Answer Key

Other (142 Questions)

Q1. (A)	Q2. (C)	Q3. (A)	Q4. (A)	Q5. (A)
Q6. (C)	Q7. (D)	Q8. (D)	Q9. (A)	Q10. (B)
Q11. (B)	Q12. (A)	Q13. (A)	Q14. (D)	Q15. (C)
Q16. (D)	Q17. (C)	Q18. (D)	Q19. (A)	Q20. (A)
Q21. (D)	Q22. (B)	Q23. (B)	Q24. (D)	Q25. (B)
Q26. (B)	Q27. (B)	Q28. (A)	Q29. (D)	Q30. (D)
Q31. (A)	Q32. (C)	Q33. (B)	Q34. (B)	Q35. (A)
Q36. (C)	Q37. (C)	Q38. (B)	Q39. (D)	Q40. (C)
Q41. (A)	Q42. (C)	Q43. (A)	Q44. (B)	Q45. (C)
Q46. (A)	Q47. (B)	Q48. (D)	Q49. (A)	Q50. (C)
Q51. (A)	Q52. (D)	Q53. (D)	Q54. (B)	Q55. (C)
Q56. (C)	Q57. (A)	Q58. (A)	Q59. (B)	Q60. (C)
Q61. (D)	Q62. (C)	Q63. (A)	Q64. (C)	Q65. (C)
Q66. (B)	Q67. (B)	Q68. (C)	Q69. (B)	Q70. (B)
Q71. (B)	Q72. (A)	Q73. (D)	Q74. (B)	Q75. (D)
Q76. (C)	Q77. (D)	Q78. (C)	Q79. (C)	Q80. (D)
Q81. (C)	Q82. (B)	Q83. (D)	Q84. (C)	Q85. (A)
Q86. (C)	Q87. (A)	Q88. (B)	Q89. (B)	Q90. (C)
Q91. (B)	Q92. (D)	Q93. (C)	Q94. (B)	Q95. (C)
Q96. (C)	Q97. (A)	Q98. (C)	Q99. (C)	Q100.(C)
Q101.(B)	Q102.(B)	Q103.(D)	Q104.(D)	Q105.(A)

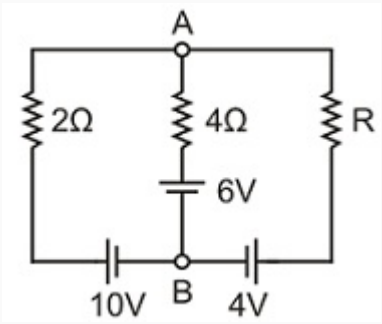
Q106.(B)	**Q107.(B)**	**Q108.(A)**	**Q109.(C)**	**Q110.(C)**
Q111.(A)	**Q112.(A)**	**Q113.(A)**	**Q114.(C)**	**Q115.(D)**
Q116.(D)	**Q117.(A)**	**Q118.(B)**	**Q119.(B)**	**Q120.(D)**
Q121.(C)	**Q122.(C)**	**Q123.(B)**	**Q124.(B)**	**Q125.(C)**
Q126.(B)	**Q127.(C)**	**Q128.(A)**	**Q129.(C)**	**Q130.(C)**
Q131.(B)	**Q132.(B)**	**Q133.(B)**	**Q134.(A)**	**Q135.(A)**
Q136.(C)	**Q137.(D)**	**Q138.(A)**	**Q139.(C)**	**Q140.(B)**
Q141.(B)	**Q142.(B)**			

Solutions

Q1. Solution

Correct Answer: (A)

When the current through $4\ \Omega$ resistance is zero, then $V_A - V_B = 6$ V



i.e., the potential difference across $2\ \Omega$ resistance would be $10 - 6 = 4$ V

$\therefore$ Current through $2\ \Omega$ resistance is 2 A.

The potential difference across R is $(6 - 4)$ V and 2 A flows through it

$\Rightarrow R = \frac{6-4}{2}$

$\therefore R = 1\ \Omega$

Q2. Solution

Correct Answer: (C)

At the surface of the earth, the weight of the person.

$W = mg \Rightarrow \frac{mGM}{R^2}$

At a height h

weight $W' = mg' \Rightarrow \frac{mGM}{(R+h)^2}$

$\therefore \frac{W'}{W} = \frac{R^2}{(R+h)^2}$

When $h = R$, $\frac{W'}{W} = \frac{R^2}{(2R)^2} = \frac{1}{4}$

Q3. Solution

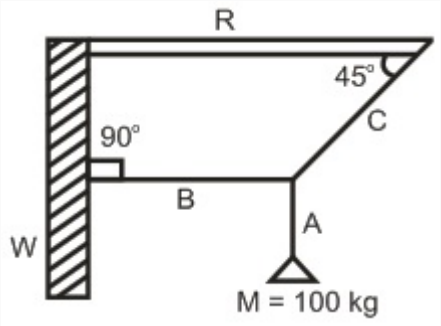
Correct Answer: (A)

The gases carbon monoxide (CO) and nitrogen (N_2) are diatomic, so both have equal kinetic energy $\frac{5}{2}kT,\ ie.\ E_1 = E_2.$

Q4. Solution

Correct Answer: (A)

Let T be the tension in the string C. Hence



$\mathrm{T}\cos 45^{\circ} = Mg$

$T \sin\ 45^{\circ} =$ tension in B

Hence, tension in $\mathrm{B} = \mathrm{Mg} = 100\mathrm{g}\,\mathrm{N}$

Q5. Solution

Correct Answer: (A)

Magnetic field at the axis inside the solenoid

$\mathrm{B} = \mu_0\,\mathrm{ni}$

Here, $\mathrm{n} = 10\ \text{turns}\ \ \mathrm{cm}^{-1} = 1000\ \text{turns}\ \ \mathrm{m}^{-1}$, $\mathrm{i} = 5\ \mathrm{A}$

$\therefore\ \ \mathrm{B} = 4\pi \times 10^{-7} \times 1000 \times 5$

$\quad = 2\pi \times 10^{-3}\ \mathrm{T}$

Q6. Solution

Correct Answer: (C)

From Curie's law

$\chi \propto \frac{1}{\mathrm{T}}$

$\frac{\chi_2}{\chi_1} = \frac{\mathrm{T}_1}{\mathrm{T}_2}$

$\chi_2 = \chi_1 \cdot \frac{\mathrm{T}_1}{\mathrm{T}_2} = 2.8 \times 10^{-4} \times \frac{350}{300} = 3.267 \times 10^{-4}$

Q7. Solution

Correct Answer: (D)

$$\frac{v_{T_1}}{v_{T_2}} = \frac{r_1^2}{r_2^2}$$

$$\sqrt{\frac{9}{4}} = \frac{r_1}{r_2}$$

Terminal velocity, $v_T \propto r^2$ $\frac{r_1}{r_2} = \frac{3}{2}$

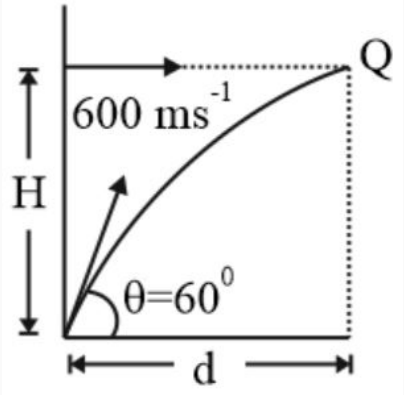
$$v = \frac{4}{3}\pi r^3$$

$$\frac{v_1}{v_2} = \frac{r_1^3}{r_2^3} = \frac{27}{8}$$

Q8. Solution

Correct Answer: (D)

If being hit, then horizontal distance remains same.



$v_x = 600 \cos 60^o = 300 \text{ m s}^{-1}$

$\left(250 \text{ m s}^{-1}\right) \text{ t} + \frac{1}{2}(20) \text{ t}^2 = 300 \text{ t}$

$(50 \text{ t}) = \frac{1}{2}(20) \text{ t}^2$

$\text{t} = 0 \text{ or } \text{t} = 5$

$\text{H} = \left((600)\sin 60^o\right) \text{ t} - \frac{1}{2} \text{ gt}^2$

$= (600)\frac{\left(\sqrt{3}\right)}{2} \times 5 - \frac{1}{2} \cdot (10)(25)$

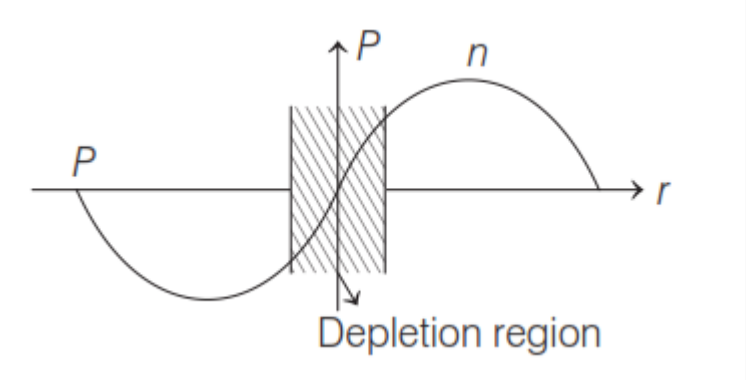
$\text{H} = \left(\left(300\sqrt{3}\right)5 - (125)\right) \text{ m}$

$\text{H} = 2473 \text{ m}$

Q9. Solution

Correct Answer: (A)

As we know that, in case of $p-n$ junction diode, there is no or very less movement of charges in the depletion region. $\therefore$ Current is least in depletion region. So, graph of charge density versus distance will be as shown below



Q10. Solution

Correct Answer: (B)

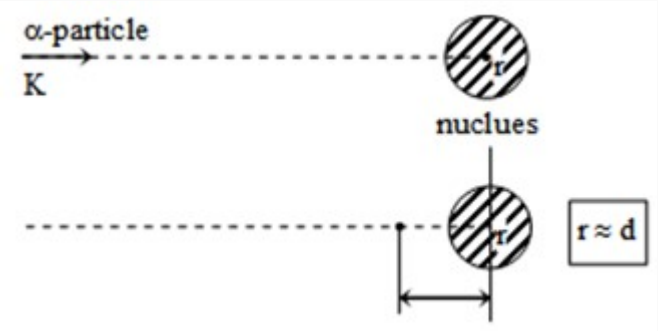
Rms value of AC, $V_{\text{rms}}=220$ V Peak value of AC, $V_0=\sqrt{2}V_{\text{rms}}=\sqrt{2}\times 220=311$ V $V_{DC}=220$ V Since, peak value of 220 VAC is 311 V which is much more than 220 DC. Hence, 220 V AC is more dangerous than 220 V DC.

Q11. Solution

Correct Answer: (B)

A rough estimate of size of the nucleus r is given by the distance of closest approach d of an $\alpha-$ particle incident head-on on a nucleus of charge Ze ;

$K=\frac{1}{2}mv^2=\frac{2Ze^2}{4\pi\varepsilon_0 d}\approx\frac{2Ze^2}{4\pi\varepsilon_0 r}$ [where $K=6$ MeV, $Z=10$]



$r=\frac{2\times 100\times\left(1.6\times 10^{-19}\right)\times 9\times 10^9}{6\times 10^6\times 1.6\times 10^{-19}}$

$r=3\times 10^{-14}$ m ~

Q12. Solution
Correct Answer: (A)

This is a problem on 'flow calorimeter' used to measure the specific heat of the liquid.
Amount of heat supplied to the water per second by the heating coil = $Q_{\mathrm{s}}=250 \mathrm{~J} \quad=\frac{250}{4186} \mathrm{kcal}$
The volume of liquid flowing out per second = $8.0 \mathrm{~cm}^3 \quad=8 \times 10^{-6} \mathrm{~m}^3$

Mass of this liquid = $\left(0.85\right) \times 1000 \times 8 \times 10^{-6} \mathrm{~kg}$
The temperature rise of this mass of liquid = $15^{\circ} \mathrm{C}$

Hence, $=\frac{250}{4186}=\mathrm{mst}=0.85 \times 8 \times 10^{-3} \times \mathrm{s} \times 15$
Hence, $\mathrm{s}=\frac{250 \times 10^3}{4186 \times 0.85 \times 8 \times 15}=0.6 \mathrm{~kcal} \mathrm{~kg}^{-1} \mathrm{~K}^{-1}$

,

Q13. Solution
Correct Answer: (A)

$\mathrm{VP}^2=$ constant
$\mathrm{V}\left(\frac{\mathrm{RT}}{\mathrm{V}}\right)^2=$ constant from ideal gas equation
or $\frac{\mathrm{T}^2}{\mathrm{V}}=$ constant
Let the new temperature become $\mathrm{T}^{\prime}\left(\frac{\mathrm{T}^{\prime}}{\mathrm{T}}\right)^2=\left(\frac{2 \mathrm{~V}}{\mathrm{~V}}\right)=2$ or $\mathrm{T}^{\prime}=\sqrt{(2)}\,\mathrm{T}$ ~

Q14. Solution
Correct Answer: (D)

$\frac{dy}{dt}=y_0 \cos 2\pi\left[ft-\frac{x}{\lambda}\right] \times 2\pi f$
$\therefore$ maximum particle velocity $=\left(\frac{dy}{dt}\right)_{max}=2\pi f y_0 \times 1$
Wave velocity $=f\lambda$
As $2\pi f y_0=4f\lambda$,
$\therefore \lambda=\frac{2\pi y_0}{4}=\frac{\pi y_0}{2}$,

Q15. Solution
Correct Answer: (C)

$E_y \geq 100\mathrm{keV}$ $\begin{matrix} E_X=100\mathrm{eV} \text{ to } 100\mathrm{keV} \\ E_v=2.48\mathrm{eV} \end{matrix}$ So, we can say that $E_y>E_X>E_v$.

