Monthly Progressive Test (Solution)

Academic Excellence Programme TECHNO ACE

TECHNO INDIA GROUP PUBLIC SCHOOL

Class: XII

Subject: PCMB

Test Booklet No.: MPT010 **Test Date: 10022025**

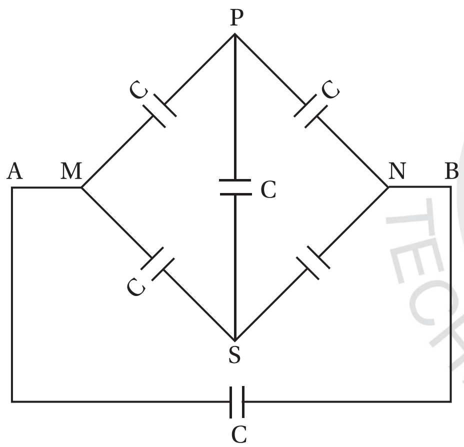
Physics

1. Ⓐ

$\phi = (CZ^2\hat{K}).(a^2)\hat{K}$

$= CZ^2a^2$ Put $Z = a$ $\therefore \phi = Ca^4$

2. Ⓓ



$\frac{C \times C}{C + C} = \frac{C}{2}$

$\frac{C}{2} + \frac{C}{2} = C$

$C \parallel C \Rightarrow 2C$

3. Ⓒ

$V = 3E - 3rI \Rightarrow 6 = 3E$ Put $I = 0$

$\therefore E = 2$ volt.

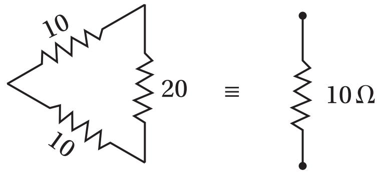
4. Ⓐ

$V = IR \Rightarrow V = \frac{E.R}{R + r} = \frac{E}{1 + \left(\frac{r}{R}\right)}$

$\left(\frac{r}{R}\right) \longrightarrow$ negligible for large value of R.

and $V \cong E$

5. Ⓑ



and so on.

finally $(20 \,||\, 30) + 8 + 10 = 12 + 18 = 30\ \Omega$

$$P = \frac{V^2}{R} = \frac{(6)^2}{30} = 1.2\ W.$$

6. Ⓑ

Semi circle: $B_1 = \frac{\mu_0}{4\pi} \cdot \frac{\pi i}{r} = 0.523 \times 10^{-5}\ T\ \odot$

Circle: $B_2 = \frac{\mu_0}{4\pi} \cdot \frac{2\pi i}{r} = 1.57 \times 10^{-5}\ T\ \otimes$

But $= (B_2 - B_1) = 1.047 \times 10^{-5}\ T\ \otimes$

7. Ⓑ

at $r = \frac{a}{2}$ $(r < a)$

$$B_1(2\pi r) = \mu_0 \cdot \frac{I}{\cancel{\pi} a^2} \cdot \cancel{\pi} r^2$$

$$B_1 = \frac{\mu_0 I}{2\pi a^2} \cdot r = \frac{\mu_0 I}{2\pi a^2} \times \frac{a}{2} \left(\text{put } r = \frac{a}{2}\right)$$

$$B_1 = \frac{\mu_0 I}{4\pi a}.$$

for $r > a$

$$B_2 \cdot 2\pi r = \mu_0 \cdot I.$$

$$= \left(\frac{\mu_0 I}{4\pi}\right) \cdot \frac{1}{a} = \frac{\mu_0 I}{4\pi a}.$$

8. Ⓒ

$$\frac{1}{2} m\upsilon^2 = q\Delta V$$

9. Ⓐ

$$R = \frac{m\upsilon \sin\theta}{qB},\ T = \frac{2\pi R}{V \sin\theta} = \frac{2\pi m}{qB}$$

$P = (T)\, V \cos\alpha.$

10. Ⓑ

$$S = \left(\frac{i_g}{i - i_g}\right) G = \frac{4 \times 10^{-3}}{6 - 0.004} \times 15 = \frac{2}{3} \times 15 \times 10^{-3} = 0.01\ \text{ohm}$$

