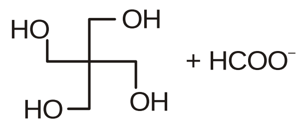
1-butene $\xrightarrow{Br_2}$ Racemic mix. (Y)

39. Answer (3)

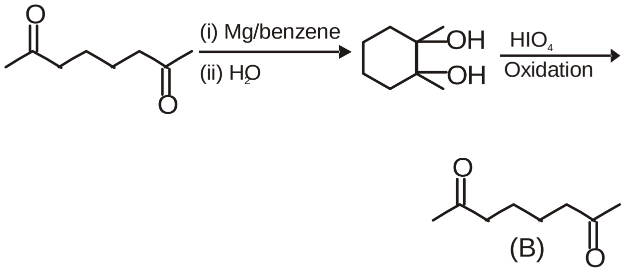


40. Answer (2)

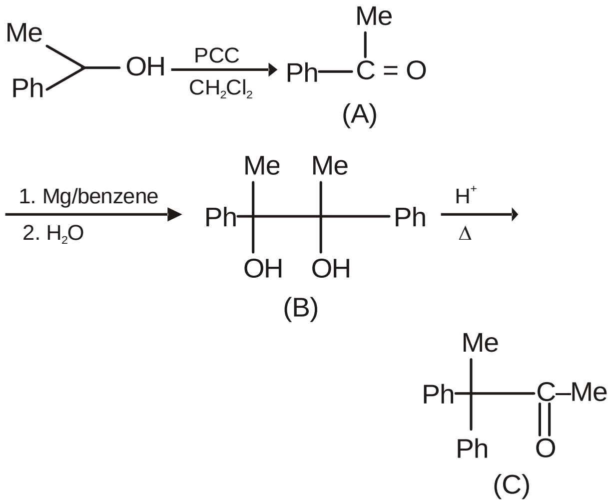




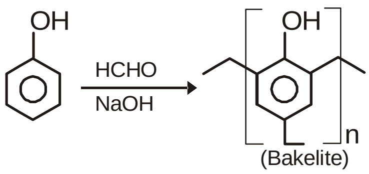
41. Answer (4)



42. Answer (2)



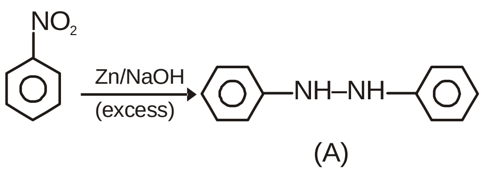
43. Answer (3)

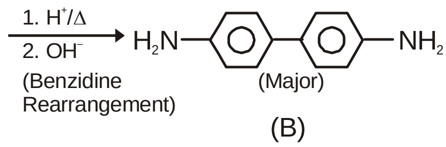


44. Answer (3)

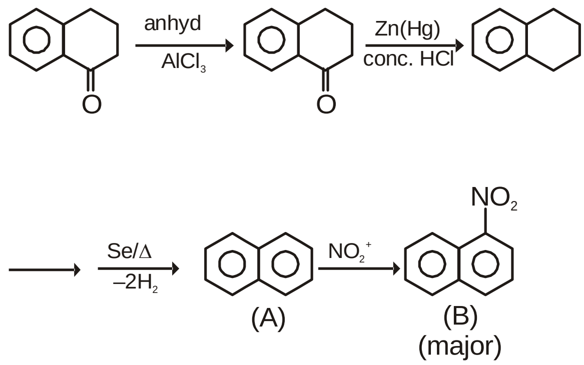
Only alkyl and acyl diazonium salts produces N_2 gas at all temperatures but aryl diazonium salts are stable in this temperature range.

45. Answer (4)





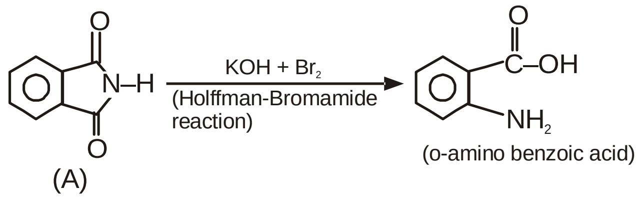
46. Answer (3)



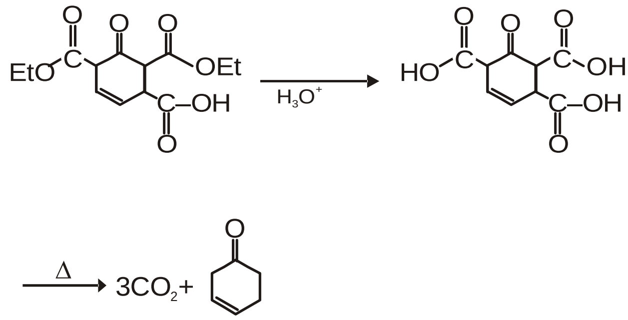
47. Answer (2)

It is Gabriel phthalimide reaction.