Q16. Solution

Correct Answer: (D)

Force exerted by the fraction of ,ight that is absorbed is given as, $\mathrm{F}_1 = \frac{\eta \mathrm{IA}}{\mathrm{c}}$.

Force exerted by the fraction of light that is totally reflected is given as, $\mathrm{F}_2 = \frac{(1-\eta)\times 2\,\mathrm{IA}}{\mathrm{c}}$.

Hence, total force will be given as, $\mathrm{F} = \mathrm{F}_1 + \mathrm{F}_2 = \frac{(2-\eta)\,\mathrm{IA}}{\mathrm{c}}$.

∧

Q17. Solution

Correct Answer: (C)

Magnetic induction inside the solenoid

$B = \frac{\mu_0 NI}{\mathrm{L}}$

Magnetic flux, $\phi = \mathrm{BA}$

$= \frac{\mu_0\, NI.A}{\mathrm{L}}$

Magnetic moment $= NIA = \frac{\phi \mathrm{L}}{\mu_0}$

$= \frac{1.57\times 10^{-6}\times 0.6}{4\times 3.14\times 10^{-7}}$

$= 0.75\ \mathrm{A\ m^2}$ ∧

Q18. Solution

Correct Answer: (D)

Given,

$A = +\,3\ n\mathrm{C} = 3\times 10^{-9}\ \mathrm{C}$

$B = +\,1\ n\mathrm{C} = 1\times 10^{-9}\ \mathrm{C}$

Distance, $r_1 = 5\ \mathrm{cm} = 0.05\ \mathrm{m} = 5\times 10^{-2}\ \mathrm{m}$

Work done $(W) = U_B - U_A$

$= \frac{kq_1q_2}{r_2} - \frac{kq_1q_2}{r_1}$

Here, $r_2 = r_1 - 1$

$r_2 = 5 - 1 = 4\ \mathrm{cm} = 0.04\ \mathrm{m} = 4\times 10^{-2}\ \mathrm{m}$

$= kq_1q_2\left[\frac{1}{r_2} - \frac{1}{r_1}\right]$

$= 9\times 10^9 \times 3\times 10^{-9}\times 1\times 10^{-9}$

$\left[\frac{1}{4\times 10^{-2}} - \frac{1}{5\times 10^{-2}}\right]$

$= \frac{27\times 10^{-9}\times 1}{5\times 4\times 10^{-2}}$

$= \frac{27}{20}\times 10^{-7}$

$= 1.35\times 10^{-7}\ \mathrm{J}$ ∧

Q19. Solution

Correct Answer: (A)

$\because \quad \mathrm{Q}=\sum \mathrm{B.E.} \text{ of products} - \sum \mathrm{B.E.} \text{ of reactants}$

$\mathrm{H}^2 +_1 \mathrm{H}^2 \rightarrow_2 \mathrm{H}^4$

$\text{Energy released} = \mathrm{Q} = 4\left[\mathrm{B.E.}\left({}_2\mathrm{H}^4\right)\right] - 4\left[\mathrm{B.E.}\left({}_1\mathrm{H}^2\right)\right]$

$= 4 \times 7 - 4 \times 1.1$

$= 28 - 4.4 \qquad !$

$= 23.6 \text{ MeV}$

Q20. Solution

Correct Answer: (A)

$y_4 = \frac{4D\lambda}{d}$

Separation between the fourth bright fringes

$= \frac{4D\lambda_1}{d} - \frac{4D\lambda_2}{d}$

$\frac{4D}{d}(\lambda_1 - \lambda_2) = \frac{4\times1.2}{2\times10^{-3}}(6500 - 5200) \times 10^{-10}$

$= 3120 \times 10^{-7} = 0.312 \text{ mm}$,

Q21. Solution

Correct Answer: (D)

Moment of inertia of masses will be $I = 2mD^2$.

New moment of inertia will be $I\prime = 2m(2D)^2$.

Initially, it is moving with angular acceleration, α_1.

Finally, it is moving with angular acceleration, α_2.

Corresponding torque for initial case will be given by $\tau = I\alpha_1$.

Corresponding torque for final case will be given by $\tau\prime = I\prime\alpha_2$

As torque in both cases are equal, so,

$\tau = \tau\prime = 2mD^2\alpha_1 = 2m(2D)^2\alpha_2$

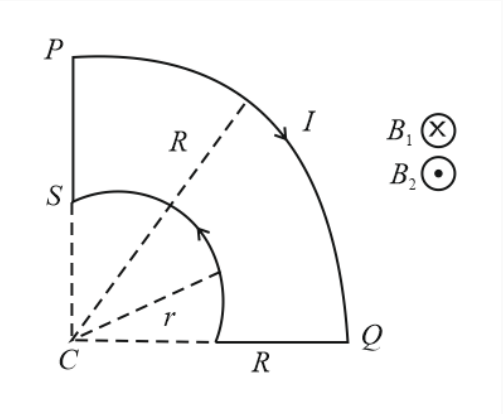
$\Rightarrow 2mD^2\alpha_1 = 2m(2D)^2\alpha_2$

$\Rightarrow 2\alpha_1 = 8\alpha_2$

$\Rightarrow \alpha_2 = \frac{\alpha_1}{4}$

Q22. Solution

Correct Answer: (B)



Due to current flowing in circular arc, the magnetic field at the centre is given by,

$B = \frac{\mu_0}{4\pi}\frac{i\theta}{r}$

Here θ = Angle subtended by arc on centre
r = Radius of arc

Due to wires QR andSP, the magnetic field at centre C when zero, because both wires will pass through that point is extended.

Magnetic field due to arc PQ,

$B_1 = \frac{\mu_0}{4\pi}\frac{I(\pi/2)}{R} = \frac{\mu_0}{8}\frac{I}{R}$

(From right-hand rule-direction inside the page)

Magnetic field due to arc RS,

$B_1 = \frac{\mu_0}{4\pi}\frac{I(\pi/2)}{(r)} = \frac{\mu_0}{8}\frac{I}{(r)}$
(From right-hand rule-direction outside the page)

$\therefore$Net magnetic field outside the page,
$B_{\text{net}} = \frac{\mu_0}{8}\frac{I}{r} - \frac{\mu_0}{8}\frac{I}{R} \Rightarrow B_{\text{net}} = \frac{\mu_0 I}{8}\left(\frac{1}{r} - \frac{1}{R}\right)$

Q23. Solution

Correct Answer: (B)

The force on satellite is only gravitational. When gravitational force becomes zero then net force becomes zero.

So sattelite will move in straight line path

Q24. Solution

Correct Answer: (D)

Given, diameter of pipe $D = 2\ \text{cm} = 0.02\ \text{m}$

Viscosity of water $\eta = 10^{-3}\ \text{Pa s}$

Reynold's number $N_\text{R} = 3000$

We know that velocity of liquid $v = \frac{N_\text{R}\eta}{\rho D}$; where ρ is density of water and $\rho = 1000\ \text{kg m}^{-3}$.

Thus, $v = \frac{N_\text{R}\eta}{\rho D}$

$\Rightarrow v = \frac{3000 \times 10^{-3}}{10^3 \times 0.02}$

$\Rightarrow v = 0.15\ \text{m s}^{-1}$

Q25. Solution

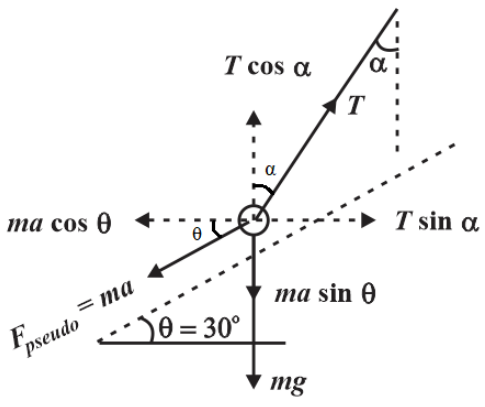
Correct Answer: (B)

The power of the incident light is $\text{P} = 25\ \text{W cm}^{-2} \times 25\,\text{cm}^2$
$= 625\,\text{W}$
Energy incident per second, $E = \frac{\text{hc}}{\lambda} = 625\ \text{J}$
Momentum incident per second, $p = \frac{E}{c} = \frac{\text{h}}{\lambda} = \frac{625}{\text{c}}$
$\therefore$ Total momentum transferred to the surface $= \frac{625}{\text{c}} \times 40 \times 60$
$= 5 \times 10^{-3}\,\text{N s}$

Q26. Solution

Correct Answer: (B)

The following figure represents a free body diagram of the bob. The components of pseudo force and tension in the horizontal and vertical directions are also shown in the figure.



On writing the equilibrium equations for horizontal and vertical directions,

$T\sin(\alpha) = ma\cos(\theta) \quad \ldots(1) \quad T\cos(\alpha) = ma\sin(\theta) + mg \quad \ldots(2)$

From equations (1) and (2), we obtain the expression,

$\tan(\alpha) = \frac{a\cos(\theta)}{a\sin(\theta)+g} \quad \ldots\left(3\right)$

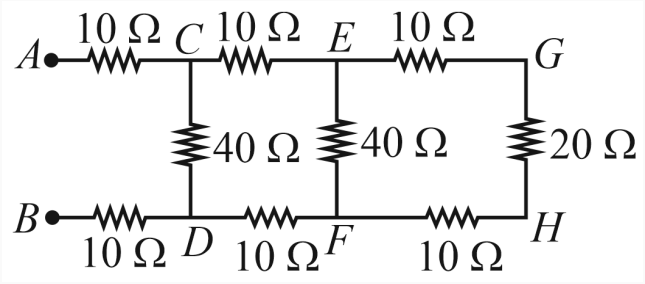
In the question, it is clearly given that$a = 10\ \mathrm{m\ s^{-2}}$ and $\theta = 30^\circ$.

On substituting these values in equation (3), we get,

$\tan(\alpha) = \frac{1}{\sqrt{3}}$
or $\alpha = 30^\circ$.

Q27. Solution

Correct Answer: (B)



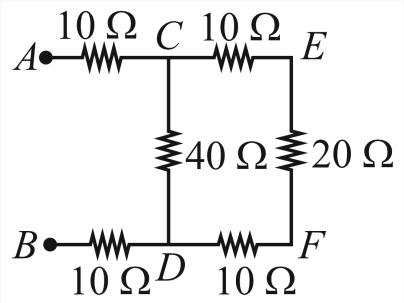
In the circuit, the branch $EGHF$ have three resistance of 10 Ω, 20 Ω and 10 Ω, respectively which are connected in series combination. So, their equivalent resistance is given by

$R_1 = 10 + 20 + 10 = 40\ \Omega$

This R_1 resistance is parallel with 40 Ω resistance which is connected in the branch EF. So, their equivalent resistance

$R_2 = \frac{40 \times 40}{40+40} = 20\ \Omega$

Now, the circuit becomes



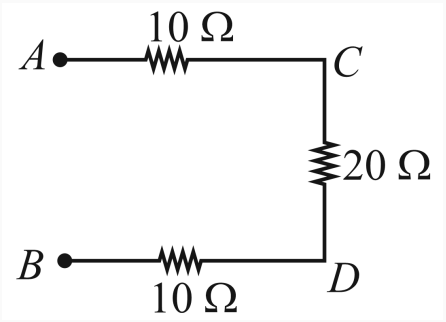
Now, t in the branch $CEFD$ 10 Ω, 20 Ω and 10 Ω resistance are connected in series combination their equivalent resistance is given by

$R_3 = 10\ \Omega + 20\ \Omega + 40\ \Omega = 40\ \Omega$

This R_3 is parallel with 40 Ω resistance which is present in branch CD. Their equivalent resistance.

$R_4 = \frac{40 \times 40}{40+40} = 20\ \Omega$

Now, circuit becomes



The net resistance between A and B,

$R_{\text{net}} = 10 + 20 + 40 = 10\ \Omega$

Q28. Solution

Correct Answer: (A)

We have the relation

$\Rightarrow \quad r = \frac{mv}{eB}$

Given, $m = 9.1 \times 10^{-31}$ kg, $e = 1.6 \times 10^{-19}$ C

$r = 0.5$ m, $v = 10^6$ ms^{-1}

$\therefore B = \frac{mv}{re} = \frac{9.1 \times 10^{-31} \times 10^6}{0.5 \times 1.6 \times 10^{-19}}$

$= \frac{9.1 \times 10^{-25}}{0.8 \times 10^{-19}} = \frac{91}{8} \times 10^{-6}$

$= 11.3 \times 10^{-6} = 1.13 \times 10^{-5}$ T

Q29. Solution

Correct Answer: (D)

By Malus law, $\mathrm{I} = \mathrm{I_0}\cos^2\theta$

(I = Intensity of emergent polarized light)

Where $\theta = 60^o$, $\mathrm{I} =$?