11. Ⓒ

as $S = \frac{i_g \cdot G}{i - i_g}.$

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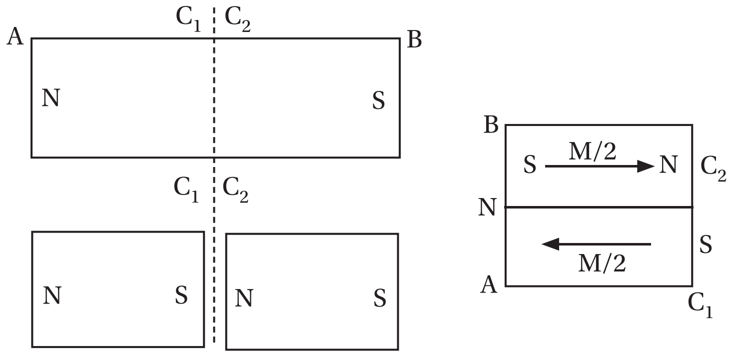
12. Ⓐ



$M_{net} = 0$

13. Ⓒ

$-1 < \chi < 0$ for Diamagnetic

$0 < \chi < 1$ for Paramagnetic

14. Ⓓ

$$B \,.\, 2\pi r = \pi_0 \,.\, I \,.\, \frac{r^2}{a^2} \,;\, B \propto r \quad \text{for } r < a$$

$$B = \frac{\mu_0 I}{2\pi r} \quad \text{for } r > a$$

15. Ⓑ

apply $\dfrac{F}{\ell} = \dfrac{\mu_0 I, I_2}{2\pi r}$.

16. Ⓑ

Conversion of mechanical work to electrical energy.
An ideal inductor has zero resistance

17. Ⓓ

$$\frac{1}{2} B\omega l^2 - \frac{1}{2} B\omega l^2 .$$

18. Ⓐ

$$e = \frac{Mdi}{dt} = 0.5 \times \frac{4}{0.04} = 50 \text{ volt.}$$

19. Ⓓ

When current I in XY is increased, then induced current in the loop in clockwise direction.

20. Ⓑ

$$e = -M\frac{di}{dt}.$$

21. Ⓐ

$$L_p = \frac{\mu_0 \mu_r N_p^2 A_p}{l_p} = \mu_0 (200)^2 \frac{A}{l}$$

$$L_q = \mu_0 (500) \times (50)^2 \times \frac{A}{l}$$

$$\frac{L_p}{L_q} = \frac{1}{500} . \left(\frac{200}{50}\right)^2 = \frac{16}{500} = 0.032$$

$$L_q = \frac{2}{0.032} ; L_q = \frac{1000}{16} = \frac{250}{4} = \frac{125}{2} = 62.5 \text{ mH}$$

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Cont.. 4

22. Ⓒ

Plano concave $\frac{1}{f_1} = (\mu - 1)\left(\frac{1}{-R} - \frac{1}{\alpha}\right)$

Plano convex $\frac{1}{f_2} = (\mu - 1)\left(\frac{1}{\alpha} - \frac{1}{-R}\right)$

$f_1 : f_2 = (-1) : 1$

23. Ⓑ

$$\frac{I_1}{I_2} = \frac{4I_0 \cos^2\left(\frac{\phi_1}{2}\right)}{4I_0 \cos^2\left(\frac{\phi_2}{2}\right)} = \left[\frac{\cos\left(\frac{\pi}{6}\right)}{\cos\left(\frac{\pi}{12}\right)}\right]^2$$

24. Ⓓ

$\lambda = \frac{h}{p} \Rightarrow \lambda . \rho = h$

The graph is rectangular hyperbola.

25. Ⓐ

Angular momentum, $L = n . \left(\frac{h}{2\pi}\right)$

$\therefore \frac{L_H}{L_{Li^{++}}} = 1$

Chemistry

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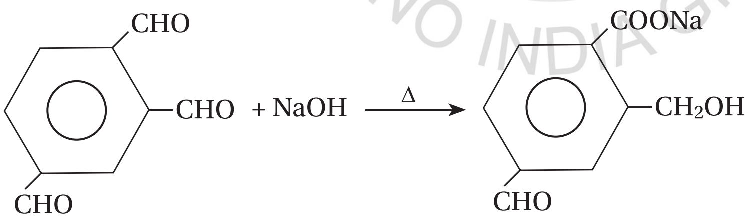
26. Ⓓ



(Main Product)

This is Cannizaro reaction. Cannizaro reaction mainly takes place at ortho position.

