Monthly Progessive Test

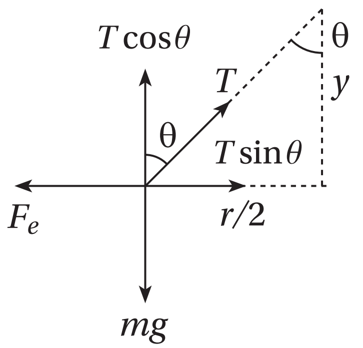
Class: XII

Subject: PCMB

Solution

Physics

1. (D)



$\tan\theta = \dfrac{F_e}{mg} = \dfrac{r/2}{y} = \dfrac{r}{2y}$

2nd case: $\tan\theta' = \dfrac{F_e'}{mg} = \dfrac{r'}{2(y/2)} = \dfrac{r'}{y}$

$\therefore \dfrac{mg}{y} = \dfrac{2F_e}{r}$ ... (1)

$\dfrac{mg}{y} = \dfrac{F_e'}{r'}$ ... (2)

From (1) and (2)

$\dfrac{2F_e}{r} = \dfrac{F_e'}{r'} \quad \Rightarrow \dfrac{2r'}{r} = \dfrac{F_e'}{F_e} = \dfrac{r^2}{r'^2} \quad \Rightarrow 2(r')^3 = r^3 \quad \Rightarrow \sqrt[3]{2}(r') = r \quad \therefore r' = \dfrac{r}{\sqrt[3]{2}}$

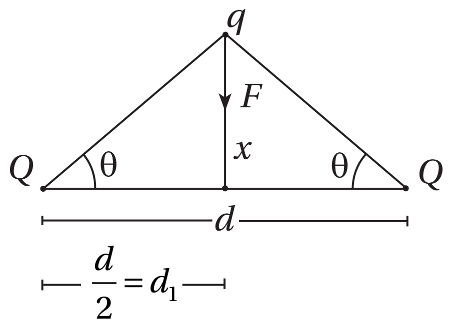
2. (A)

F_0 (air) $= F_m$ (medium)

$$\frac{1}{4\pi\varepsilon_0}\cdot\frac{q_1\cdot q_2}{d^2} = \frac{1}{4\pi(k\varepsilon_0)}\cdot\frac{q_1\cdot q_2}{d^2}$$

$\Rightarrow d_0^2 = kd^2 \quad \Rightarrow d_0 = d\sqrt{k}$

3. Ⓓ



$$F=\frac{1}{4\pi\varepsilon_0}\cdot\frac{2Qq}{\left(d_1^2+x^2\right)}\cdot\sin\theta=\frac{2Qq}{4\pi\varepsilon_0}\cdot\frac{x}{\sqrt{d_1^2+x^2}}\cdot\frac{1}{\left(d_1^2+x^2\right)}$$

$$F=\frac{2Qq}{4\pi\varepsilon}\cdot\frac{x}{\left(d_1^2+x^2\right)^{3/2}}=\frac{Qq}{4\pi\varepsilon_0}\left[x\cdot\left(d_1^2+x^2\right)^{-3/2}\right]$$

$$\frac{dF}{dx}=\frac{Qq}{2\pi\varepsilon_0}\cdot\left[1\cdot\left(d_1^2+x^2\right)^{-3/2}+x\cdot\left(\frac{-3}{2}\right)\left(d_1^2+x^2\right)^{-5/2}\cdot 2x\right]=0$$

$$\Rightarrow\left(d_1^2+x^2\right)^{-3/2}=3x^2\cdot\frac{\left(d_1^2+x^2\right)^{-3/2}}{\left(d_1^2+x^2\right)}\quad\Rightarrow d_1^2+x^2=3x^2\quad\Rightarrow 2x^2=d_1^2$$

$$\therefore\ x=\frac{d_1}{\sqrt{2}}=\frac{d}{2\sqrt{2}}$$

4. Ⓑ

$$dq=(4\pi r^2)(dr)(\phi(r))$$

$$\Rightarrow dq=4\pi r^2\cdot\frac{A}{r^2}\cdot e^{-2r/a}\,dr$$

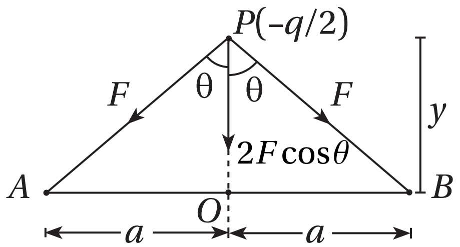
$$\Rightarrow Q=4\pi A\int_0^R e^{-2r/a}dr\qquad\Rightarrow Q=4\pi A\cdot\left(-\frac{a}{2}\right)[e^{-2r/a}]_0^R$$