$= \mathrm{I_0} \times \cos^2 60^o$

($\mathrm{I_0}$ = Intensity passed through polarizer)

$= \mathrm{I_0} \times \left(\frac{1}{2}\right)^2 = \frac{\mathrm{I_0}}{4}$

Q30. Solution

Correct Answer: (D)

The centre of mass about $x-$axis is given as,

$x_{\mathrm{cm}}=\frac{m_1x_1+m_2x_2}{m_1+m_2}$

Here, m_1 = mass of the square plate= m

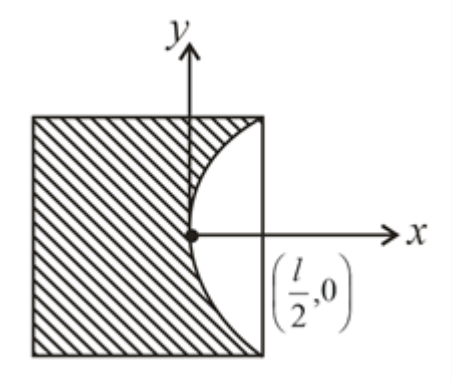
x_1 =centre of mass of the square plate = 0 (As the origin is at centre of the square)

m_2 = mass of the removed part=mass density of square×area of the semicircular= $-\frac{m}{l^2}\left(\frac{\pi\left(\frac{l}{2}\right)^2}{2}\right)=-\frac{\pi}{8}m$

x_2 =centre of mass of the removed part= $\frac{l}{2}-\frac{4}{3\pi}\left(\frac{l}{2}\right)=\frac{l}{2}\left(1-\frac{4}{3\pi}\right)$

Now, the centre of mass of the system will be,$x_{\mathrm{cm}}=\frac{-\frac{\pi m}{8}\times\frac{l}{2}\left(1-\frac{4}{3\pi}\right)}{m-\frac{\pi}{8}m}$

Hence, the centre of mass of remaining portion $x_{\mathrm{cm}}=-\frac{l\left(\pi-\frac{4}{3}\right)}{2(8-\pi)}$.



Q31. Solution

Correct Answer: (A)

Electron deficient species (in complete octet) acts as an electrophile i.e. BCl_3.

Q32. Solution

Correct Answer: (C)

$PbCl_2$ is most ionic because on going down the group the metallic character increases and also the inert pair effect predominates.

Q33. Solution

Correct Answer: (B)

The equilibrium constant for the reaction

$\mathrm{CuO(s)} \rightleftharpoons \mathrm{Cu(s)} + 0.5\mathrm{O_2(g)}$ would be-

$\frac{\mathrm{K_1}}{\mathrm{K_2}} = \frac{2\times10^{15}}{5\times10^{22}} = 4 \times 10^{-8}$

Q34. Solution

Correct Answer: (B)

The given reaction is,

$\mathrm{H_2 + I_2 \rightarrow 2\,HI}$

For this reaction,

$-\frac{\mathrm{d[I_2]}}{\mathrm{dt}} = \frac{1}{2}\frac{\mathrm{d[HI]}}{\mathrm{dt}}$

Here, $-\frac{\mathrm{d[I_2]}}{\mathrm{dt}}$ is the rate of disappearance of $\mathrm{I_2}$ and $\frac{\mathrm{d[HI]}}{\mathrm{dt}}$ is rate of appearance of HI.

So,

$\frac{\mathrm{d[HI]}}{\mathrm{dt}} = -\frac{2\,\mathrm{d[I_2]}}{\mathrm{dt}}\ \frac{\mathrm{d[HI]}}{\mathrm{dt}} = 2 \times 10^{-6}$

The rate of the appearance of HI is $2 \times 10^{-6}\ \mathrm{mol\ L^{-1}\ s^{-1}}$.

Q35. Solution

Correct Answer: (A)

Due to the large size of group IA elements, the outermost electron is far from the nucleus and can easily be removed. their ionisation energies or ionisation potentials are relatively low.

	Li	Na	K	Rb	Cs
Ionisation potential (eV)	5.4	5.1	4.3	4.2	3.9

Q36. Solution

Correct Answer: (C)

	Column I		Column II
(p)	3d-transition series	(iii)	Z = 21 to Z = 30 (Zn)
(q)	Lanthanoid series	(i)	Z = 58 to Z = 71 (Lu)
(r)	Actinoid series	(iv)	Z = 90 to Z = 103 (Lr)
(s)	4d-transition series	(ii)	Z = 39 to Z = 48 (Cd)

Q37. Solution

Correct Answer: (C)

Addition takes place according to Markownikoff's rule in which Cl^+goes to that carbon atom which is more hydrogenated.

Q38. Solution

Correct Answer: (B)

$K_c = \frac{[YX_2]}{[X]^2[Y]} = \frac{2}{4\times4\times2} = \frac{1}{16} = 0.0625.$

Q39. Solution

Correct Answer: (D)

Li is smallest in size among the alkali metals as it has minimum number of shells.

Q40. Solution

Correct Answer: (C)

Bond order (BO) can be calculated using the following methods:

(i) $\mathrm{BO}=\frac{\text{Total number of bonds associated with the central atom}}{\text{Number of } \sigma \text{ bonds associated with the central atom}}$

(or)

$\mathrm{BO}=\frac{\text{Total number of bonds between two atoms}}{\text{Total number of resonance structures}}$

(ii) $\mathrm{BO}=\frac{\text{Number of bonding electrons}-\text{Number of antibonding electrons}}{2}$

We use both the concepts as per situation.

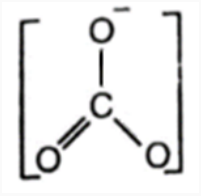
Thus,

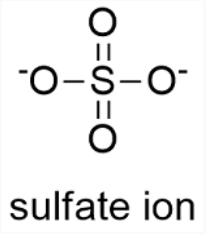
(I) We use concept (i) for the species $\mathrm{C_6H_6},\ \mathrm{CO_3^{2-}}$ and $\mathrm{SO_4^{2-}}$and concept (ii) for $\mathrm{NO^-}$.

On the basis of concept (i)

BO for $\mathrm{C_6H_6}=\frac{2+1}{2}=1.5$

BO for $\mathrm{CO_3^{2-}}=\frac{4}{3}=1.33$





BO for $\mathrm{SO_4^{2-}}=\frac{6}{4}=1.5$

On the basis of concept (ii)

BO of $\mathrm{NO^-}=7+8+1$

$=16$ electrons

$\therefore$ BO for $\mathrm{NO^-}=\frac{10-6}{2}=2$

Hence highest value for BO is of $\mathrm{NO^-}$.

Q41. Solution

Correct Answer: (A)

d-orbitals are absent in nitrogen.

Q42. Solution

Correct Answer: (C)

The principal buffer present in blood is $\mathrm{HCO_3^-/H_2CO_3}$.

Q43. Solution

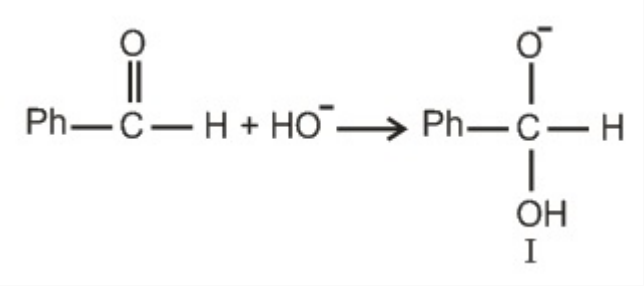
Correct Answer: (A)

Physical adsorption is weak, multilayer, non-directional and non-specific.
Physisorption happens due to weak attraction forces like van der waal's forces.

Q44. Solution

Correct Answer: (B)

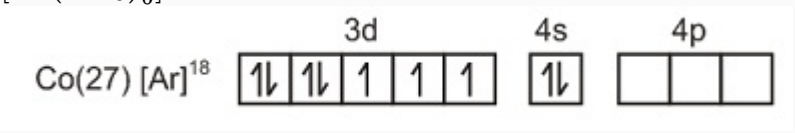
The slowest step in Cannizzaro reaction is transfer of hydride to the carbonyl group.

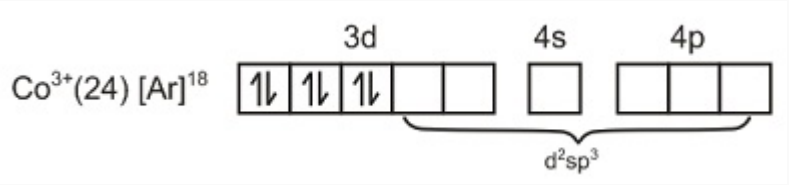


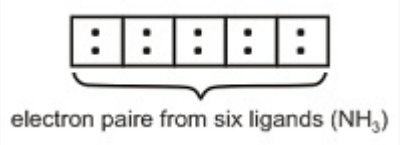
Q45. Solution

Correct Answer: (C)

$[Co(NH_3)_6]^{3+}$







$d^2sp^3 \rightarrow$ inner octahedral complex & diamagnetic.
$[Zn(NH_3)_6]^{2+} \rightarrow$ sp^3d^2 hybridisation (outer).
$[Cr(NH_3)_6]^{3+} \rightarrow$ d^2sp^3 (inner) and paramagnetic.
$[Ni(NH_3)_6]^{2+} \rightarrow$ sp^3d^2 (outer) and paramagnetic.

Q46. Solution
Correct Answer: (A)

Let oxidation number of Mn be x. We know that, Ox. no. of $\mathrm{O} = -2$. So, Ox. no. Mn $+4(\text{Ox. no. O}) = -1$
$x + 4(-2) = -1$ or $x - 8 = -1$ or $x = +8 - 1 = +7$ The oxidation number of Mn in $[\mathrm{MnO_4}]^-$ ion is $+7$.

Q47. Solution
Correct Answer: (B)

% of chlorine = $\frac{35.5}{143.5} \times \frac{\text{Mass of AgCl}}{\text{Mass of substance}} \times 100$
= $\frac{35.5}{143.5} \times \frac{0.287}{0.099} \times 100 = 71.71\%$.

Q48. Solution
Correct Answer: (D)

Boron form different hydride of general formula $\mathrm{B}_n\mathrm{H}_{n+4}$ and $\mathrm{B}_n\mathrm{H}_{n+6}$ but BH_3 is unknown.

Q49. Solution
Correct Answer: (A)

$V_2 = \frac{T_2}{T_1} \cdot V_1 = \frac{270^\circ\mathrm{K}}{300^\circ\mathrm{K}} \cdot 400\ \mathrm{cm}^3 = 360\ \mathrm{cm}^3$ contraction $= V_1 - V_2 = 400 - 360 = 40\ \mathrm{cm}^3$

Q50. Solution
Correct Answer: (C)

Mixed halides of flourine and chlorine are easily liquifible gases having low boiling point and low specific heats.

Q51. Solution
Correct Answer: (A)

Barium salt gives green coloured flame as it has low ionization energy

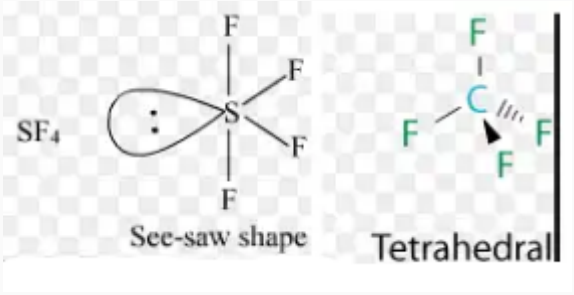
Q52. Solution
Correct Answer: (D)

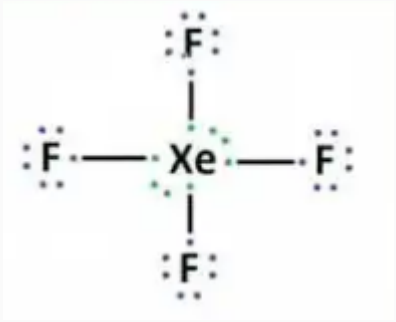
Analgesic means pain killer. This is of two types: narcotics and non-narcotics. Both novalgin and analgin are analgesic. Sulfaguanidine is a guanidine derivative of sulfanilamide used in veterinary medicine.

Q53. Solution

Correct Answer: (D)

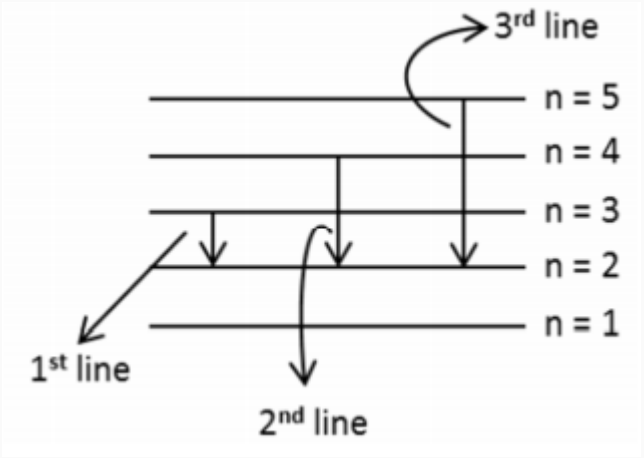
Molecular shapes of SF_4, CF_4 and XeF_4 are different with $1, O$ and 2 lone pair of electrons respectively.