27. Ⓐ

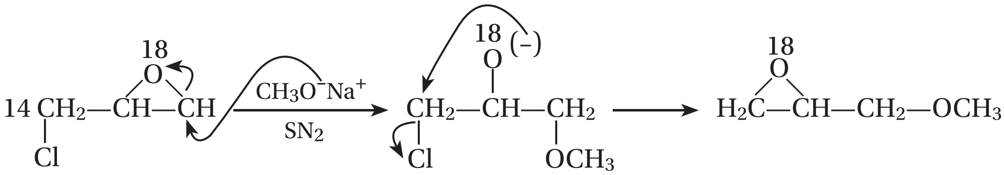
$Yb^{3+} < Pb^{3+} < Ce^{3+} < La^{3+}$

Ionic radii of Lanthanides decrease across the series due to Lanthanide contraction. Lanthanide contraction due to in effective shielding produce by larger f-shell.

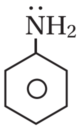
28. Ⓓ

Sucrose does not contain C_1–C_4 glycosidic linkage. Sucrose has C_1–C_2 linkage.

29. Ⓐ

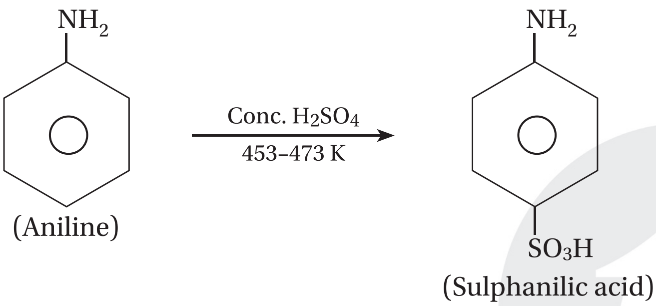


30. Ⓐ

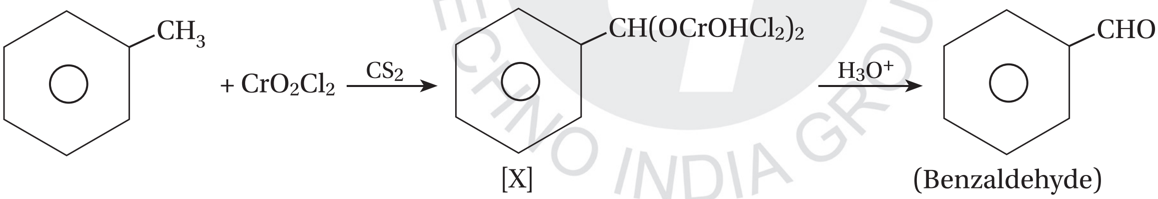
Aniline  is the weakest Bronsted base as it is aromatic. Due to resonance lone pair is delocalised in benzene nucleus.

Aliphatic amines are more basic due to absence of resonance.

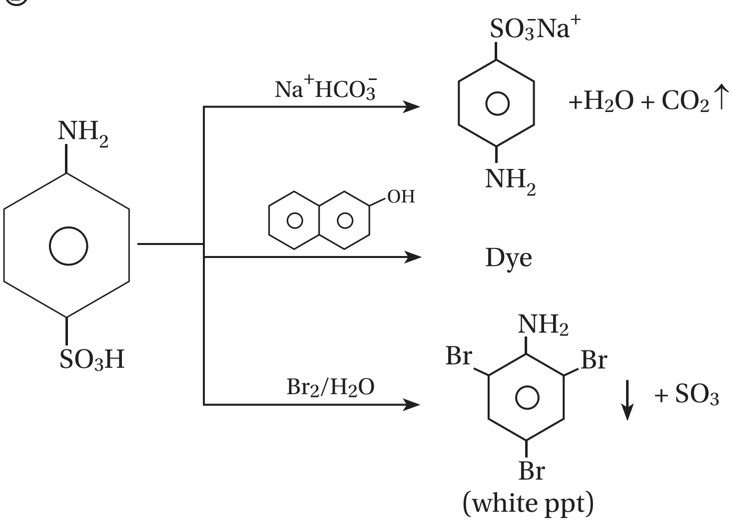
31. Ⓒ



32. Ⓑ



33. Ⓑ



34. Ⓓ

Isomers that differ only in configuration at C–1 are called anomers.

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35. Ⓐ

Greater the number of alkyl groups attached to the carbonyl group, lower will be its reactivity : III > II > I.