$$\Rightarrow Q=-2\pi Aa\cdot\left[e^{-2R/a}-1\right]\qquad\Rightarrow-\frac{Q}{2\pi Aa}=e^{-2R/a}-1$$

$$\Rightarrow e^{-2R/a}=1-\frac{Q}{2\pi Aa}\qquad\Rightarrow-2R/a=\ln\left(1-\frac{Q}{2\pi Aa}\right)$$

$$\Rightarrow R=\frac{a}{2}\log\left(1-\frac{Q}{2\pi Aa}\right)^{-1}=\frac{a}{2}\cdot\log\left[\frac{1}{1-\frac{Q}{2\pi aA}}\right]$$

5. Ⓐ

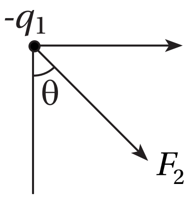


$$F_{\text{net}} = 2F\cos\theta = \frac{kq^2 y}{(a^2+y^2)^{3/2}}$$

$$F_{\text{net}} = \frac{kq^2 y}{a^3}, \text{ where } y << a$$

$\therefore F_{\text{net}} \propto y$

6. Ⓑ



$$F_1 = \frac{1}{4\pi\varepsilon_0}\cdot\frac{q_1\cdot q_2}{b^2}$$

$$F_2 = \frac{1}{4\pi\varepsilon_0}\cdot\frac{q_1\cdot q_3}{a^2}$$

$$F_x = F_1 + F_2\sin\theta = \frac{1}{4\pi\varepsilon_0}\cdot q_1\left[\frac{q_2}{b^2}+\frac{q_3}{a^2}\sin\theta\right]$$

$$F_x \propto \frac{q_2}{b^2}+\left(\frac{q_3}{a^2}\right)\sin\theta$$

7. Ⓓ

q_1 must be positive, q_2 must be negative and $\left|\frac{q_1}{q_2}\right| = \frac{12}{6} = 2 \quad \Rightarrow |q_1| = 2|q_2|$

8. Ⓐ

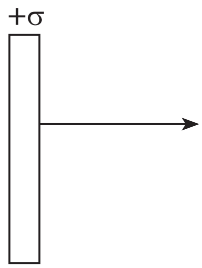
$$l = v(t) \quad \Rightarrow t = \left(\frac{l}{v}\right)$$

y direction: $h = \frac{1}{2}\cdot a_y t^2 = \frac{1}{2}\cdot\left(\frac{qE}{m}\right)\cdot\frac{l^2}{v^2}$

$$\Rightarrow \frac{2hv^2}{El^2} = \left(\frac{q}{m}\right) = \text{charge to mass ration}$$

9. (D)

10. (A)



$$E=\frac{\sigma}{2\varepsilon_0}(\hat{k})$$

$$W=\overrightarrow{qE}\cdot\left(\overrightarrow{dl}\right)=\left(\frac{q\sigma}{2\varepsilon_0}\right)a(6-3)=\frac{3q\sigma a}{2\varepsilon_0}$$

12. (C)

$$E\left(4\pi r^2\right)=\frac{\int_0^r p_0\left(\frac{3}{4}-\frac{r}{R}\right)\cdot 4\pi r^2\,dr}{\varepsilon_0}$$

$$=\frac{4\pi p_0}{\varepsilon_0}\cdot\int_0^r\left(\frac{3}{4}\cdot r^2-\frac{r^3}{R}\right)dr$$

$$E\cdot\cancel{4\pi}\cdot r^2=\frac{\cancel{4\pi}p_0}{\varepsilon_0}\cdot\left[\frac{\cancel{3}}{4}\frac{r^3}{\cancel{3}}-\frac{r^4}{4R}\right]$$

$$E=\frac{p_0}{\varepsilon_0}\cdot\left[\frac{r}{4}-\frac{r^2}{4R}\right]=\frac{p_0}{4\varepsilon_0}\cdot r\cdot\left[1-\frac{r}{R}\right]$$