Q54. Solution

Correct Answer: (B)



3 rd line in Balmer series is $5 \rightarrow 2$

$$\frac{1}{\lambda}=\mathrm{Rz}^2\left[\frac{1}{4}-\frac{1}{25}\right]$$

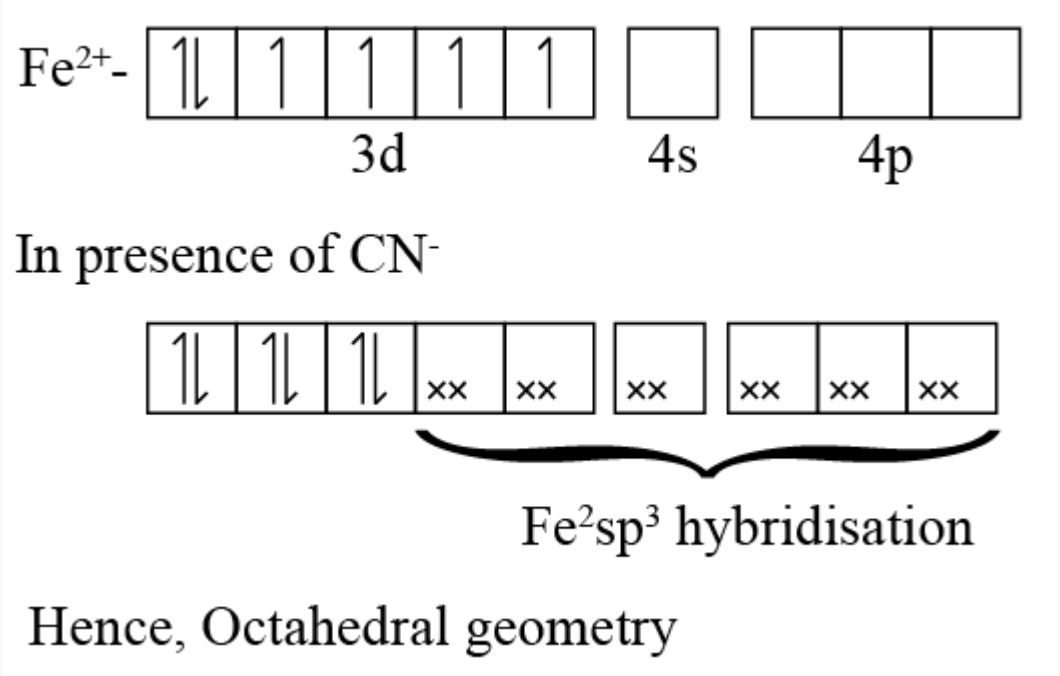
$$\frac{1}{\lambda}=\frac{21\mathrm{R}}{100}$$

Q55. Solution

Correct Answer: (C)

Correct option is C)

$[Fe(CN)_6]^{4-} \rightarrow Fe^{2+} \rightarrow [Ar]3\ d^6$. CN^- is a strong field ligand so pairing of electrons take place.



Q56. Solution

Correct Answer: (C)

$$\text{Weight } = \frac{E \times i \times t}{F} = \frac{Mit}{n-\text{ factor } \times F} \mid E = \frac{M}{n-\text{ factor}}$$

$$\Rightarrow 22.2 = \frac{177 \times 5 \times 2 \times 60 \times 60}{n-\text{ factor } \times 96500}$$

$$\therefore n-\text{ factor } = 2.97 \simeq 3$$

Hence oxidation state of metal $= +3$

Q57. Solution

Correct Answer: (A)

According to Huckel rule for aromaticity, the molecule must be planar, cyclic system having delocalised $(4n\pi + 2)$ electron where n is an integer i. e, $0, 1, 2, 3$. Thus, aromatic compounds have $2, 6, 10$ or 14π electrons. Cyclopropenyl cation (Δ) has 2π electron $(n = 0)$ so, it is aromatic. Hence, option A is correct.

Q58. Solution

Correct Answer: (A)

$$\text{Wavelength } = \frac{h}{mv}$$

$$= \frac{6.6 \times 10^{-34}}{10^{-3} \times 100} = 6.6 \times 10^{-33}\ m$$

Q59. Solution

Correct Answer: (B)

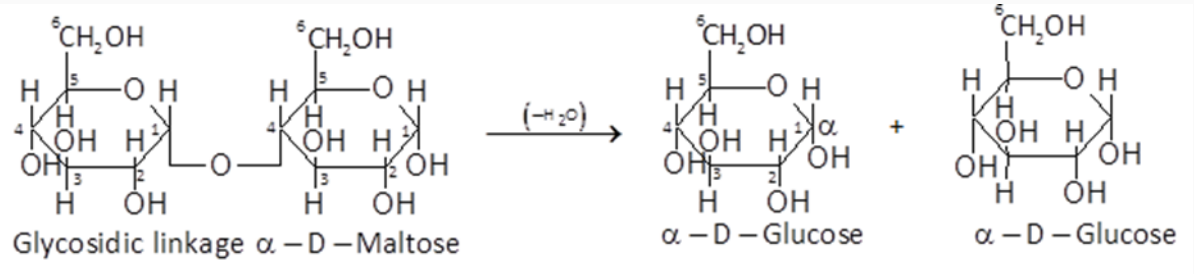
Gibb's free energy G, enthalpy H and entropy S are interrelated as in $G = H - TS$.

Also, change in Gibb's free energy ΔG, change in enthalpy ΔH and change in entropy ΔS are interrelated as in $\Delta G = \Delta H - T\Delta S$.

Q60. Solution

Correct Answer: (C)

Maltose on hydrolysis give 2 mole of α -D Glucose because in maltose glucosidic linkage is present in between C_1 & C_4 of α -D glucose.



Q61. Solution

Correct Answer: (D)

We have,

Among six persons – Rishu, Sunil, Kiran, Umesh, Vimal and Tarun, each of different height, who is the tallest?

Statement I: Tarun is taller than only one person. Kiran is taller than Rishu but shorter than Vimal.

Statement II: Rishu is taller than both Tarun and Sunil. Vimal is not the tallest.

Checking Statement I:

Statement I: Tarun is taller than only one person. Kiran is taller than Rishu but shorter than Vimal.

Reference 1:

Tarun is taller than only one person.

Inference 1:

After using the above references, we have

Order of Height:

Tarun > ____

Reference 2:

Kiran is taller than Rishu but shorter than Vimal.

Inference 2:

After using the above references, we have

Order of Height:

Vimal > Kiran > Rishu

Here, we cannot merge the above inferences to form a single chart of the order of heights of these persons.

So, we cannot say who among these persons is the tallest.

Clearly, Statement I alone is not sufficient to answer the question.

Checking Statement II:

Statement II: Rishu is taller than both Tarun and Sunil. Vimal is not the tallest.

Reference:

Rishu is taller than both Tarun and Sunil.

Vimal is not the tallest.

Inference:

After using the above references, we have

Order of Height:

Rishu > Tarun, Sunil

And, Vimal is not the tallest.

Here, we don’t have any other information about the order of heights of the other persons.

So, we cannot say who among these persons is the tallest.

Clearly, Statement II alone is also not sufficient to answer the question.

Checking both Statements II and III together:

Statement I: Tarun is taller than only one person. Kiran is taller than Rishu but shorter than Vimal.

Statement II: Rishu is taller than both Tarun and Sunil. Vimal is not the tallest.

Reference 1:

Rishu is taller than both Tarun and Sunil.

Tarun is taller than only one person.

Inference 1:

After using the above references, we have:

Order of Height:

Rishu > Tarun > Sunil

Reference 2:

Kiran is taller than Rishu but shorter than Vimal.

Vimal is not the tallest.

Inference 2:

After using the information we get from above references with the inference 1, we get:

Order of Height:

____ > Vimal > Kiran > Rishu > Tarun > Sunil

At this point we can say that Umesh is the tallest.

Order of Height:

Umesh > Vimal > Kiran > Rishu > Tarun > Sunil

Clearly, both statements I and II together are sufficient to answer the question.

Hence, the correct answer is option **D**.

Q62. Solution

Correct Answer: (C)

$P \times Q + R$ means P is the brother of Q, who is the daughter of R i.e, P is the son of R.

Q63. Solution

Correct Answer: (A)

According to the question,

Given information is, Given a series and we need to find the next term of given series,

Given series is, $6,\ 11,\ 24,\ 49,\ 90,\ ?$

So, the method used in this series I s, $+1^2 + 2^{2,},\ +2^2 + 3^2,\ +3^2 + 4^2,\ +4^2 + 5^2 \ldots\ldots$

$11 = 6 + 1^2 + 2^2$
$24 = 11 + 2^2 + 3^2$
$49 = 24 + 3^2 + 4^2$
$90 = 49 + 4^2 + 5^2$
$? = 90 + 5^2 + 6^2 = 151.$

Hence, the answer is 151.

Q64. Solution

Correct Answer: (C)

The given logic is,

$(352) + (422)$

$3 + 5 + 2 + 4 + 2 + 2 = 18$

$(712) + (735)$

$7 + 1 + 2 + 7 + 3 + 5 = 25$

$(452) + (328)$

$4 + 5 + 2 + 3 + 2 + 8 = 24$

Hence, correct answer is 24.

Q65. Solution

Correct Answer: (C)

Nephrology is the study of kidney and any disease that affect them.

Entomology is the study of insects.

Astrology is the study of universe and its contents.

Mycology is the study of fungi.

All except Astrology are concerned with biology.

Hence, the correct answer is Astrology.

Q66. Solution

Correct Answer: (B)

In the given question, the second one is used to measure the first one.

An odometer is an instrument to measure the distance between two points.

Similarly, the pressure is measured using an instrument known as a barometer.

Hence, Pressure is the answer.

Q67. Solution
Correct Answer: (B)

According to the question.

An intense admiration means something regarded as impressive or worthy of a respect which results in love, similarly, ecstasy means a state of extreme happiness.

Thrash is to beat repeatedly and violently with a stick.

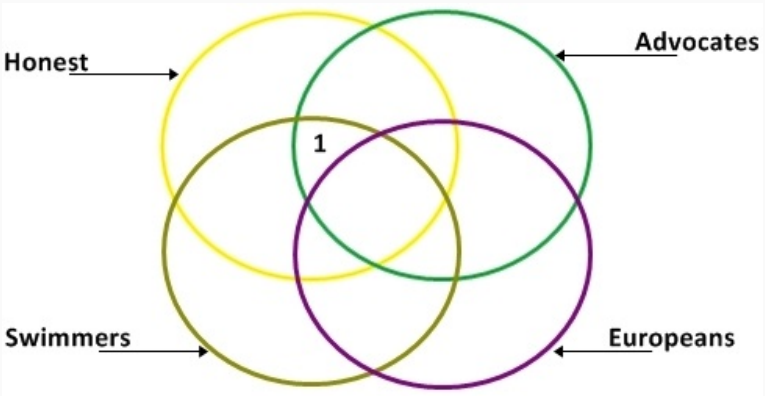
Break means to destroy something.

Complex means too hard to understand something.

Hence, the correct answer is Happiness.

Q68. Solution
Correct Answer: (C)

Area marked 1 in the given figure represents “All non-European advocates who are honest swimmers.”



Hence, option (C) is correct.

Q69. Solution
Correct Answer: (B)

The bottom square rotates 45° clockwise at each stage.

Q70. Solution
Correct Answer: (B)

By taking reverse of the given letter and then by adding 1 in their number place.

$$\begin{aligned} Z\,\mathrm{I}\,\mathrm{P} &= (\mathrm{Z}+\mathrm{I}+\mathrm{P})\times 6 \\ &= (2+19+12)\times 6 = 198 \\ \mathrm{V}I\mathrm{P} &= (\mathrm{V}+\mathrm{I}+\mathrm{P})\times 6 \\ (6+19+12)\times 6 &= 222 \end{aligned}$$

Q71. Solution

Correct Answer: (B)

In this question, there is a word which is encoded in some manner. Now, we have to encode the other given word in the question in the same manner.

According to the question,

ACT is written as BGZ.

$A \xrightarrow{+1} B$

$C \xrightarrow{+4} G$

$T \xrightarrow{+6} Z$

Similarly,

$G \xrightarrow{+1} H$

$E \xrightarrow{+4} I$

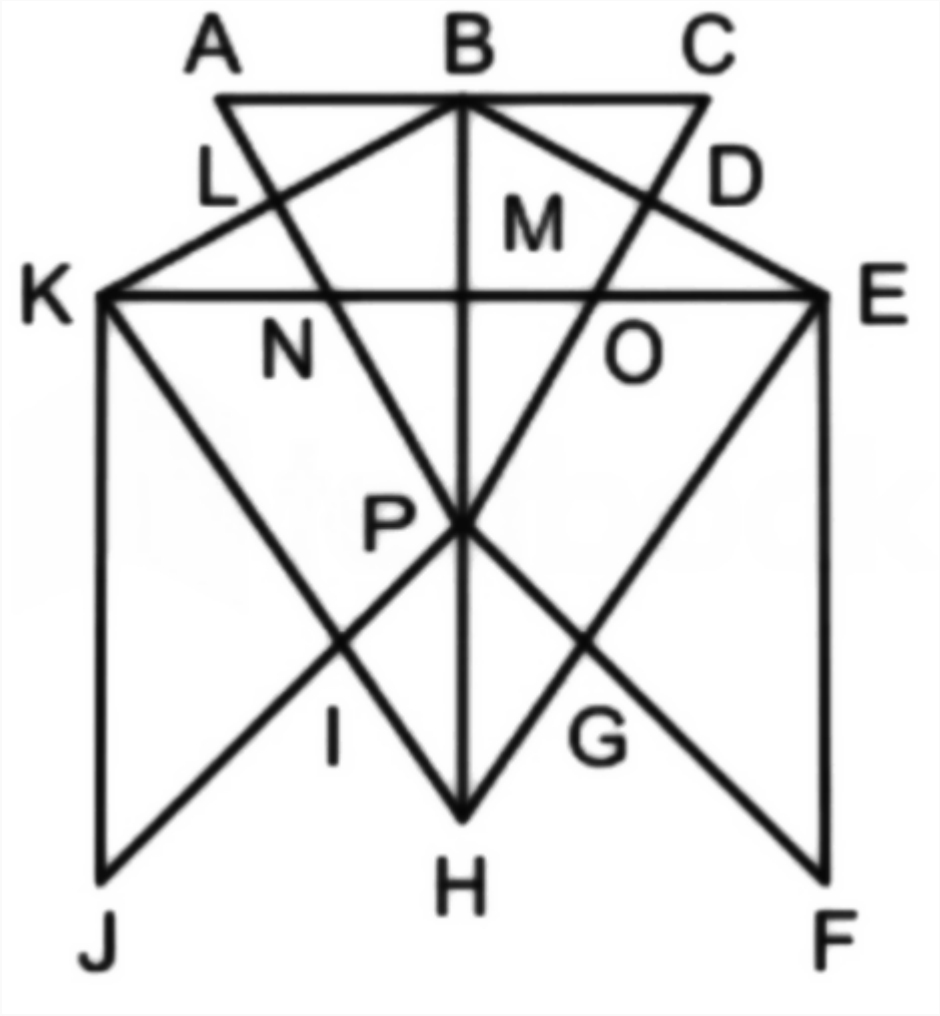
$L \xrightarrow{+6} R$

Hence, the GEL is written as HIR.