36. Ⓑ

$$\text{Pate}\frac{1}{4}\frac{\left[d\left(NO_2\right)\right]}{dt}\frac{1}{4}\times 0.0125\ \ 0.2031\text{mol}\left(L^{-1}\right)(S)^{-1}$$

37. Ⓐ

Both assertion and reason are correct and reason is the correct explanation of assertion.

38. Ⓑ

Both assertion and reason are correct but reason is not the correct explanation of assertion.

39. Ⓑ

Both assertion and reason are correct but reason is not the correct explanation of assertion.

$$t_{1/2} = \frac{2.303}{k_1}\log_{10} 2$$

40. Ⓑ

Enzymes are very specific for a particular reaction. This is correct. Enzymes are biocatalysts. This is also correct. But not the correct explanation of assertion.

41. Ⓒ

Glucose decolourises orange yellow colour, but fructose does not.

$$\underset{\text{D (+) glucose}}{\begin{matrix} CHO \\ | \\ (CHOH)_4 \\ | \\ CH_2OH \end{matrix}} \xrightarrow[Br_2/H_2O]{[O]} \underset{\text{D (+) gluconic acid}}{\begin{matrix} COOH \\ | \\ (CHOH)_4 \\ | \\ CH_2OH \end{matrix}} + 2HBr$$

42. Ⓒ

Glucose does not react with sodium bisulphite

43. Ⓓ

Fructose reduces Tollen's reagent due to enolisation of fructose followed by conversion to aldehyde by base.

44. Ⓒ

$$Na_2SO_4 \rightleftharpoons 2Na^+ + SO_4^{2-} \quad [\therefore\ n = 3]$$

As the solutions are isotonic,

$$i_{Na_2SO_4}\ C_{Na_2SO_4} = C_{C_6H_{12}O_6}$$

$$\Rightarrow\ i_{Na_2SO_4} = \frac{0.01}{0.004} = 2.5$$

$$\therefore\ \alpha = \frac{1-i}{1-n} = \frac{1-2.5}{1-3} = \frac{+1.5}{+2} = 0.75$$

So, degree of dissociation (α) = 75%

45. Ⓐ

The equation of Swart's-reaction is: $R-X+AgF \xrightarrow{\text{Acetone}} R-F+AgX$

(where, X = Cl, Br)

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46. Ⓐ

DNA has 4 pairs of nitrogenous bases as — adenine, guanine, thyamine and cytosine. Out of them adenine pairs with thyamine and guanine pairs with cytosine.

47. Ⓐ

Spin only magnetic moment of $Cr(CO)_6$ is zero as the all six electrons are pair. CO is the strongest ligand.

$\mu = \sqrt{n(n+2)}\ BM = 0$

48. Ⓓ

In $[NiCl_4]^{2-}$ complex: It involves sp^3 hybridisation. It is paramagnetic and tetrahedral. It has two unpaired electrons.

49. Ⓒ

$KMnO_4$ is deep pink colour due to charge transfer.

50. Ⓑ

$E^o_{cell} = -0.42 - (-0.72) = +0.3V$

Cell Reaction is: $2Cr + 3Fe^{2+} \longrightarrow 2Cr^{3+} + 3Fe\ ;\ n = 6$

$$E_{cell} = E^o_{cell} - \frac{0.0591}{6}\log_{10}\frac{[Cr^{3+}]^2}{[Fe^{2+}]^3}$$

$$= +0.30 - \frac{0.0591}{6}\log_{10}\frac{(0.1)^2}{(0.01)^3}$$

$$= +0.30 - \frac{0.0591}{6}\times 4$$

$$= +0.30 - 0.04 = +0.26V$$

Mathematics

51. Ⓐ

$$I = \int\frac{(\sin^4 x)^2 - (\cos^4 x)^2}{(1 - 2\sin^2 x.\cos^2 x)}$$

$$= \int\frac{(\sin^4 x + \cos^4 x)\ (\sin^4 x - \cos^4 x)}{(1 - 2\sin^2 x.\cos^2 x)}$$

