Answer Key

Other (130 Questions)

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

Q106.(C)	Q107.(B)	Q108.(C)	Q109.(D)	Q110.(B)
Q111.(A)	Q112.(B)	Q113.(A)	Q114.(C)	Q115.(B)
Q116.(C)	Q117.(C)	Q118.(C)	Q119.(B)	Q120.(D)
Q121.(D)	Q122.(C)	Q123.(C)	Q124.(A)	Q125.(C)
Q126.(B)	Q127.(B)	Q128.(D)	Q129.(A)	Q130.(A)

Solutions

Q1. Solution

Correct Answer: (C)

Given, $I_R = 75\%$ of $I_{\max}$

$= \frac{3}{4} I_{\max}$

$= \frac{3}{4}\left(4a^2\right) = 3a^2$

$\Rightarrow \quad 4a^2 \cos^2 \frac{\phi}{2} = 3a^2$

$\cos^2 \frac{\phi}{2} = \frac{3}{4}$ or $\cos \frac{\phi}{2} = \frac{\sqrt{3}}{2}$

$\Rightarrow \quad \frac{\phi}{2} = \frac{\pi}{6}$ or $\phi = \frac{\pi}{3}$

Q2. Solution

Correct Answer: (C)

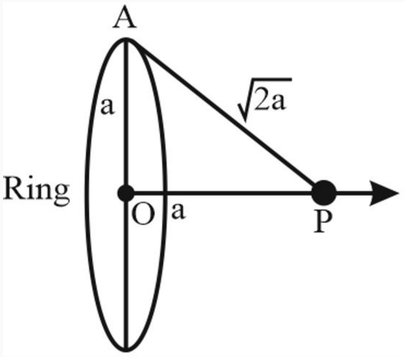
For no slipping the linear velocity at point of contact for both the discs must be same

$\omega_1 R_1 = \omega_2 R_2$ or $\frac{\omega_1}{\omega_2} = \frac{R_2}{R_1}$

But $R_1 > R_2$

$\therefore \omega_1 < \omega_2$

Q3. Solution
Correct Answer: (D)



The gravitational potential at P, $V_P = -\frac{GM}{AP}$
$V_P = -\frac{GM}{\sqrt{a^2+a^2}} = -\frac{GM}{\sqrt{2}a}$ and gravitational potential at O, $V_O = -\frac{GM}{a}$
Let v be the velocity of the particle when it reaches O.
$\therefore$ K.E. at $O = \frac{1}{2}mv^2$
Gravitational P.E. = Gravitational potential × mass
$\therefore$ P.E. at $P = -\frac{GMm}{\sqrt{2}a}$ and P.E. at $O = -\frac{GMm}{a}$
By the principle of conservation of mechanical energy
$\frac{1}{2}mv^2 - \frac{GMm}{a} = -\frac{GMm}{\sqrt{2}a}$
$\therefore v^2 = 2\left[\frac{GMm}{a} - \frac{GMm}{\sqrt{2}a}\right] = \frac{2GM}{a}\left[1 - \frac{1}{\sqrt{2}}\right]$
$\therefore v = \sqrt{\frac{2GM}{a}\left(1 - \frac{1}{\sqrt{2}}\right)}$

Q4. Solution
Correct Answer: (A)

$\text{Intensity} \propto (\text{amplitude})^2$
$\propto (2a\cos kx)^2$
Hence, intensity will be maximum when $\cos kx$ is maximum.

Q5. Solution
Correct Answer: (D)

Resistance of a wire is
$\mathrm{R} = \frac{\rho l}{\mathrm{A}}$
$\frac{\Delta \mathrm{R}}{\mathrm{R}} = \frac{\Delta l}{l} - \frac{\Delta \mathrm{A}}{\mathrm{A}} = 1 - (-1) = 2\%$

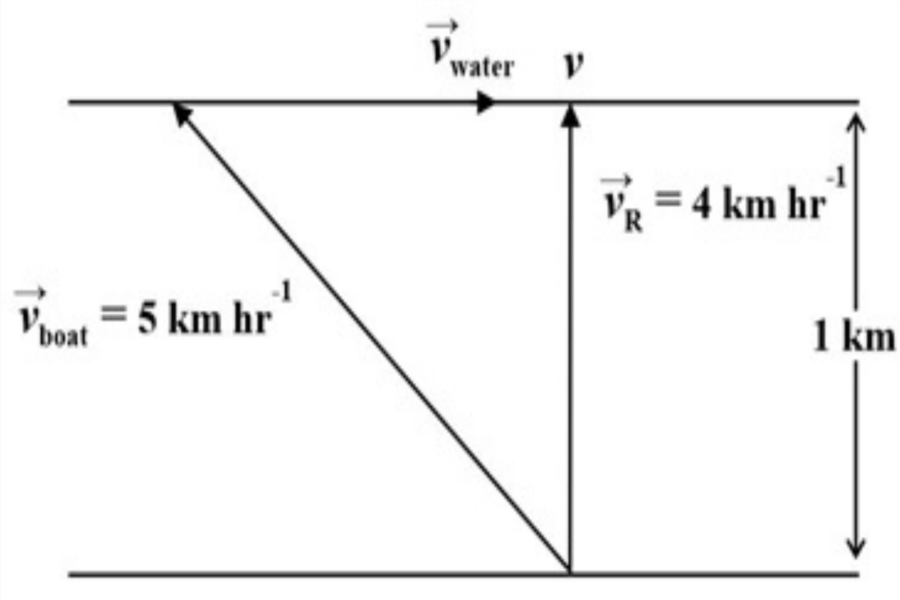
Q6. Solution
Correct Answer: (C)