13. (B)

$$a_y=\frac{eE}{m}=\frac{e}{m}\cdot\frac{8m}{e}=8\text{ m/s}^2$$

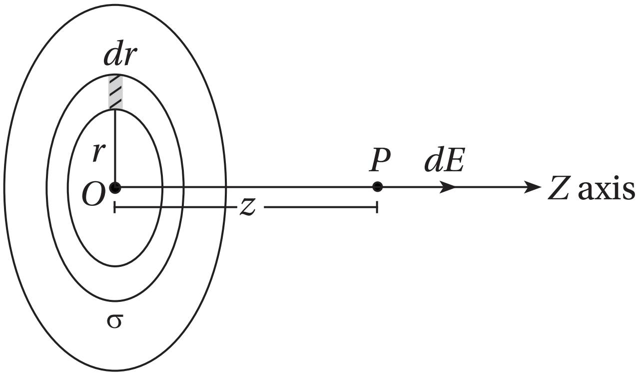
x direction : $1=(2)(t)\quad\Rightarrow\ t=0.5\text{ s}$

y direction :

$v_y=a_y\cdot t=4\text{ m/s}$

$$\tan\theta=\frac{V_y}{V_x}=\frac{4}{2}=2\quad\therefore\theta=\tan^{-1}(2)$$

14. Ⓐ



$$dE = \frac{k\sigma(2\pi r)dr \cdot z}{\left(r^2 + z^2\right)^{3/2}}$$

$$E = \int_0^R dE = \frac{\sigma}{2\varepsilon_0}\left[1 - \frac{z}{\sqrt{R^2 + z^2}}\right]$$

15. Ⓑ

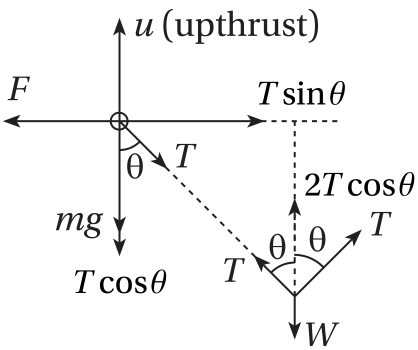
Charge per unit length of rod

$$\lambda = \left(\frac{-Q}{R \cdot \frac{2\pi}{3}}\right) = \frac{-3Q}{2\pi R}$$

$$E = \int dE \cos\theta$$

$$= \int_{-\pi/3}^{\pi/3} \frac{k(Q)}{\frac{2\pi R}{3}} \times \frac{R\,d\theta}{R^2}\cos\theta = \frac{3}{2\pi} \cdot \frac{kQ}{R} \cdot \frac{2\sqrt{3}}{2} = \frac{3\sqrt{3}Q}{8\pi^2\varepsilon_0 R^2}(+\hat{i})$$

16. Ⓐ



$$2T\cos\theta = W, \quad T\sin\theta = F$$

$$\therefore \frac{\tan\theta}{2} = \frac{F}{W} \quad \Rightarrow F = W\frac{\tan\theta}{2}$$

$$\frac{q^2}{4\pi\varepsilon_0(2x)^2} = \frac{W\tan\theta}{2} \qquad \therefore q = \left(\sqrt{8W\tan\theta\pi\varepsilon_0}\right)x$$

17. Ⓐ

As $E \propto \frac{1}{r^2}$

18. Ⓑ

19. Ⓒ

Use $E_x = \frac{\lambda}{4\pi\varepsilon_0}\cdot\frac{1}{r}$ $\qquad E_y = \frac{\lambda}{4\pi\varepsilon_0 r}$ $\qquad \therefore \tan\theta = \frac{E_y}{E_x} = 1$ $\qquad \theta = 45°$

20. Ⓒ

We know, for a disc

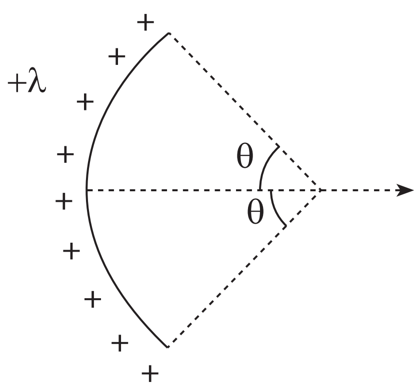
$$E_x = \frac{\sigma}{2\varepsilon_0}\left[1 - \frac{x}{\sqrt{x^2+R^2}}\right]$$