$$= \int(\sin^2 x - con^2 x)\,dx$$

$$= \int \cos 2x dx = -\int \cos 2x$$

$$= -\frac{\sin 2x}{2} + C$$

$$\therefore\ a = -\frac{1}{2}$$

52. Ⓑ

$$I=\int\frac{dx}{x(x^7+1)}$$

$$=\int\frac{dx}{x^8\left(1+\frac{1}{x^7}\right)}$$

put $1+\frac{1}{x^7}=t$

$$\therefore\ I=\frac{-1}{7}\int\frac{dt}{t}$$

$$=-\frac{1}{7}\log^t{}_e + c$$

$$=\frac{1}{7}\log\left|\frac{x^7}{x^7+1}\right|+c.$$

53. Ⓐ

wkt, $\int e^{ax}\sin bx=\frac{e^{ax}}{a^2+b^2}$ [a sinx bx – b cos bx] = u

$\int e^{ax}\cos bx=\frac{e^{ax}}{a^2+b^2}$ [a cos bx + b sin bx] = v

$$\frac{u}{v}=\frac{a\sin bx-b\cos bx}{a\cos bx+b\sin bx}$$

$$=\frac{\tan bx-\frac{b}{a}}{1+\frac{b}{a}\tan bx}=\tan(bx-\alpha)\text{ where }\alpha=\tan^{-1}\left(\frac{b}{a}\right)$$

$$\therefore\ \tan^{-1}(\tan(bx-\alpha))+\tan^{-1}\left(\frac{b}{a}\right)$$

$$=bx-\alpha+\tan^{-1}\left(\frac{b}{a}\right)$$

$$=bx-\tan^{-1}\left(\frac{b}{a}\right)+\tan^{-1}\left(\frac{b}{a}\right)$$

$$=bx.$$

54. Ⓑ

$$\lim_{n\to\infty}\frac{(n!)^{\frac{1}{n}}}{n^n}=e^{\lim_{n\to\infty}\frac{1}{n}\log_e n!/n^n}$$

Let, $L=\lim_{n\to\infty}\frac{1}{n}\log\frac{n!}{n^n}$

$$=\lim_{n\to\infty}\frac{1}{n}\log\frac{1\times}{n}\frac{2\times}{n}\cdots\cdots\frac{xn}{n}$$

$$=\lim_{x\to\infty}\frac{1}{n}\sum_{r=1}^{n}\log\left(\frac{r}{n}\right)$$

$= \int_0^1 \log x \, dx$

$= [x(\log x - 1)]_0^1$

$= -1.$

$\therefore e^{-1}$

55. Ⓑ

$I = \int_0^{\frac{\pi}{2}} \frac{dx}{a\cos^2 x + b^2 \sin^2 x}$

$= \int_0^{\frac{\pi}{2}} \frac{\text{see}^2 x \, dx}{a^2 + b^2 + ax^2 x}$

put $\tan x = t$

$\Rightarrow \text{see}^2 x \, dx = dt$

$= \int_0^{\infty} \frac{dt}{a^2 + b^2 t^2} = \frac{1}{ab}\left[\tan^{-1}\left(\frac{bt}{a}\right)\right]_0^{\infty} = \frac{\pi}{2ab}$

56. Ⓒ

Let, $f(x) = e^{x^2}$

$\int'(x) = 2x\, e^{x^2} > 0 \; \forall \; x \in [0, 1]$

$\Rightarrow$ f(x) is increasing

$m = e^0 = 1$

$\mu = e^{1^2} = e$

$1 < \int_0^1 e^{x^2} \, dx < e$

$\therefore \int_0^1 e^{x^2} \, dx \in (1, e)$

57. Ⓐ

$\not{2} \int_0^{\sqrt{3k}} \left(3 - \frac{x^2}{k}\right) dx = \not{12}\; 6$

$\Rightarrow \left(3x - \frac{x^3}{3k}\right)_0^{\sqrt{k}} = 6$

$\Rightarrow \quad 2\sqrt{3k} = 6$

$\Rightarrow \sqrt{3k} = 3$

$\Rightarrow 3k = 9$

$\therefore k = 3.$

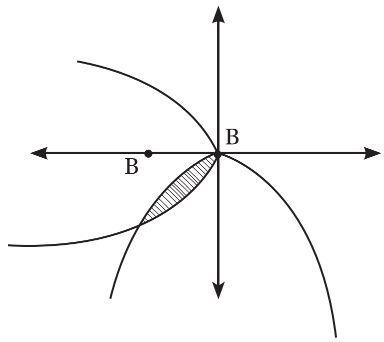
58. Ⓐ

$y = -\sqrt{-x}$ .... (1)

$x = -\sqrt{-y} \Rightarrow x^2 = -y$ .... (2)