So, the correct answer is option B.

Q72. Solution

Correct Answer: (A)



The minimum number of lines required to make the given image is:
$AC, KE, KJ, BH, EF, KH, HE, PF, JP, KB, BE, AP$, PC Hence, ' 13 ' is the correct answer.

Q73. Solution

Correct Answer: (D)

In each step, the last sign becomes the first sign in the clockwise direction, and a new sign appears in front of it. So, the answer figure 4 will continue the series.

Q74. Solution

Correct Answer: (B)

Arrange the girls in two bathrooms in such a way that they take minimum time possible.

Arrangement 1

Bathroom 1	Bathroom 2
23	22
9	11
13	18
45	51

maximum time is 51 minutes

Arrangement 2

Bathroom 1	Bathroom 2
22	23
9	11
18	13
49	47

maximum time is 49 minutes

Arrangement 3

Bathroom 1	Bathroom 2
22	23
11	9
13	18
46	50

maximum time is 50 minutes

Out of all the three arrangements minimum time taken is 49 minutes in arrangement 2.

So the minimum time in which all the girls can get ready is 49 minutes.

$\therefore$ They will get together at $7:49$ am

Q75. Solution

Correct Answer: (D)

Average amount of interest paid by the Company during the given period

$$\begin{aligned} &= \text{Rs.} \left[\frac{23.4 + 32.5 + 41.6 + 36.4 + 49.4}{5}\right] \text{lakhs} \\ &= \text{Rs.} \left[\frac{183.3}{5}\right] \text{lakhs} \\ &= \text{Rs. } 36.66 \text{ lakhs.} \end{aligned}$$

Q76. Solution

Correct Answer: (C)

$$\begin{aligned} \text{Required percentage } &= \left[\frac{(3.00 + 2.52 + 3.84 + 3.68 + 3.96)}{(288 + 342 + 324 + 336 + 420)} \times 100\right]\% \\ &= \left[\frac{17}{1710} \times 100\right]\% \\ &\approx 1\% \end{aligned}$$

Q77. Solution

Correct Answer: (D)

24 ÷ 12 - 18 + 9 ?

After changing the signs and applying the rule of BODMAS, we get

⇒ 24 × 12 + 18 ÷ 9

= 288 + 2

= 290

Hence, option D is correct.

Q78. Solution

Correct Answer: (C)

The given sequence: 519 368 437 246 175

The new sequence: 509 369 427 247 165

Sequence in ascending order: 165 247 369 427 509

Lowest number: 165

Second highest number: 427

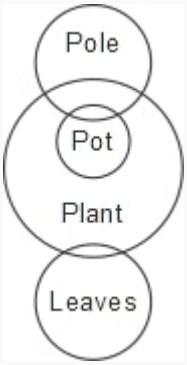
The product of digits of second highest number and lowest number: 1 × 6 × 5 × 4 × 2 × 7 = 1680

Hence, option C is correct.

Q79. Solution

Correct Answer: (C)

Venn Diagram Method:



Analytical Method:

Some poles are pots (I) + All pots are plants (A) = I + A =I = Some poles are plants.

Hence, conclusion I follows.

Again, some plants are leaves (I).

Hence the possibility in II exist.

Hence conclusion II follows.

Hence, option C is correct.

Q80. Solution

Correct Answer: (D)

Venn Diagram Method:

Analytical Method:

E + E = No conclusion through deduction method.

Thus, neither conclusion I nor conclusion II follows.

Hence, option D is correct.

Q81. Solution
Correct Answer: (C)

To play second fiddle- To support the role and view of another person
If you play second fiddle to someone, your position is less important than theirs in something that you are doing together.
Usage: She hated the thought of playing second fiddle to Rose.

Q82. Solution
Correct Answer: (B)

The idiom "To read between the lines" means to understand what someone really means, or what is really happening in a situation, even though it is not said openly.

For example:
Let's read between the lines and not jump to conclusions.

Therefore, the answer is option (2).

Q83. Solution
Correct Answer: (D)

Correct option: Comply with - To follow or adhere to a particular rule or regulation.

Meaning of other options:

Cope with - cope with someone or something means to endure someone or something.

Side with - to agree with and support one particular person.

Conduce to - help to bring about (a particular situation or outcome).

Hence, 'comply with' is the appropriate answer.

Q84. Solution
Correct Answer: (C)

The given sentence is talking about how human beings must be with nature. The preposition 'with' suggests that only 'admiration' or 'harmony' can be the answer. Other words do not take the preposition 'with' after it.

'Harmony' means a state of peaceful existence and agreement.

Hence, 'harmony with nature' includes every dimension of relation which we can have with nature. It also fits the context of the sentence.

Q85. Solution
Correct Answer: (A)

The first option is the incorrect one because the correct answer will be "By the next December, we shall have lived here for six years" which means we will complete a span of six years by the next December.
Though we are talking of something of the future, but about completing a time period of an event (living) that started in the past. So, the answer will be in the future perfect tense.

Q86. Solution
Correct Answer: (C)

Did you think you had seen me somewhere before? This tense is formed with the past tense form of 'to have' (Had) plus the past participle of the verb. It indicates that an action was completed at some point in the past before something else happened.

Q87. Solution
Correct Answer: (A)

The 'tion' part here will be spoken as 'shn'. There will be a sound like 'suh' due to 'so' part of the word solution. Hence, this will be the correct pronunciation of the word solution

Q88. Solution
Correct Answer: (B)

'Grudge' refers to sullen malice or malevolence; cherished malice, enmity, or dislike; ill will; an old cause of hatred or quarrel.

Similarly, 'Hatred' means extreme dislike or disgust. So, it is correct substitute for the given word.

Whereas, 'Gracious' refers to courteous, kind, and pleasant, especially towards someone of lower social status.

'Gloom' means partial or total darkness.

'Solution' refers to a means of solving a problem or dealing with a difficult situation.

Hence, the correct answer is 'Hatred'.

Q89. Solution
Correct Answer: (B)

Laudable refers to someone or something deserving praise and commendation. Also, commendable is something deserving praise.
Lovable means 'inspiring or deserving love or affection'. Profitable is something yielding profit or financial gain.
Oblivious is someone not aware of or concerned about what is happening around one.

Q90. Solution
Correct Answer: (C)

Correct Answer: Shown

As soon as the visitor's dishonest purpose was discovered he was **shown** the door.

The usual past participle of 'show' that is 'shown' is used. The structure of the sentence requires V3 just after the past form of the helping verb 'was'.

Here, in the sentence, it tells that they immediately opposed the man when they discovered his dishonest purpose.

Q91. Solution

Correct Answer: (B)

The equation of a plane passing through three points $A(x_1,\ y_1,\ z_1),\ B(x_2,\ y_2,\ z_2)$ and $C(x_3,\ y_3,\ z_3)$ can be obtained using:

$$\begin{vmatrix} x-x_1 & y-y_1 & z-z_1 \\ x_2-x_1 & y_2-y_1 & z_2-z_1 \\ x_3-x_1 & y_3-y_1 & z_3-z_1 \end{vmatrix} = 0$$

The points given in the question are $(3, -2, -1),\ (-1,\ 1,\ 2)$ and $(2,\ 3, -4)$. So, the equation passing through these can be found as

$$\begin{vmatrix} x-3 & y+2 & z+1 \\ -1-3 & 1+2 & 2+1 \\ 2-3 & 3+2 & -4+1 \end{vmatrix} = 0$$

$$\begin{vmatrix} x-3 & y+2 & z+1 \\ -4 & 3 & 3 \\ -1 & 5 & -3 \end{vmatrix} = 0$$

$$(x-3)[-9-15] - (y+2)[12+3] + (z+1)[-20+3] = 0$$

$$-24x + 72 - 15y - 30 - 17z - 17 = 0$$

$$24x + 15y + 17z = 25$$

The given points are coplanar if the fourth point $(4,\ 5,\ \lambda)$ satisfies the above equation, so the value of λ can be found as

$$(24 \times 4) + (15 \times 5) + 17\lambda = 25$$

$$96 + 75 + 17\lambda = 25$$

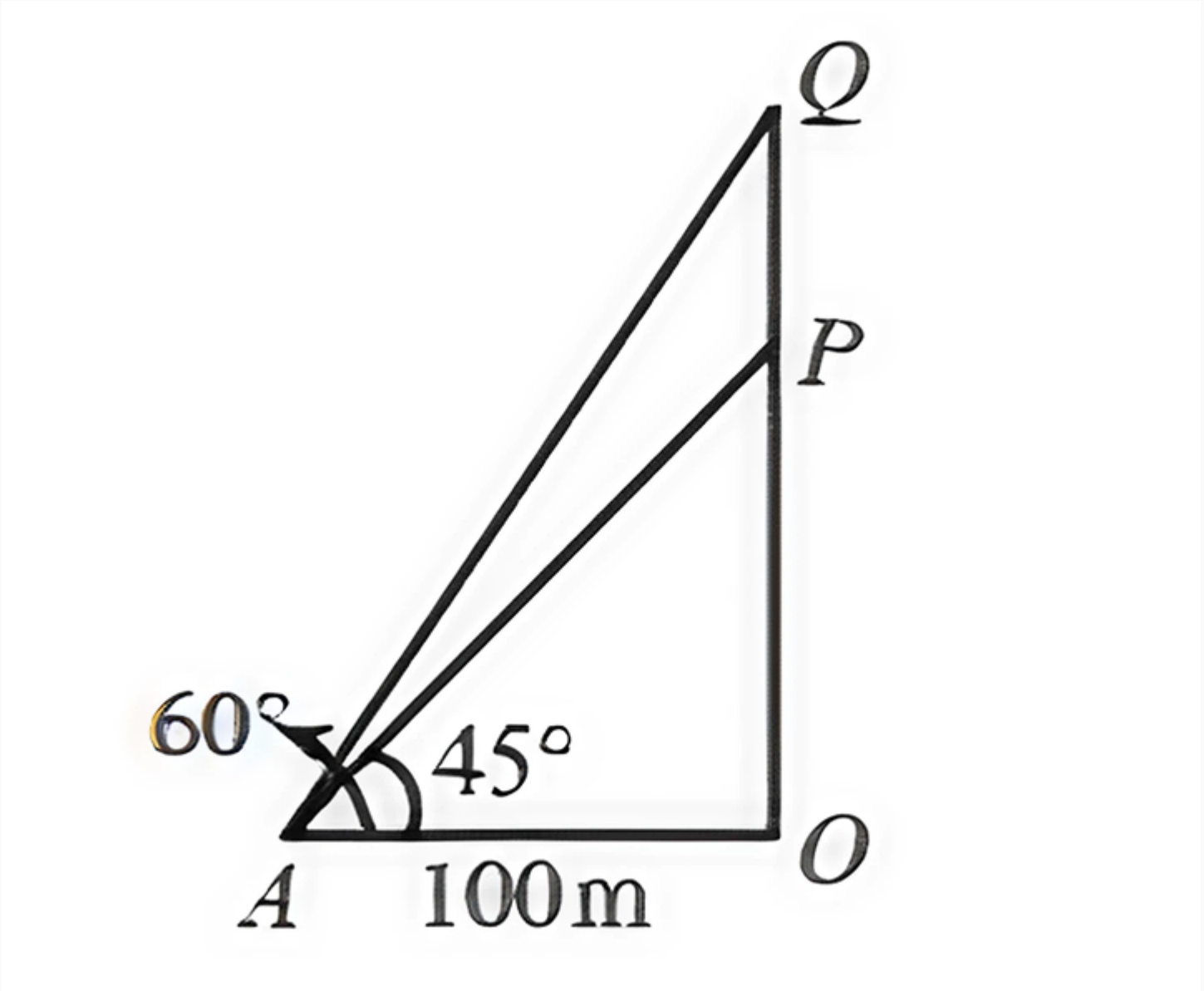
$$17\lambda = -146$$

$$\lambda = -\frac{146}{17}$$

Q92. Solution

Correct Answer: (D)

$PQ = OQ - OP = 100\tan 60^\circ - 100\tan 45^\circ = 100(\sqrt{3} - 1)$



Q93. Solution

Correct Answer: (C)

Given lines is $y = -3x - k$

And equation of circle is $x^2 + y^2 = 10$

Here, $a^2 = 10,\ m = -3,\ c = -k$

For tangency, $c^2 = a^2(1 + m^2)$

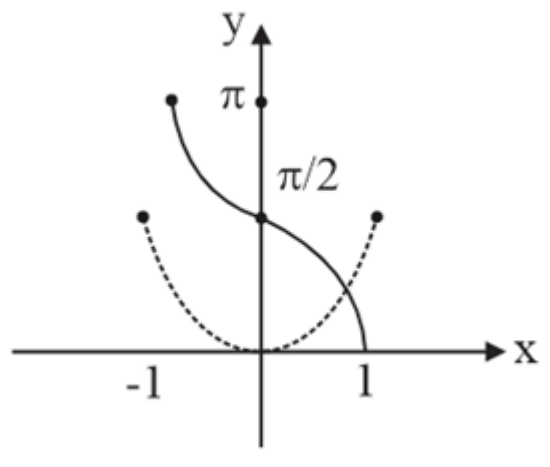
For tangency, $c^2 = a^2(1 + m^2)$

$\Rightarrow\ k^2 = 10(1 + 9)\ \Rightarrow k = \pm 10$

Q94. Solution

Correct Answer: (B)

Here, the dotted curve is $y = \sin^{-1}|x|$ and the dark curve is $y = \cos^{-1} x$.