If $R >> x$, $\left(\frac{1}{\sqrt{1+\frac{R^2}{x^2}}}\right) \to 0$

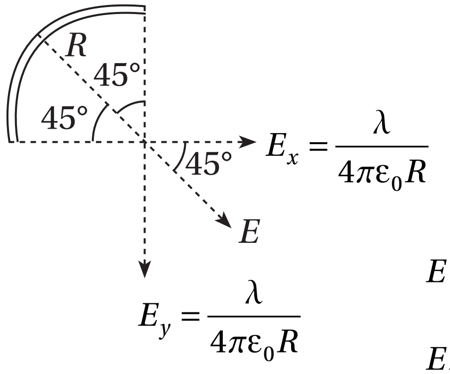
and we get, $\quad E_x = \frac{\sigma}{2\varepsilon_0}$

21. Ⓐ

Quarter circular ring having charge density λ, apply the concept



$$E = \frac{1}{4\pi\varepsilon_0}\cdot\left(\frac{\lambda}{R}\right)\cdot 2\sin\theta$$

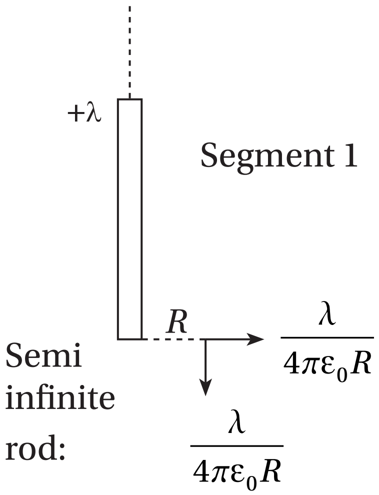


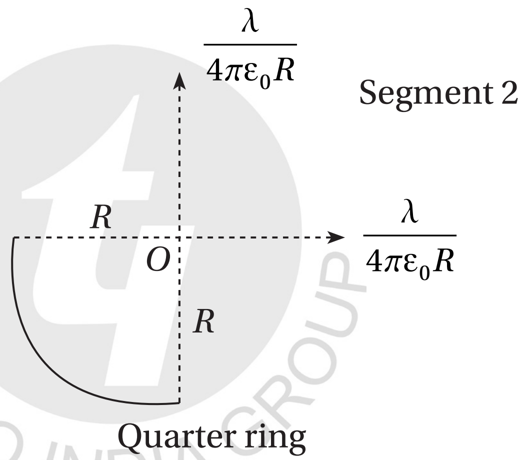
$$E = \left[\frac{\lambda}{4\pi\varepsilon_0 R}\cdot\sqrt{2}\right]$$

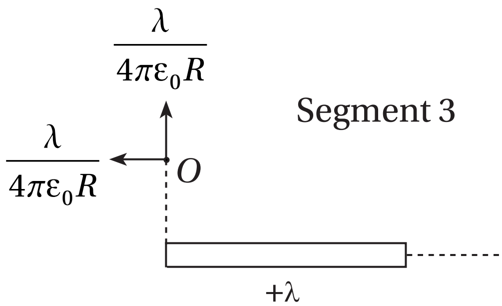
$$E_x = E\cos 45^\circ$$

$$E_y = E\sin 45^\circ$$

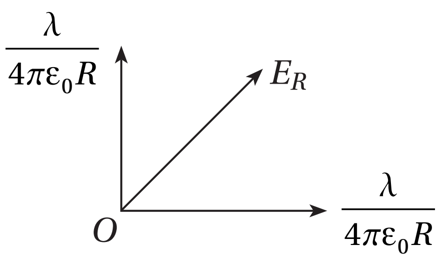
22. Ⓑ





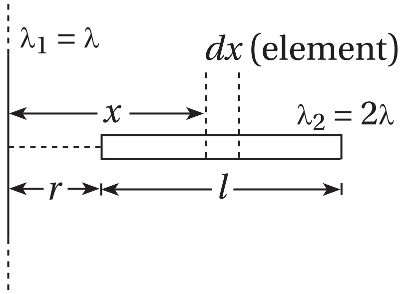


Net:



$$E_R(\text{at } O) = \frac{\lambda}{4\pi\varepsilon_0 R}\sqrt{2}$$

23. Ⓓ



The force acting on this element

$$dF = E\,dQ = \left[\frac{\lambda_1}{2\pi\varepsilon_0}\right]\lambda_2\,dx$$

$$F = \int dF = \int_r^{r+l} \frac{\lambda_1 \cdot \lambda_2}{2\pi\varepsilon_0} \cdot \frac{dx}{x} = \frac{\lambda_1\lambda_2}{2\pi\varepsilon}\ln\left[1+\frac{l}{r}\right] = \frac{(\lambda)(2\lambda)}{2\pi\varepsilon_0}\cdot\ln\left(1+\frac{l}{r}\right) = \frac{\lambda^2}{\pi\varepsilon_0}\ln\left(1+\frac{l}{r}\right)$$