① ∩ ② :- x = 0, –1

$$\text{Area} = \int_{-1}^{0} (\sqrt{-x} - x^2)\,dx = \frac{1}{3}$$



59. Ⓑ

$$\frac{d^2x}{dt^2} + n^2x = 0$$

60. Ⓐ

$$\frac{y^2}{x} = 4a$$

$$\Rightarrow \frac{2y.\frac{dy}{dx} - x - y^2}{x^2} = 0$$

$$\Rightarrow 2xy\frac{dy}{dx} - y^2 = 0$$

for orthogonal trajectory,

$$\Rightarrow 2xy\frac{-dx}{dy} - y^2 = 0 \quad (\text{Replace } \frac{dy}{dx} \text{ by } \frac{-dx}{dy})$$

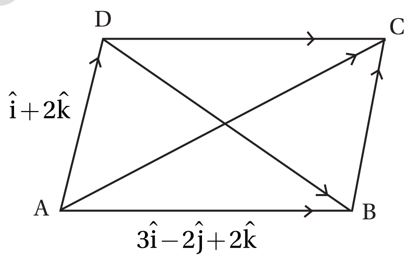
$$\Rightarrow 2xy\frac{dx}{dy} + y^2 = 0$$

$$\Rightarrow 2x\,dx + y\,dy = 0$$

$$\Rightarrow \frac{2x^2}{2} + \frac{y^2}{2} = c_1$$

$$\Rightarrow 2x^2 + y^2 = c$$

61. Ⓑ



$\overrightarrow{AC} = \overrightarrow{AB} + \overrightarrow{BC}$

$= 3\hat{i} - 2\hat{j} + 2\hat{k} + \hat{i} + 2\hat{k}$

$= 4\hat{i} - 2\hat{j} + 4\hat{k}$

$\overrightarrow{DB} = \overrightarrow{AB} - \overrightarrow{AD}$

$= 2\hat{i} - 2\hat{j}$

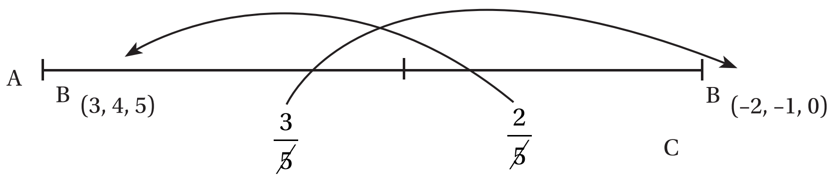
$|\overrightarrow{AC}| = 6, \qquad |\overrightarrow{DB}| = 2\sqrt{2}$

$\overrightarrow{AC} \cdot \overrightarrow{DB} = 12$

$$\therefore \cos\theta = \frac{\overrightarrow{AC}.\overrightarrow{DB}}{|\overrightarrow{AC}|\,|\overrightarrow{DB}|} = \frac{12}{6.2\sqrt{2}} = \frac{1}{\sqrt{2}}$$