It is very much clear from the graphs that, there is a single point of intersection.
$\therefore$ Number of solution is 1.

Q95. Solution

Correct Answer: (C)

Required number of ways $=$ coefficient of x^{10} in

$\left(x^0 + x^1 + x^2 + \ldots + x^{10}\right)^2 \left(x^0 + x^1 + x^2 + \ldots + x^9\right)$

$=$ coeff. of x^{10} in $\left(\frac{1-x^{11}}{1-x}\right)^2 \left(\frac{1-x^{10}}{1-x}\right)$

$=$ coeff. of x^{10} in $(1-x)^{-3}\left(1-x^{11}\right)^2\left(1-x^{10}\right)$

$=$ coeff. of x^{10} in $(1-x)^{-3}\left(1 + x^{22} - 2x^{11} \ldots .\right)\left(1-x^{10}\right)$

$=$ coeff. of x^{10} in

$(1-x)^{-3}\left(1 + x^{22} - 2x^{11} - x^{10} - x^{32} + 2x^{21} + \ldots\right)$

$=$ coeff. of x^{10} in

$(1-x)^{-3}\left(1 - x^{10} - 2x^{11} + 2x^{21} + x^{22} - x^{32}\right)$

$=$ coeff. of x^{10} in $(1-x)^{-3}-$ coeff. of x^0 in $(1-x)^{-3}$

$= {}^{10+3-1}C_{10} - 1 = {}^{12}C_{10} - 1 = \frac{12\times 11}{2} - 1 = 65$

Q96. Solution
Correct Answer: (C)

$\sin x . \cos y = 1$

$\Rightarrow (\sin x = 1 \& \cos y = 1)$ or $(\sin x = -1 \& \cos y = -1)$

So, (x, y) can be $\left(\frac{\pi}{2}, 0\right)$, $\left(\frac{\pi}{2}, 2\pi\right)$, $\left(\frac{3\pi}{2}, \pi\right)$

Total 3 solutions

Q97. Solution
Correct Answer: (A)

$f(x) = x^3 + bx^2 + cx + d$

Now, differentiating both the sides with respect to x,

$\frac{dy}{dx} = 3x^2 + 2bx + C$

Calculating the discrimant to check out the nature of the roots of the quadratic equation,
$D = 4b^2 - 4 \times 3 \times c = 4\left(b^2 - 3c\right),\ b^2 < c = -\text{ve}$

This means that graph is always increasing.

Q98. Solution
Correct Answer: (C)

$T_{r+1} = {}^{2n}C_r x^{2n-r}\left(\frac{1}{x^2}\right)^r = {}^{2n}C_r x^{2n-3r},$ This contains x^m, if $2n - 3r = m$ i.e. if $r = \frac{2n-m}{3}$ $\therefore$ Coefficient of $x^m = {}^{2n}C_r, \quad r = \frac{2n-m}{3} = \frac{2n!}{(2n-r)!r!} = \frac{2n!}{(2n-\frac{2n-m}{3})!(\frac{2n-m}{3})!} = \frac{2n!}{(\frac{4n+m}{3})!(\frac{2n-m}{3})!}$.

Q99. Solution

Correct Answer: (C)

$$2A+4B=\begin{bmatrix}2 & 4 & 0\\ 12 & -6 & 6\\ -10 & 6 & 2\end{bmatrix} \ldots(1)$$

$$2A-B=\begin{bmatrix}2 & -1 & 5\\ 2 & -1 & 6\\ 0 & 1 & 2\end{bmatrix} \ldots(2)$$

Subtracting equation (2) from equation (1), we get

$$5B=\begin{bmatrix}0 & 5 & -5\\ 10 & -5 & 0\\ -10 & 5 & 0\end{bmatrix}$$

$$\text{Hence,B}=\begin{bmatrix}0 & 1 & -1\\ 2 & -1 & 0\\ -2 & 1 & 0\end{bmatrix} \text{ \& A}=\begin{bmatrix}1 & 0 & 2\\ 2 & -1 & 3\\ -1 & 1 & 1\end{bmatrix}$$

So $tr(A)-tr(B)=1-(-1)=2$

Q100. Solution

Correct Answer: (C)

The given n observation are $\mathrm{x}_1, \mathrm{x}_2 \cdot \mathrm{x}_\mathrm{n}$ Mean $=\bar{x}$ variance $=\sigma^2 \therefore \sigma^2=\frac{1}{n}\sum_{i=1}^{n} y_i(x_i-\bar{x})^2$ If each observation is multiplied by a and the new observation are y_i then

$\mathrm{y_i}=\mathrm{ax_i}$, i.e, $\mathrm{x_i}=\dfrac{1}{\mathrm{a}}\mathrm{y_i}$

$$\therefore \bar{\mathrm{y}}=\frac{1}{\mathrm{n}}\sum_{\mathrm{i}=1}^{\mathrm{n}}\mathrm{y_i}=\frac{1}{\mathrm{n}}\sum_{\mathrm{i}=1}^{\mathrm{n}}\mathrm{ax_i}=\frac{\mathrm{a}}{\mathrm{n}}\sum_{\mathrm{i}=1}^{\mathrm{n}}\mathrm{x_i}=\overline{\mathrm{ax}}, \left(\because \bar{\mathrm{x}}=\frac{1}{\mathrm{n}}\sum_{\mathrm{i}=1}^{\mathrm{n}}\mathrm{x_i}\right)$$ Substituting the values of $\mathrm{x_i}$ and x in (1)

$$\sigma^2=\frac{1}{2}\sum_{i=1}^{n}\left(\frac{1}{a}y_i-\frac{1}{a}\bar{y}\right)^2$$

we obtain Thus the variance of the observation $\mathrm{ax_1, ax_2 \ldots axn}$ is $\mathrm{a^2\sigma^2}$

$$\Rightarrow a^2\sigma^2=\frac{1}{n}\sum_{i=1}^{n}(y_i-\bar{y})^2$$

Q101. Solution

Correct Answer: (B)

$f(1)=5, f'(x)=nx^{n-1}$so $f'(1)=n$
$f''(1)=n(n-1), \ldots f^n(1)=1.2.\ldots.n$
Thus, $f(1)+\frac{f'(1)}{1!}+\ldots+\frac{f^n(1)}{n!}$
$=5+\frac{n}{1}+\frac{n(n-1)}{2!}+\ldots+\frac{n!}{n!}$
$=(1+1)^n+4=2^n+4$

Q102. Solution
Correct Answer: (B)

$f(x)$ is defined if $-1 \leq \frac{x}{2} - 1 \leq 1$ and $\cos x > 0$
or $0 \leq x \leq 4$ and $\frac{-\pi}{2} < x < \frac{\pi}{2}$

Therefore $0 \leq x < \frac{\pi}{2}$

Q103. Solution
Correct Answer: (D)

Exactly one root of quadratic equation $x^2 - (k-1)x + k^2 = 0$, lies between 1 and 2.

Condition for exactly one root of quadratic equation $f(x) = ax^2 + bx + c = 0$ lies in the interval (d, e) will be $f(d) \cdot f(e) < 0$.

$\Rightarrow f(1) \cdot f(2) < 0$

$\Rightarrow \left(1 - (k-1) + k^2\right)\left(4 - (k-1)2 + k^2\right) < 0$

$\Rightarrow \left(k^2 - k + 2\right)\left(k^2 - 2k + 6\right) < 0$

For quadratic $k^2 - k + 2$

Discriminant, $D = (-1)^2 - 4(2) = -7$.

Since, the leading coefficient $(= 1)$ is positive and discriminant is negative, this implies it does not have real roots and will always be positive.

For quadratic $k^2 - 2k + 6$,

Discriminant, $D = (-2)^2 - 4(6) = -20$

Since, leading coefficient $(= 1)$ is positive and discriminant is negative, this implies it does not have real roots and will always be positive.

Both quadratic expressions are always positive, so their product can not be negative.

Hence, $k \in \phi$.

Q104. Solution
Correct Answer: (D)

Total number of words formed with the 6 letters of the word $\mathrm{GENIUS} = 6!$

Now,

Total number of words starting with $\mathrm{G} = 5!$

Total number of words ending with $\mathrm{S} = 5!$

Total number of words beginning with G and ending with $\mathrm{S} = 4!$

Thus,

Total number of words starting with G or ending with S =Total number of words starting with G+Total number of words ending with S−Total number of words starting with G and ending with S.

$= 5! + 5! - 4!$ (Because the words starting with G and ending with S has been considered twice with the words that starts with G or ends with S)

$\therefore$ Total number of words that neither begin with G nor ends with $S = 6! - (5! + 5! - 4!) = 504.$

Q105. Solution
Correct Answer: (A)

We have, $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1,\ (a > b)$

Let SPQ is a focal chord of the ellipse,

$H.M$ of segment $(SP\ \&\ SQ)$ of the focal chord $PSQ = \frac{1}{2} \times$ length of latus rectum of an ellipse $\ldots (i)$

$\therefore\ a > b,$ then, the length latus rectum of an ellipse $= \frac{2b^2}{a}\ \ldots (ii)$

From (i) & (ii) we get,

$H.M.$ of $SP\ \&\ SQ = \frac{b^2}{a}$

Q106. Solution

Correct Answer: (B)

$I_n = \int \tan^n x dx = \int \tan^{n-2} x\left(\sec^2 x - 1\right) dx$
$= \int \tan^{n-2} x . \sec^2 x dx - I_{n-2}$
$\Rightarrow\ I_n + I_{n-2} = \int \tan^{n-2} x . \sec^2 x dx$
Put $\tan x = t \quad \Rightarrow \quad \sec^2 x dx = dt$

$\therefore\ I_n + I_{n-2} = \int t^{n-2} dt = \frac{t^{n-1}}{n-1} + c$
$\Rightarrow\ I_n + I_{n-2} = \frac{\left(\tan^{n-1} x\right)}{n-1} + c$

Q107. Solution

Correct Answer: (B)

$\lim\limits_{x \to 0} \frac{e^{ax} - e^{bx}}{x}$

$= \lim\limits_{x \to 0} \frac{\left(1 + \frac{ax}{1!} + \frac{(ax)^2}{2!} + \ldots\right) - \left(1 + \frac{bx}{1!} + \frac{(bx)^2}{2!} + \ldots\right)}{x}$

$= \lim\limits_{x \to 0} \frac{x(a-b) + \frac{x^2}{2!}\left(a^2 - b^2\right) + \ldots.}{x}$

$= \lim\limits_{x \to 0} \left[(a-b) + \frac{x}{2!}\left(a^2 - b^2\right) + \ldots.\right]$

$= a - b$

Alternate

$\lim\limits_{x \to 0} \frac{e^{ax} - e^{bx}}{x}$

On applying, L'Hospital Rule

$= \lim\limits_{x \to 0} \frac{ae^{ax} - be^{bx}}{1} = \frac{ae^0 - be^0}{1} = a - b$

Q108. Solution

Correct Answer: (A)

For non-zero solution $\begin{vmatrix} a & 4 & 1 \\ b & 3 & 1 \\ c & 2 & 1 \end{vmatrix} = 0$

$\therefore \quad a - 2b + c = 0$

$\therefore \quad a + 10,\ b + 13,\ c + 16$ are in A.P.

Q109. Solution

Correct Answer: (C)

p	$\sim p$	$p \Rightarrow \sim p$	$\sim p \Rightarrow p$	$(p \Rightarrow \sim p) \wedge (\sim p \Rightarrow p)$
T	F	F	T	F
F	T	T	F	F

Q110. Solution

Correct Answer: (C)

$$[\vec{a}\vec{b}\vec{c}] = 0 \begin{vmatrix} 1 & 1 & 1 \\ 2 & 0 & 4 \\ 1 & \lambda & 3 \end{vmatrix} = 0\ l(0+4\lambda) - 1(6+4) + 1(2d) = 0\ 4\lambda - 10 + 2\lambda = 0\ d = \frac{10}{6}\ \lambda = 5/3$$

Q111. Solution

Correct Answer: (A)

Let $f(x) = \ln(x), x > 0$ $f(x) = \ln(x)$ is a continuous function of x for every positive value of x.
$f\left(\frac{x}{y}\right) = \ln\left(\frac{x}{y}\right) = \ln(x) - \ln(y) = f(x) - f(y)$.