24. Ⓐ

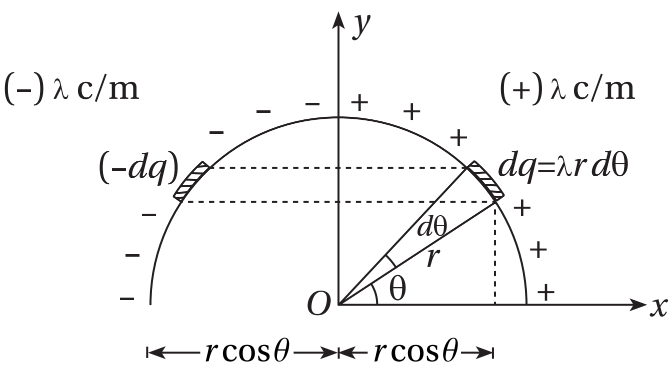
No. of force per unit solid angle $= \dfrac{q_1}{4\pi}$

$\therefore$ Number of lines through the cone of half angle $\alpha = \dfrac{q_1}{4\pi}\cdot 2\pi(1-\cos\alpha)$

because the solid angle of a cone is $2\pi(1-\cos\theta)$
where θ is the semivertical angle of a cone.
By the property of lines of force

$$\frac{q_1}{4\pi}\cdot 2\pi(1-\cos\alpha) = \frac{q_2}{4\pi}\cdot 2\pi(1-\cos\beta) \quad \therefore \sin\left(\frac{\beta}{2}\right) = \sin\left(\frac{\alpha}{2}\right)\sqrt{\frac{q_1}{q_2}}$$

25. Ⓒ



$$dp = (\lambda r\,d\theta)(2r\cos\theta) = 2\lambda r^2 \cos\theta\,d\theta$$

$$p = \int dp = 2\lambda r^2 \int_{-\pi/2}^{\pi/2} \cos\theta\,d\theta = 4\lambda r^2$$

Chemistry

26. Ⓒ

$V_T S_T = V_1 S_1 + V_2 S_2$

$\therefore (250)S_T = (200 \times 0.1) + (50 \times 0.01)$

$\therefore \ S_T = \frac{20.5}{250} = 0.082\ N$

27. Ⓓ

As CCl_4 is a non-polar molecule so, it cannot form strong ion-dipole interaction with ionic compounds.

28. Ⓐ

Concentration $= \left[\frac{3.6}{180} \times \frac{1000}{200}\right] = 0.1\ m$

29. Ⓒ

According to Henry's law, $p = k.(\chi) = (150 \times 0.12) = 18$ torr

30. Ⓐ

At high altitude, the partial pressure of oxygen is lower than that at ground level, hence oxygen concentration becomes less in blood or tissues. Hence, people suffer from anoxia.

31. Ⓐ

Due to strong intermolecular force between solute and solvent, the rate of escape of the components decreses. Hence, vapour pressure decreases.

32. Ⓓ

$p_{total} = \left[p_A^0 \chi_A + p_B^0 \chi_B\right] = \left[\frac{200 \times 2}{20} + \frac{600 \times 18}{20}\right] = 560$ mm of Hg

33. Ⓑ

$$T_b - T_b^o = \frac{K_b \times W_{solute} \times 1000}{M_{solute} \times W_{solvent}} = \frac{(0.52) \times (12) \times 1000}{M_{solute} \times (52)}$$

$$\therefore 0.40 = \frac{(0.52) \times (12) \times 1000}{M_{solute} \times (52)}$$

$\therefore M_{solute} = 300$

34. Ⓐ

$$T_f^o - T_f = \frac{K_f \times W_{solute} \times 1000}{M_{solute} \times W_{solvent}} = \frac{(1.86)\times(20)\times 1000}{(60)\times(250)}$$

$\therefore 273 - T_f = 2.48$

$\therefore T_f = (273 - 2.48) = 270.52\ K$

35. Ⓑ

Methanol does not form strong hydrogen bond with water. So, escaping character of both the components is high. Hence, it causes higher vapour pressure than expected

36. Ⓒ

Strong solute - solvent atttractive interaction is generated when sugar is added to water. Hence, higher temperature is needed for breaking the solute - solvent interaction. Thus boiling point increases

37. Ⓓ

According to van't Hoff equation, osmotic pressure is directly proportional to temperature at a constant concentration. More the number of solute, more is the osmotic pressure of the system

38. Ⓓ

H_2SO_4 forms strong hydrogn bonding with water. Thus escaping character of both the components decreases. So, negetive deviation from Raoult's law is obeyed.