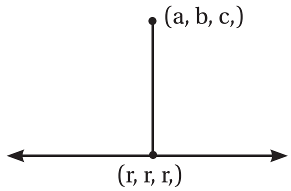
$$= \theta = \frac{\pi}{4}$$

62. Ⓐ



$$\left(\frac{-6+6}{5}, \frac{-3+8}{5}, \frac{0+10}{5}\right) = (0,1,2)$$

63. Ⓑ

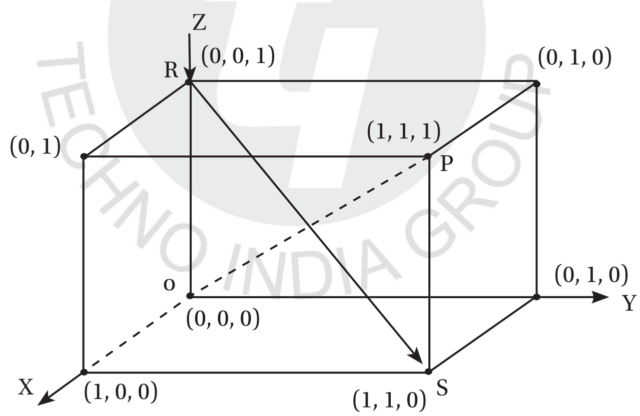


$$\frac{x}{1}=\frac{y}{1}=\frac{z}{1}$$

$$(a-r).1+(b-r).1+(c-r).1=0$$

$$\Rightarrow r=\frac{a+b+c}{3}$$

64. Ⓒ



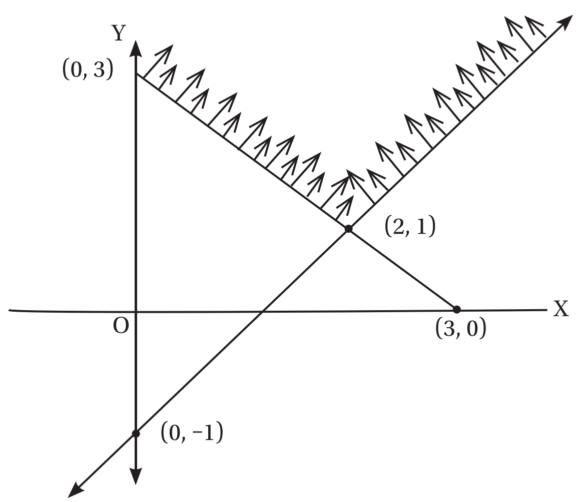
$$\overrightarrow{OP}=(1,1,1)$$

$$\overrightarrow{RS}=(1,1,-1)$$

$$\cos\theta=\frac{1+1+(-1)}{\sqrt{3}.\sqrt{3}}=\frac{1}{3}$$

$$\theta=\cos^{-1}\left(\frac{1}{3}\right)$$

65. Ⓒ



$Z_{min} = 3x + 3y$

s.t $\quad x - y \le 1$

$\quad\quad x + y \ge 3$

$Z_{min}\,(0, 3) = 0 + 3.3 = 9$

$Z_{min}\,(2, 1) = 3 \times 2 + 3 \times 1 = 9$

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66. Ⓒ

$P(A)=\frac{1}{4},\ P(B)=\frac{1}{5},\ P(A\cap B)=\frac{1}{8}$

$P(A\cup B)=\frac{1}{4}+\frac{1}{5}-\frac{1}{8}=\frac{13}{40}$

$1-P(A\cup B)=\frac{27}{40}$

$\Rightarrow\ P(\overline{A\cup B})=\frac{27}{40}\ \Rightarrow\ P(\bar{A}\cap\bar{B})=\frac{27}{40}$

$\Rightarrow\ P\left(\frac{\bar{A}}{B}\right)=\frac{P(\bar{A}\cap\bar{B})}{1-P(\bar{B})}=\frac{\frac{27}{40}}{\frac{4}{5}}=\frac{27}{32}$

67. Ⓐ

1 white + 3 others
2 white + 2 others
3 white + 1 other
4 white + other
} out of 4 case 1 case will happen.

P (white) = $\frac{1}{4}\times\frac{1}{4}+\frac{1}{4}\times\frac{2}{4}+\frac{1}{4}\times\frac{3}{4}+\frac{1}{4}\times\frac{4}{4}$

$=\frac{1}{4}\left(\frac{1}{4}+\frac{2}{4}+\frac{3}{4}+\frac{4}{4}\right)$

$=\frac{1}{4}\times\frac{10}{4}$

P (all white | white drawn) = $\frac{\frac{1}{4}\times\frac{4}{4}}{\frac{1}{4}\times\frac{10}{4}}=\frac{2}{5}$

68. Ⓒ

Now, $p(x=0)+p(x=1)+p(x=2)+p(x=3)+p(x=4)=1$

$\Rightarrow 6k=1-.1=.9\ \Rightarrow k={}^{3}/_{20}$

$\therefore\ p(x=2)+p(x=3)+p(x=4)=5k=\cancel{5}\times\frac{3}{\cancel{20}}=\frac{3}{4}=0.75$

69. Ⓓ

$\frac{x^4-2x^3+3x^2-2x+2}{2x^2-2x+1}>0$ (here D^r is always positive)

$\Rightarrow x^4-2x^3+3x^2-2x+2>0.$

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

$\Rightarrow \left(\underbrace{x^2-x}_{\geq 0}\right)^2+2\left(\underbrace{x^2-x+1}_{>0}\right)>0$

$\forall x\ \ N^r>0$.

$D_f=R$.