Q112. Solution

Correct Answer: (A)

Given,

$\log_2 3 = a,\ \log_3 5 = b,\ \log_7 2 = c$

$\because\ a = \frac{\log 3}{\log 2},\ b = \frac{\log 5}{\log 3}$ and $c = \frac{\log 2}{\log 7}$

$\therefore\ abc = \frac{\log 3}{\log 2} \times \frac{\log 5}{\log 3} \times \frac{\log 2}{\log 7} = \frac{\log 5}{\log 7}$

$2c = \frac{2\log 2}{\log 7}$ and $ac = \frac{\log 3}{\log 2} \times \frac{\log 2}{\log 7} = \frac{\log 3}{\log 7}$

$\therefore\ \log_{140} 63 = \frac{\log 63}{\log 140} = \frac{\log(3^2 \times 7)}{\log(2^2 \times 5 \times 7)}$

$= \frac{2\log 3 + \log 7}{\log 7 + 2\log 2 + \log 5}$

$= \frac{2\left(\frac{\log 3}{\log 7}\right) + 1}{1 + 2\left(\frac{\log 2}{\log 7}\right) + \frac{\log 5}{\log 7}}$

$= \frac{2ac + 1}{1 + 2c + abc}$

Q113. Solution

Correct Answer: (A)

The focal chord of $y^2 = 16x$ is tangent to the circle $(x-6)^2 + y^2 = 2$.

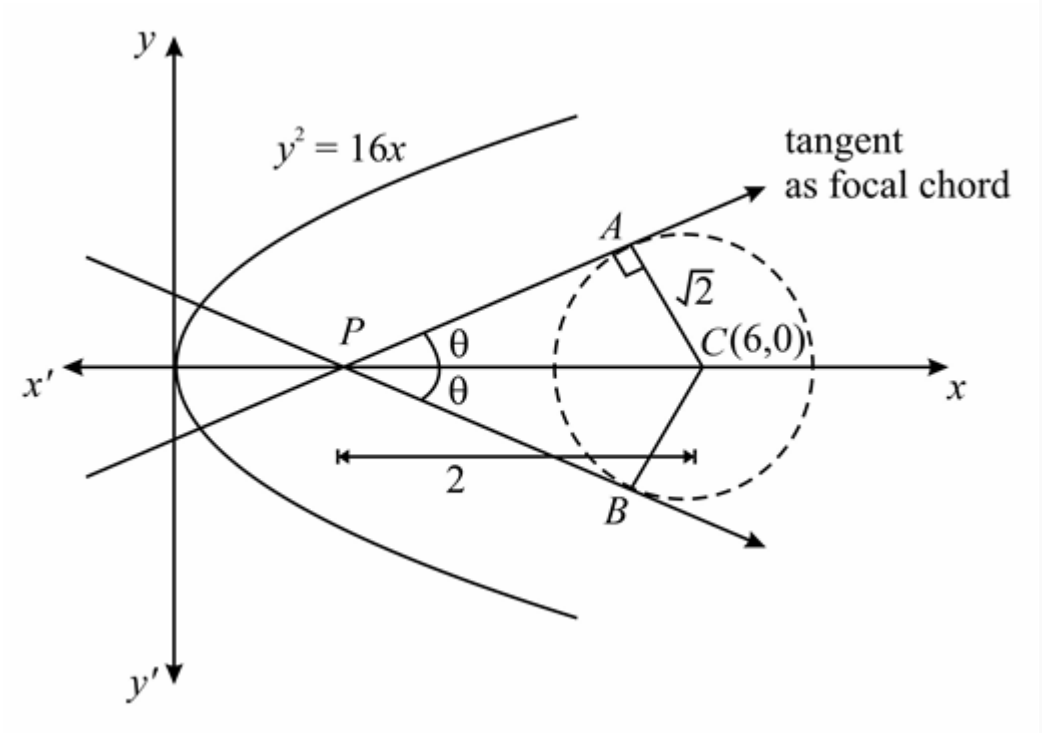
The focus of the parabola is $(a, 0)$ i.e., $(4, 0)$ is the Focus.

Now, tangents are drawn from $(4, 0)$ to $(x-6)^2 + y^2 = 2$

Since, PA is tangent to the circle.

Since $\tan\theta$ =slope of tangent

$= \frac{AC}{AP} = \frac{\sqrt{2}}{\sqrt{2}} = 1 \quad \therefore$ slope 1 or -1



$\therefore$ The slope of the focal chord as a tangent to the circle $= \pm 1$

Q114. Solution

Correct Answer: (C)

Let A be the event that face 4 turns up and B be the event that face 5 turns up then $P(A) = 0.25$, $P(B) = 0.05$. Since A and B are mutually exclusive, so $P(A \cup B) = P(A) + P(B) = 0.25 + 0.05 = 0.30$. We have to find $P\left(\frac{A}{A \cup B}\right)$, which is equal to $P\frac{[A \cap (A \cup B)]}{P(A \cup B)} = \frac{P(A)}{P(A \cup B)} = \frac{0.25}{0.30} = \frac{5}{6}$

Q115. Solution
Correct Answer: (D)

$(1,\ 1),\ (2,\ 2),\ (3,\ 3),\ (4,\ 4) \in R$, therefore, relation is reflexive.

$(1,\ 2) \in R$ but $(2,\ 1) \notin R$, therefore, relation is not symmetric.

$(3,\ 1) \in R\ \&\ (1,\ 2) \in R$ but $(3,\ 2) \notin R$, therefore, relation is not transitive.

Q116. Solution
Correct Answer: (D)

We know that orthocentre of triangle is point of intersection of any two altitudes of triangle.

Like in this figure,

Slope of BC $\Rightarrow \frac{(y_2-y_1)}{(x_2-x_1)} = \frac{0-4}{4-3} = -4$

We know that if two lines are perpendicular then $m_1 m_2 = -1$

Here BC is perpendicular to AL

$\Rightarrow$Slope of AL is $\frac{1}{4}$

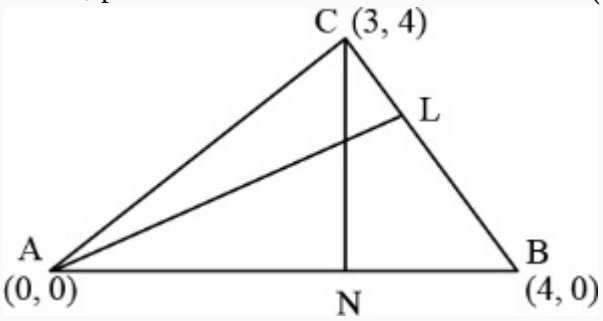
Where AL is the altitude from A to BC,

$\Rightarrow (y - y_1) = m(x - x_1)$

$\Rightarrow (y - 0) = \frac{1}{4}(x - 0)$

Similarly, altitude of CN is $\mathrm{x} = 3$

Hence, point of intersection of AL and CN is $(3,\ {}^{3}/_{4})$



Q117. Solution

Correct Answer: (A)

Given, $f(x) = \frac{x}{1+|x|}$

$\therefore \quad f'(x) = \frac{(1+|x|).1 - x.\frac{|x|}{x}}{(1+|x|)^2}$

$= \frac{1}{(1+|x|)^2} > 0 \; \forall x \in R$

$\Rightarrow \quad f(x)$ is strictly increasing

Q118. Solution

Correct Answer: (B)

Let point is $\frac{x-2}{1} = \frac{y+3}{-2} = \frac{z+5}{-2} = \lambda$

$P \equiv (\lambda + 2, \; -2\lambda - 3, -2\lambda - 5)$

Let, $Q \equiv (2, \; -3, -5)$

Given, $PQ = 6$

$\Rightarrow PQ^2 = 36$

$\Rightarrow (\lambda + 2 - 2)^2 + (-2\lambda - 3 + 3)^2 + (2\lambda - 5 + 5)^2 = 36$

$\Rightarrow 9\lambda^2 = 36$

$\Rightarrow \lambda^2 = 4$

$\Rightarrow \lambda = \pm 2$

$\therefore$ From $\lambda = 2, \; P \equiv (4, -7, -9)$.

And from $\lambda = -2, \; P \equiv (0, \; 1, \; -1)$.

Q119. Solution

Correct Answer: (B)

The volume of the parallelepiped is, $v = \left[\vec{a}\,\vec{b}\,\vec{c}\right]$

$$\Rightarrow \begin{vmatrix} 1 & 1 & n \\ 2 & 4 & -n \\ 1 & n & 3 \end{vmatrix} = \pm 158$$

$\Rightarrow 1(12 + n^2) - 1(6 + n) + n(2n - 4) = \pm 158$

$\Rightarrow 3n^2 - 5n - 152 = 0$ or $3n^2 - 5n + 164 = 0$

($\because \; D < 0$, no real roots of $3n^2 - 5n + 164 = 0$)

$n = 8, \; -\frac{19}{3} \quad \Rightarrow \quad n = 8$, as $n \geq 0$

then, $\vec{b} \cdot \vec{c} = 2 + 4n - 3n = 10$

$\vec{a} \cdot \vec{c} = 1 + n + 3n = 33$

Q120. Solution

Correct Answer: (D)

Consider following events

A : Person chosen is a smoker and non vegetarian.

B : Person chosen is a smoker and vegetarian.

C : Person chosen is a non-smoker and vegetarian

E : Person chosen has a chest disorder

Given

$P(A)=\frac{160}{400} P(B)=\frac{100}{400} P(C)=\frac{140}{400}$

$P\left(\frac{E}{A}\right)=\frac{35}{100} P\left(\frac{E}{B}\right)=\frac{20}{100} P\left(\frac{E}{C}\right)=\frac{10}{100}$

To find

$P\left(\frac{A}{E}\right)=\frac{P(A) P\left(\frac{E}{A}\right)}{P(A) \cdot P\left(\frac{E}{A}\right)+P(B) \cdot P\left(\frac{E}{B}\right)+P(C) \cdot P\left(\frac{E}{C}\right)}$

$=\frac{\frac{160}{400} \times \frac{35}{100}}{\frac{160}{400} \times \frac{35}{100}+\frac{100}{400} \times \frac{20}{100}+\frac{140}{400} \times \frac{10}{100}}$

$=\frac{28}{45}$

option (4)

Q121. Solution

Correct Answer: (C)

Let $\mathrm{x}_1, \mathrm{x}_2, \mathrm{x}_3, \ldots\ldots, \mathrm{x}_\mathrm{n}$ be n observations. Then

$$\overline{\mathrm{x}}=\frac{1}{\mathrm{n}} \sum_{\mathrm{i}=1}^{\mathrm{n}} \mathrm{x}_\mathrm{i}$$

$\therefore$ New mean, $\overline{\mathrm{x}}=\frac{1}{\mathrm{n}} \sum_{\mathrm{i}=1}^{\mathrm{n}}\left(\frac{\mathrm{x}_\mathrm{i}}{\alpha}+10\right)$

$$=\frac{1}{\alpha}\left(\frac{1}{\mathrm{n}} \sum_{\mathrm{i}=1}^{\mathrm{n}} \mathrm{x}_\mathrm{i}\right)+\frac{1}{\mathrm{n}} \cdot(10 \mathrm{n})$$

$$=\frac{1}{\alpha} \overline{\mathrm{x}}+10=\frac{\overline{\mathrm{x}}+10 \alpha}{\alpha}$$

Q122. Solution

Correct Answer: (C)

Circle touching $x-$axis and having radius $r-$

$x^2+y^2 \pm 2rx+2fy+f^2=0$

-Wherein

Where f is a variable parameter.

Let the equation of the circle is $(x-1)^2+(y-k)^2=k^2$ It passes through $(2,\ 3)$

$\therefore\ 1+9+k^2-6k=k^2$

$\Rightarrow\quad k=\frac{5}{3} \Rightarrow$ diameter $=\frac{10}{3}$

Q123. Solution

Correct Answer: (B)

Let $y=xt$
$\frac{xdt}{dx}+t=t+\tan t$
$\Rightarrow\ \int \cot t dt=\ln|x|+c$
$\Rightarrow\ \log|\sin t|=\ln|x|+c$
$\Rightarrow\ \sin\frac{y}{x}=|x|$
$y=x\sin^{-1}|x|\ (x\neq 0)$
$\therefore x\in[-1,1]-\{0\}$

Q124. Solution

Correct Answer: (B)

Given, $B=-A^{-1}BA \therefore\quad AB=-AA^{-1}BA=-IBA=-BA$
$\therefore\quad AB=-BA$
Now $(A+B)^2=(A+B)(A+B)=A^2+AB+BA+B^2$
$=A^2+B^2\quad[\because BA=-AB]$
Thus, $(A+B)^2=A^2+B^2$.

Q125. Solution

Correct Answer: (C)

The three terms of the geometric sequence with the common ratio r , are $\mathrm{x},\ \mathrm{xr},\ \mathrm{xr}^2$

$\therefore\ \mathrm{x}\ +\ \mathrm{xr}\ +\ \mathrm{xr}^2 = 42$

After multiplying the middle term by $\frac{5}{4}$ will get an arithmetic sequence.

This yields $\frac{5}{4}\mathrm{xr} -\ \mathrm{x} = \mathrm{xr}^2 -\ \frac{5}{4}\mathrm{xr}$

After cancelling x , we obtain a quadratic equation

$2\mathrm{r}^2 - 5\mathrm{r}\ +\ 2 = 0$, with roots $\mathrm{r} = \frac{1}{2}$ and $\mathrm{r} = 2$.