39. Ⓑ

Molar mass of NH_3 = 17 and molar mass of C_2H_6 = 30.

Now, NH_3 is polar molecule can form strong hydrogen bond with water but C_2H_6 is a non-polar molecule and cannot form hydrogen bond with water.

40. Ⓓ

According to van't Hoff law,

(i) osmotic pressure α temperature [at a constant concentration]

(ii) osmotic pressure α concentration [at a constant temperature]

So, π = CRT

Both concentration and tempearture are intensive properties and hence product of them will be an intensive property.

41. Ⓐ

The formula of vapour pressure of non-volatile solute is given below

$$\frac{p^o - p}{p^o} = \frac{W_{solute}}{M_{solute}} \times \frac{M_{solvent}}{W_{solvent}}$$

$$\therefore \left(p^o - p\right) = \frac{p^o \times W_{solute}}{M_{solute}} \times \frac{M_{solvent}}{W_{solvent}}$$

$$\therefore \left(p^o - p\right) = \frac{Q}{M_{solute}} \qquad \left[\text{where, } Q = \frac{p^o \times W_{solute} \times M_{solvent}}{W_{solvent}}\right]$$

So, according to the equation, higher the molecular weight of the solute, lower is the value of (p^o - p). Hence, vapour pressure of the solution will be higher.

42. Ⓐ

$$\chi_{sugar} = \frac{n_{sugar}}{n_{sugar} + n_{water}} = \frac{\frac{W_{sugar}}{M_{sugar}}}{\frac{W_{sugar}}{M_{sugar}} + \frac{W_{water}}{M_{water}}} = \frac{\frac{3.42}{342}}{\frac{3.42}{342} + \frac{180}{18}}$$

$$\therefore \chi_{sugar} = 9.99 \times 10^{-4}$$

43. Ⓑ

$$(\Delta p)_{glucose} = (\Delta p)_{urea}$$

$$\therefore \chi_{glucose} = \chi_{urea}$$

$$\therefore \frac{n_{glucose}}{n_{water}} = \frac{n_{urea}}{n_{water}}$$

$$\therefore \frac{W_{glucose}}{50} \times \frac{18}{180} = \frac{1}{50} \times \frac{18}{60}$$

$$\therefore W_{glucose} = 3 \text{ gm}$$

44. Ⓒ

$$CaCl_2 \longrightarrow Ca^{2+} + 2Cl^- \quad (n = 3)$$

$$\alpha = \frac{i-1}{n-1}$$

$$\therefore 0.75 = \frac{i-1}{3-1}$$

$$\therefore i = 2.5$$

$$\pi = i.C.R.T = \frac{2.5 \times 0.444 \times 1000 \times 0.08 \times 300}{111 \times 500} = 1.62 \text{ atm}$$

45. Ⓓ

Molal elevation constant of a solvent does not depend on the concentration of the solution and it depends on the boiling point and the latent heat of vaporization of the solvent.

46. Ⓑ

$$\Delta T_b = \frac{K_b \times W_{solute} \times 1000}{M_{solute} \times W_{solvent}} = \frac{K_b \times (y) \times (1000)}{M \times (250)} = \frac{4.K_b.y}{M}$$

47. Ⓐ

$$\text{molality}\,(m) = \frac{W_{solute}}{M_{solute}} \times \frac{1000}{W_{solvent}}$$

$$\therefore\ b = \frac{c}{M_B} \times \frac{1000}{(a-c)}$$

$$\therefore\ M_B = \frac{c}{b} \times \frac{1000}{(a-c)}$$

48. Ⓓ

$$m = \frac{(\chi_A) \times (1000)}{(1-\chi_A) \times m_B} = \frac{(0.2) \times (1000)}{(1-0.2) \times (78)} = 3.2\ m$$