70. Ⓓ

$|A|=-2$

$A \to 3 \times 3$

$\det(\text{adj}(\text{adj}(-3A))) = 2^a \cdot 3^b$

$\Rightarrow |-3A|^{(n-1)^2} = 2^a \cdot 3^b$

$\Rightarrow |-3A|^4 = 2^a \cdot 3^b$

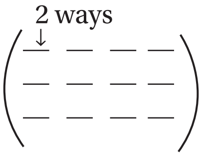
$\Rightarrow (-3)^{3\times4} \cdot |A|^4 = 2^a \cdot 3^b$

$\Rightarrow 3^{12} \cdot 2^4 = 2^a \cdot 3^b$

$\therefore\ a = 4,\ b = 12$

$4b + 2a = 4 \times 12 + 2 \times 4 = 56$

71. Ⓑ

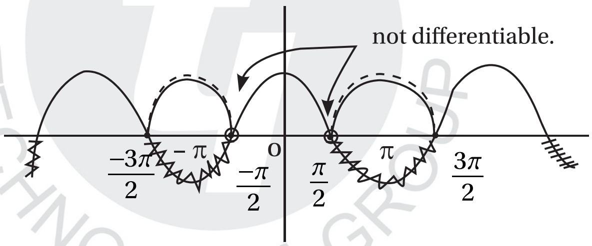
A ⟶ 2^9 way 

A is true

B ⟶ ${}^nC_r = \dfrac{n!}{r!(n-r)!}$ true

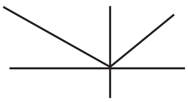
but not correct explanation.

72. Ⓒ

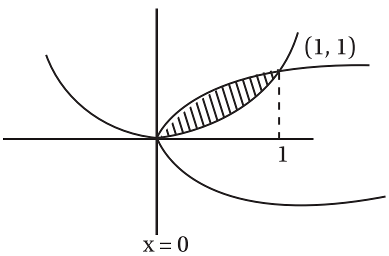


A is true.

 this part is discarded.

R is false  $y = |x|$ continuous but not differentiable.

73. Ⓓ

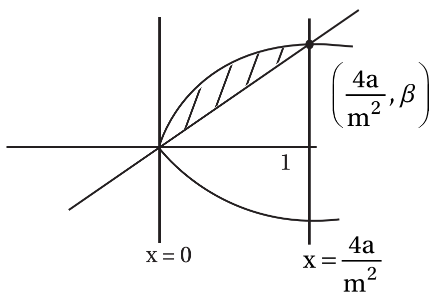


$$\int_0^1 (\sqrt{x} - x^2)\,dx = \frac{1}{3}$$

74. Ⓒ

$$\text{Area} = \int_0^{\frac{4a}{m^2}} \left(\sqrt{4ax} - mx\right) dx$$

$$= \frac{8a^2}{3m^3}$$



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75. Ⓑ

Area of an ellipse = πab

$= \pi.5.4$

$= 20\pi$

Biology

76. Ⓑ

Apomixis

77. Ⓑ

FSH

78. Ⓑ

One secondary oocyte and first polar body

79. Ⓑ

Determine any hereditary disease of the embryo

80. Ⓐ

Males and females, respectively

Insects show XO-XX type of sex determination; XO in males and XX in females

81. Ⓑ

Chromosome 1 and Y

2968 genes and 231 genes, respectively

82. Ⓒ

Pliohippus

83. Ⓐ

Opioid

84. Ⓒ

Cyanobacteria used as biofertilizer

85. Ⓑ

Exonuclease

86. Ⓒ

Toxin is inactive

87. Ⓓ

All

88. Ⓐ

50%

89. Ⓐ

Germplasm

90. Ⓑ

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Competition

91. Ⓓ

Commensalism

The orchid gets shelter and nutrition from the mango tree, while the mango tree is neither benefited nor harmed

92. Ⓑ

Mutualism

Mycorrhizae are close association between fungi and roots of higher plants. The fungi helps the plants for absorption of nutrients, while the plant provides food and protection for the fungus

93. Ⓓ

Blastocyst

94. Ⓓ

It gets attached to the endometrium of the uterus

95. Ⓓ

After implantation

These villi sprout from the area of chorion in order to ensure that the area of contact with the maternal blood is maximised

96. Ⓒ

A is true but R is false

Endosperm stores food for the embryo

97. Ⓐ

Both A and R are true and R is the correct explanation of A

In the presence of both alleles, the individual shows AB blood group

98. Ⓑ

Both A and R are true, but R is not the correct explanation of A

99. Ⓑ

Both A and R are true, but R is not the correct explanation of A

100. Ⓐ

Both A and R are true and R is the correct explanation of A

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