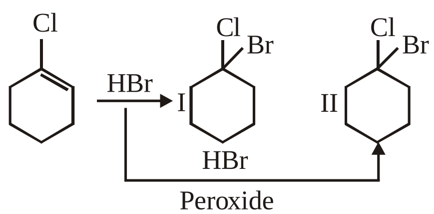
48. Answer (3)



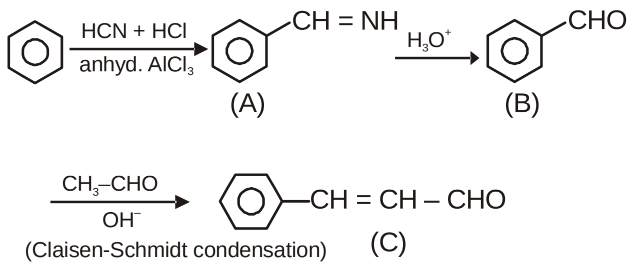
49. Answer (3)



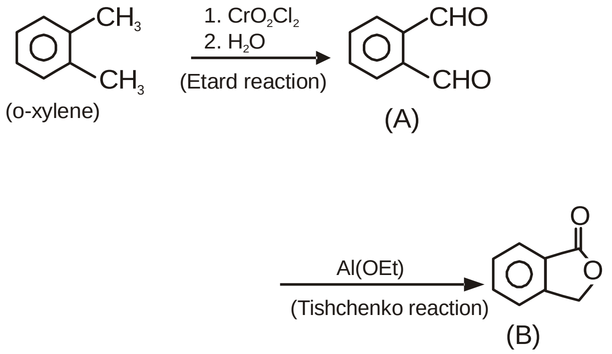
50. Answer (1)



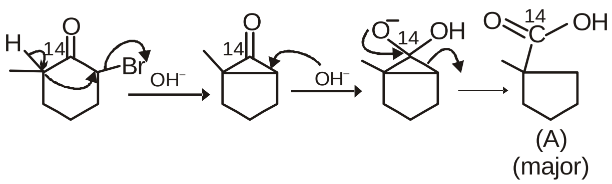
51. Answer (4)



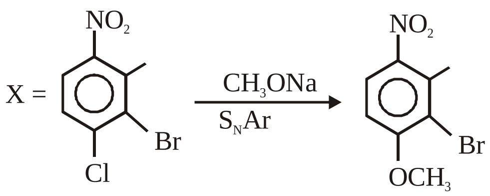
52. Answer (2)



53. Answer (1)



54. Answer (2)



55. Answer (2)

o-toluidine is less basic than aniline due to ortho effect further m- and p-toluidines are stronger bases than amiline.

56. Answer (2)

57. Answer (4)

58. Answer (1)

59. Answer (4)

60. Answer (3)

[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 $= \dfrac{1}{5\sqrt{3}}(-\hat{i}+7\hat{j}+5\hat{k})$

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

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

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 $x + y + 2 - 1 = 0$

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

$\lambda = -\frac{2}{3}$ 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 $(1 + x + x^2 + ...x^6)$

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

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

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

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

$= {}^5C_3P^3q^2 + {}^5C_4P^4q + {}^5C_5P^5$

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

78. Answer (3)

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

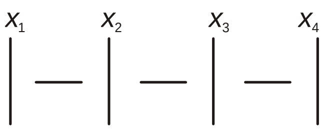
$\Rightarrow \frac{3n}{2(n-1)} = \frac{6}{7} n = 4$

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)

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

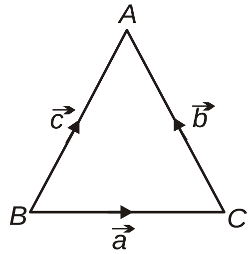
$\therefore (\vec{u}+\vec{v}-\vec{w})\cdot(\vec{u}-\vec{v})\times(\vec{v}-\vec{w})$

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

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

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

$aa'+1+cc' = 0$.

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 $|\vec{a}|=|\vec{b}|$

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

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

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

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 $\forall\ i = 1, 2 \ldots n$

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

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

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

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