49. Ⓓ

$$\pi_1 V_1 + \pi_2 V_2 = \pi_{total}(V_1 + V_2)$$

$$\therefore\ (1.2 \times 100) + (2.4 \times 300) = \pi_{total}(300 + 100)$$

$$\therefore\ \pi_{total} = \frac{840}{400} = 2.1\,\text{atm}$$

50. Ⓒ

$$i_1 C_1 = C_2$$

$$\therefore\ i_1 = \frac{C_2}{C_1} = \frac{0.01}{0.004} = 2.5$$

$$Na_2SO_4 \longrightarrow 2Na^+ + SO_4^{2-} \qquad (n = 3)$$

$$\alpha = \frac{i-1}{n-1}$$

$$\therefore\ \alpha = \frac{2.5-1}{3-1}$$

$$\therefore\ \alpha = 0.75$$

$\therefore$ 75% dissociated

Mathematics

51. Ⓑ

$$\cos^{-1}x+\sin^{-1}y=\frac{2\pi}{3}\Rightarrow\frac{\pi}{2}-\sin^{-1}x+\sin^{-1}y=\frac{2\pi}{3}\Rightarrow\sin^{-1}y-\sin^{-1}x=\frac{\pi}{6}$$

52. Ⓒ

$$\sin^{-1}\frac{x}{5}+\operatorname{cosec}^{-1}\frac{5}{4}=\frac{\pi}{2}\Rightarrow\sin^{-1}\frac{x}{5}+\sin^{-1}\frac{4}{5}=\frac{\pi}{2}\Rightarrow\sin^{-1}\frac{x}{5}=\cos^{-1}\frac{4}{5}$$

$$\Rightarrow\sin^{-1}\frac{x}{5}=\sin^{-1}\frac{3}{5}\Rightarrow x=3$$

53. Ⓒ

Let $\tan^{-1}1 = x.\ \tan^{-1}2 = y,\ \tan^{-1}3 = z \Rightarrow \tan x = 1,\ \tan y = 2,\ \tan z = 3$

$$\tan(x+y+z)=\frac{\tan x+\tan y+\tan z-\tan x\tan y\tan z}{1-\tan x\tan y-\tan y\tan z-\tan x\tan z}=\frac{1+2+3-1\times2\times3}{1-1\times2-2\times3-1\times3}=0$$

$\Rightarrow x+y+z=\pi \Rightarrow \tan^{-1}1+\tan^{-1}2+\tan^{-1}3=\pi$

54. Ⓒ

$$\cos^{-1}\left(-\sin\frac{7\pi}{6}\right)=\cos^{-1}\left(\sin\frac{\pi}{6}\right)=\cos^{-1}\left(\cos\frac{\pi}{3}\right)=\frac{\pi}{3}$$

55. Ⓒ

$$\cot^{-1}(3)+\operatorname{cosec}^{-1}\sqrt{5}=\tan^{-1}\frac{1}{3}+\sin^{-1}\frac{1}{\sqrt{5}}=\tan^{-1}\frac{1}{3}+\tan^{-1}\frac{1}{2}\ \tan^{-1}\left(\frac{\frac{1}{2}+\frac{1}{3}}{1-\frac{1}{6}}\right)=\tan^{-1}1=\frac{\pi}{4}$$

56. Ⓑ

Surjective

57. Ⓐ

If $f(x_1)=f(x_2)\Rightarrow x_1=x_2\ \forall x_1,x_2\in A,$ then the function is one-one

58. Ⓓ

It is not reflexive because aRa is not true

It is not symmetric because $(2,3)\in R$ but $(3,2)\notin R$

It is not transitive because $(1,3)\in R$ and $(3,1)\in R$ but $(1,1)\notin R$

59. Ⓑ

$f(x)=\sqrt{(x-1)(3-x)}\Rightarrow y^2=(x-1)(3-x)\Rightarrow(x-2)^2+y^2=1$ which represents a circle having centre at (2,0) and radius = 1

So, range = [0, 1]

60. Ⓐ

$$f(x)=\log(x^2+\sqrt{x^2+1}) \Rightarrow f(-x)=\log(x^2+\sqrt{x^2+1})=f(x) \Rightarrow f(x) \text{ is even function}$$

61. Ⓐ

$n(E) = 4$, $n(F) = 2$

Number of onto functions = $2^4 - {}^2C_1(2-1)^4 = 16 - 2 = 14$

62. Ⓒ

$m(A) = n$ and $f: A \to A$. So, number of bijective functions = $n!$

63. Ⓒ

$f(x) = x + 5$. It is one-one function

Co-domain = {6, 7, 8} and Range = {6, 7, 8}

It is onto function. So, it is one-one onto function

64. Ⓓ

$f(x) = 5x^2 + 2 \ \forall x \in R$

$f(1) = 5 \times 1 + 2 = 7$ and $f(-1) = 5 + 2 = 7$. So, it is many one function.