On substituting these in $\mathrm{x}\ +\ \mathrm{xr}\ +\ \mathrm{xr}^2 = 42$,

We get $\mathrm{x} = 6$ or 24

Q126. Solution

Correct Answer: (B)

Since, number of observations are even $n = 10$

Hence, the median is $= \frac{\left(\frac{n}{2}\right)^{th}\ term + \left(\frac{n}{2}+1\right)^{th}\ term}{2} = \frac{5^{th}\ term + 6^{th}\ term}{2}$

Thus, median $= \frac{34+x}{2}$

$\Rightarrow \frac{34+x}{2} = 35$

$\Rightarrow x = 36 \quad \ldots (i)$

And, mean$= \frac{sum\ of\ terms}{number\ of\ terms}$

$\Rightarrow \frac{10+22+26+29+34+x+42+67+70+y}{10} = 42$

$\Rightarrow\ x + y + 300 = 420$

$\Rightarrow\ x + y = 120 \quad \ldots (ii)$

Put the value of x from (i) in (ii), to get

$36 + y = 120$

$\Rightarrow y = 84$

$\Rightarrow \frac{y}{x} = \frac{84}{36} = \frac{7}{3}.$

Q127. Solution

Correct Answer: (C)

$\lim\limits_{n\to\infty} \frac{1}{n^2}\sec^2\frac{1}{n^2} + \frac{2}{n^2}\sec^2\left(\frac{4}{n^2}\right) + ... + \frac{1}{n}\sec^2 1$

$= \lim\limits_{n\to\infty} \frac{1}{n^2}\sec^2\frac{1}{n^2} + \frac{2}{n^2}\sec^2\left(\frac{4}{n^2}\right) + ... + \frac{n}{n^2}\sec^2\left(\frac{n^2}{n^2}\right)$

$= \lim\limits_{n\to\infty} \sum_{r=1}^{r=n}\left(\frac{r}{n^2}\right)\sec^2\left(\frac{r}{n}\right)^2 = \lim\limits_{n\to\infty} \sum_{r=0}^{r=n}\frac{1}{n}\left(\frac{r}{n}\right)\sec^2\left(\frac{r}{n}\right)^2$

$= \int\limits_0^1 x\,\sec^2\left(x^2\right)dx = \frac{1}{2}\tan 1$

Q128. Solution

Correct Answer: (A)

$I = \int \frac{3e^x - 5e^{-x}}{4e^x + 5e^{-x}}dx$

Let $3e^x - 5e^{-x} = A(4e^x + 5e^{-x}) + B(4e^x - 5e^{-x}) + c$

Then $4(A + B) = 3,\ 5(A - B) = -5,\ C = 0$

$\therefore\ \ A = -1/8,\ b = 7/8$

$\therefore\ \ I = -\frac{1}{8}\int dx \frac{7}{8}\int \frac{(4e^x - 5e^{-x})dx}{4e^x + 5e^{-x}}$

$= -\frac{1}{8}x + \frac{7}{8}\ln(4e^x + 5e^{-x})$

$\Rightarrow a = -1/8,\ b = 7/8$

Q129. Solution

Correct Answer: (C)

1^∞

eL and $\mathrm{L} = \lim\limits_{x\to 0} \frac{a^x - 1 + b^x - 1 + c^x - 1}{3x} \times \frac{2x}{\sin x + 1 - \cos x}$

$= \frac{(\ln a + \ln b + \ln c)}{3} \times \frac{2}{1+0} = \frac{2}{3}\ln abc$

$e^L = e(abc)^{\frac{2}{3}} = (abc)^{\frac{2}{3}}$

Q130. Solution

Correct Answer: (C)

$1 + (1 + x) + \left(1 + x + x^2\right) + \ldots +$
$\left(1 + x + x^2 + x^3 + \ldots + x^{n-1}\right) + \ldots$

Required sum $= \frac{1}{(1-x)}\left\{(1 - x) + \left(1 - x^2\right) + \left(1 - x^3\right)\right.$
$\left. + \left(1 - x^4\right) + \ldots\ldots\ldots \text{ upto } n \text{ terms }\right\}$
$= \frac{1}{(1-x)}\left[n - \left\{x + x^2 + x^3 + \ldots\ldots\ldots \text{ upto } n \text{ terms }\right\}\right]$
$= \frac{1}{(1-x)}\left[n - \frac{x(1-x^n)}{1-x}\right] = \frac{n(1-x) - x(1-x^n)}{(1-x)^2}.$

Q131. Solution

Correct Answer: (B)

$$\phi = \overrightarrow{\mathrm{B}} \cdot \overrightarrow{\mathrm{A}}$$
$$= \mathrm{BA}\cos 0^{\circ}$$
$$= 2 \times \frac{1}{2} \times 2 \times 1 \times 10^{-4}$$
$$= 2 \times 10^{-4}\ \mathrm{Wb}$$

Q132. Solution

Correct Answer: (B)

Acceleration due to gravity at a height h from earth's surface

$\mathrm{g}' = \frac{\mathrm{GM}}{(\mathrm{R}+\mathrm{h})^2}$

Since $\mathrm{g}' = \frac{\mathrm{g}}{100}$

or $\frac{\mathrm{g}}{100} = \frac{\mathrm{GM}}{(\mathrm{R}+\mathrm{h})^2}$

or $\frac{(\mathrm{R}+\mathrm{h})^2}{100} = \frac{\mathrm{GM}}{\mathrm{g}}$

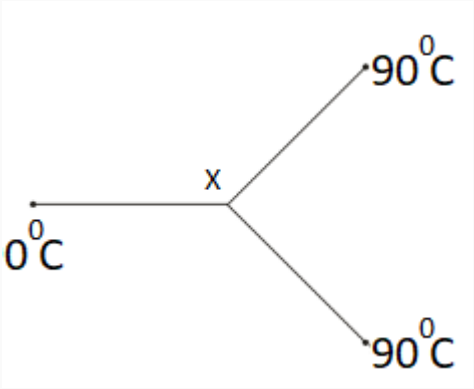
$\frac{(\mathrm{R}+\mathrm{h})^2}{100} = \mathrm{R}^2 \quad (\text{ since } \mathrm{g} = \frac{\mathrm{GM}}{\mathrm{R}^2})$

$\mathrm{R} + \mathrm{h} = 10\mathrm{R}$

$\mathrm{h} = 9\mathrm{R}$

Q133. Solution

Correct Answer: (B)



Let T be the temperature at the junction.

Let L and A be the length and area of cross-section of each rod respectively.

$\therefore$ Heat current from Y to X is

$H_1 = \frac{KA(90^\circ\text{C}-T)}{L}$

Heat current from Z to X is

$H_2 = \frac{KA(90^\circ\text{C}-T)}{L}$

Heat current from X to W is

$H_3 = \frac{KA(T-0^\circ\text{C})}{L}$

At the junction X,

$H_1 + H_2 = H_3$

$\therefore \;\; 90 - T + 90 - T = T$

$\Rightarrow \;\; T = 60^\circ\text{C}$

Q134. Solution

Correct Answer: (A)

The alkali metal ions exist as hydrated ions, $[\text{M}(\text{H}_2\text{O})_\text{x}]^+$, in the aqueous solution. The degree of hydration, however, decreases with the increasing ionic size as we move from Li^+ to Cs^+. In other words, Li^+ ion is the most hydrated. e.g. $[\text{Li}\,(\text{H}_2\text{O})_6]^+$.

Since the mobility of ion is inversely proportional to the size of their hydrated ions, therefore, amongst the alkali metal ions, lithium has the lowest ionic mobility.

$\text{Rb}^+(aq) > \text{K}^+(aq) > \text{Na}^+(aq) > \text{Li}^+(aq)$

Q135. Solution

Correct Answer: (A)

$O_2^{-2} = \sigma 1s^2 < \sigma^* 1s^2 < \sigma 2s^2 < \sigma^* 2s^2 < \sigma 2p_x^2 < \pi 2p_y^2 = \pi 2p_z^2 < \pi^* 2p_y^2 = \pi^* 2p_z^2$

$B.O. = \frac{n_b - n_a}{2} = \frac{6-4}{2} = 1$

$O_2^- = \sigma 1s^2 < \sigma^* 1s^2 < \sigma 2s^2 < \sigma^* 2s^2 < \sigma 2p_x^2 < \pi 2p_y^2 = \pi 2p_z^2 < \pi^* 2p_y^2 = \pi^* 2p_z^1$

$B.O. = \frac{6-3}{2} = 1.5$

$O_2 = \sigma 1s^2 < \sigma^* 1s^2 < \sigma 2s^2 < \sigma^* 2s^2 < \sigma 2p_x^2 < \pi 2p_z^2 = \pi 2p_y^2 < \pi^* 2p_y^1 = \pi^* 2p_z^1$

$B.O. = \frac{6-2}{2} = 2$

$O_2^+ = \sigma 1s^2 < \sigma^* 1s^2 < \sigma 2s^2 < \sigma^* 2s^2 < \sigma 2p_x^2 < \pi 2p_z^2 = \pi 2p_y^2 < \pi^* 2p_y^1 = \pi^* 2p_z^0$

$B.O. = \frac{6-1}{2} = 2.5$

$\text{Bond length} \propto \frac{1}{\text{Bond order}}$

Bond length $O_2^{-2} > O_2^- > O_2 > O_2^+$

Q136. Solution

Correct Answer: (C)

Here $\alpha = 1$

Because CH_3COOH will have molecualar mass = 120

Due to 100% association n =2 (for dimerisation)

For association of molecule

$\alpha = \frac{d-D}{d\left(1-\frac{1}{n}\right)} = \frac{d-D}{d\left(1-\frac{1}{2}\right)}$

$= \frac{2(d-D)}{d}$

Q137. Solution

Correct Answer: (D)

In the given figure, it can be observed that in each row, the third figure is the combination of the first and the second. For example, in the first row, one block is darkened in the first and second figures. So, in the third figure, two blocks are darkened.

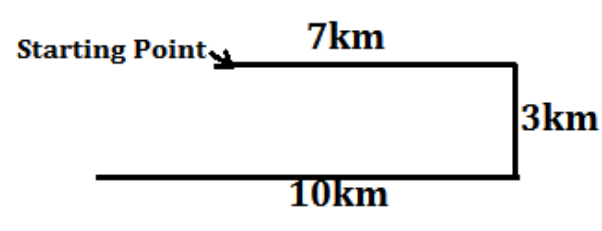
Similarly, in the third row, the third figure is the combination of the first and second.

Hence, option D is the correct answer.

Q138. Solution

Correct Answer: (A)

According to the question:

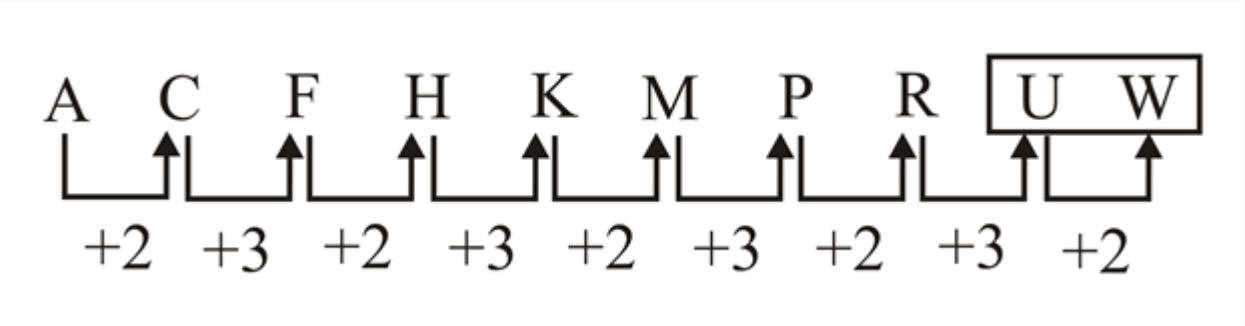


From the above diagram, it is clear that he started moving in east and after first right turn he was facing south and so on. From above, we can say that he is in the south-west direction from the starting point.

Q139. Solution

Correct Answer: (C)

According to the given series one letter is missing between two letters of each term and two letters are missing between the last and the first letters of two consecutive terms.

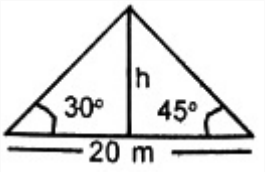


Hence, the next term will be UW.

So, the correct answer is UW.

Q140. Solution

Correct Answer: (B)



$h = \frac{120}{\cot 30 + \cot 45}$

$= \frac{20}{\sqrt{3}+1} = 10\left(\sqrt{3}-1\right)$

Hence $10\left(\sqrt{3}-1\right)$ is correct choice.

Q141. Solution

Correct Answer: (B)

Given

$\overrightarrow{a} = 2\hat{i} - 3\hat{j},\ \overrightarrow{b} = \hat{i} + \hat{j} - \hat{k}, \overrightarrow{c} = 3\hat{i} - \hat{k}$

$$\text{Volume} = \left[\overrightarrow{a}\,\overrightarrow{b}\,\overrightarrow{c}\right] = \begin{vmatrix} 2 & -3 & 0 \\ 1 & 1 & -1 \\ 3 & 0 & -1 \end{vmatrix}$$

$= 2 \times [1 \times (-1)] + 3 \times [1 \times (-1) + 1 \times 3] = -2 + 9 - 3 = 4$ Cubic unit.

Q142. Solution

Correct Answer: (B)

$T_n = \frac{1^3+2^3+3^3+\ldots.+n^3}{1+3+5+\ldots+(2n-1)} = \frac{\left(\frac{n(n+1)}{2}\right)^2}{n^2} = \frac{(n+1)^2}{4}$

$S_n = \sum T_n \ \Rightarrow\ S_n = \frac{1}{4}\sum n^2 + 2n + 1$

$= \frac{1}{4}\left[\frac{n(n+1)\,(2n+1)}{6} + 2\,.\,\frac{n(n+1)}{2} + n\right]$

Put n = 16

$S_n = 446$