Range set is subset of Codomain set. So, it is into function

65. Ⓒ

$f(x) + 2f(1-x) = x^2 + 2$

$f(1-x) + 2f(x) = (1-x)^2 + 2 \Rightarrow 2f(1-x) + 4f(x) = 2(1-x)^2 + 4$

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

$$f(x)=\frac{(x-2)^2}{3}$$

66. Ⓐ

$$-1 \le \log_3\left(\frac{x}{3}\right) \le 1 \Rightarrow 3^{-1} \le \frac{x}{3} \le 3^1 \Rightarrow 1 \le x \le 9$$

67. Ⓑ

$\forall a \in R, a \langle a$ is not true. So, not reflexive

For $a, b \in R, a \langle b$ does not imply $b \langle a$. So, not symmetric

For $a, b, c \in R, a \langle b$ and $b \langle c \Rightarrow a \langle c$. So, transitive.

68. Ⓒ

A triangle is congruent to itself. So, reflexive

For two triangles *A* and *B*, *A* is congruent to *B* means *B* is congruent *A*. So, symmetric.

For three triangles A, B and C, A is congruent B and B is congruent C implies A is congruent to C.

So, transitive.

Hence, equivalence

69. Ⓓ

Maximum number of equivalence relations on $A = \{1, 2, 3\} = 5$

70. Ⓐ

Reflexive but not symmetric

71. Ⓒ

$n(A)$ 5 and $n(B) = 6 \quad n(B) \neq n(A)$.

So, number of bijective functions = 0

72. Ⓒ

$$f(x) = \frac{4^x}{4^x + 2}, f(1-x) = \frac{4^{1-x}}{4^{1-x} + 2} = \frac{2}{4^x + 2}$$

$$f(x) + f(1-x) = 1$$

$$f\left(\frac{1}{2025}\right) + f\left(\frac{2}{2025}\right) + f\left(\frac{3}{2025}\right) + \ldots\ldots + f\left(\frac{2023}{2025}\right) + f\left(\frac{2024}{2025}\right)$$

$= 1 + 1 + 1 + \ldots\ldots 1012$ times $= 1012$

73. Ⓐ

$$\cos\left\{\tan^{-1}\left(\tan\frac{15\pi}{4}\right)\right\} = \cos\{\tan^{-1}(-1)\} = \cos\left(-\frac{\pi}{4}\right) = \cos\frac{\pi}{4} = \frac{1}{\sqrt{2}}$$

74. Ⓓ

$$\tan\left\{2\tan^{-1}\frac{1}{5} - \frac{\pi}{4}\right\} = \tan\left\{\tan^{-1}\frac{5}{12} - \frac{\pi}{4}\right\} = \frac{\frac{5}{12} - 1}{1 + \frac{5}{12}} = \frac{-7}{17}$$

75. Ⓐ

$$\sin^{-1}\left[\cos\left(\sin^{-1}\frac{\sqrt{3}}{2}\right)\right] = \sin^{-1}\left[\cos\frac{\pi}{3}\right] = \sin^{-1}\left(\frac{1}{2}\right) = \frac{\pi}{6}$$

Biology

76. Ⓓ

Triple fusion

77. Ⓒ

Malacophily

78. Ⓐ

Endosperm

79. Ⓐ

Promote cross pollination

80. Ⓐ

Dithecous with four microsporangia

81. Ⓑ

Porogamy

82. Ⓒ

Embryo sac

83. Ⓓ

Pollen grain- male gamete

84. Ⓑ

Viola

85. Ⓒ

A-Degenerating synergids; B-PEN;C-Degenerating antipodals; D-PEC

86. Ⓓ

They turn to seed coats

87. Ⓒ

Cotyledon of monocot seeds

88. Ⓑ

Male gamete(n) + Female gamete(n) → Zygote (2n)

89. Ⓒ

The flowers are called cleistogamous and show self pollination

90. Ⓐ

Water hyacinth

91. Ⓑ

Pectocellular

92. Ⓑ

Perisperm

93. Ⓓ

Parthenium

94. Ⓐ

Sporopollenin

95. Ⓐ

8-nucleate and 7-celled

96. Ⓑ

2-celled stage

97. Ⓒ

Prevent self pollination

98. Ⓒ

Apomixis is a kind of asexual reproduction which mimics sexual reproduction

99. Ⓓ

Parthenocarpy

100. Ⓒ

Sporogenous tissue → Pollen mother cell → Microspore tetrad → Pollen grain → Male gamete