The forbidden Energy gap, $E_g = \frac{hc}{\lambda}$
λ = maximum wave length of radiation

$\lambda = \frac{hc}{E_g} = \frac{12400}{0.72} = 17222\,\AA$

Q7. Solution

Correct Answer: (A)



Speed along the shortest path $= \overrightarrow{v_R}$

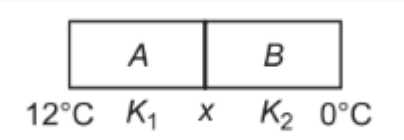
$\Rightarrow \left|\overrightarrow{v_R}\right| = \frac{\text{distance}}{\text{time}} = \frac{1}{\left(\frac{15}{60}\right)}\ \text{km h}^{-1}$

$\Rightarrow \left|\overrightarrow{v_R}\right| = 4\ \text{km h}^{-1}$

$\therefore$ Speed of water, $\overrightarrow{v}_{water} = \sqrt{5^2 - 4^2} = 3\ \text{km h}^{-1}$

Q8. Solution

Correct Answer: (C)

The given situation can be shown as 

Rate of flow of heat will be equal in both the slabs

$$\therefore \quad (12 - x)K_1 = K_2(x - 0)$$
$$12 - x = 2x \quad \left(\because K_1 = \frac{K_2}{2}\right)$$
$$x = 4^\circ\text{C}$$

The temperature difference across slab $A = (12 - x) = (12 - 4) = 8^\circ\text{C}$

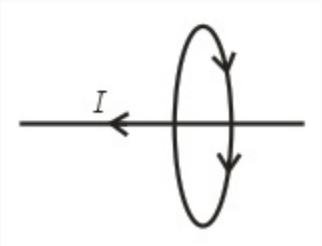
Q9. Solution
Correct Answer: (A)

The escape velocity can be given by

$$v=\sqrt{\frac{2GM}{R}}=\sqrt{2G\frac{4}{3}\pi R^2 d}$$
$$v\propto R\sqrt{d}$$

Hence escape velocity from the other planet is,
$v\prime = 2v_0$

Q10. Solution
Correct Answer: (D)



By Ampere's theorem, $\overrightarrow{\mathrm{B}}\cdot 2\pi\mathrm{d}=\mu_0\mathrm{i}$
$\overrightarrow{\mathrm{B}}=\frac{\mu_0\mathrm{i}}{2\pi\mathrm{d}}=\frac{4\pi\times10^{-7}\times100\mathrm{A}}{2\pi\times4\mathrm{m}}=50\times10^{-7}\ \mathrm{T}$
$\Rightarrow \mathrm{B}=5\times10^{-6}\ \mathrm{T}$ southwards. ~

Q11. Solution
Correct Answer: (B)

As the sound waves are mechanical waves they requires medium for propagation.

Q12. Solution
Correct Answer: (A)

The two condensers with K and with air are in parallel. With air, $C_1=\frac{\varepsilon_0}{d}\left(\frac{3A}{4}\right)=\frac{3\varepsilon_0 A}{4d}$

With medium, $C_2=\frac{\varepsilon_0 K}{d}\left(\frac{A}{4}\right)=\frac{\varepsilon_0 AK}{4d}$

$\therefore C'=C_1+C_2$

or $C'=\frac{3\varepsilon_0 A}{4d}+\frac{\varepsilon_0 AK}{4d}=\frac{\varepsilon_0 A}{d}\left[\frac{3}{4}+\frac{K}{4}\right]$

or $C'=\frac{C}{4}(K+3)\quad\left[\because C=\frac{A\varepsilon_0}{d}\right]$,

Q13. Solution
Correct Answer: (D)

As man is moving towards cliff, so apparent frequency heard directly towards source will be f_2

$f_2=\left(\frac{330-v}{330-0}\right)600$

similarly, apparent frequency heard by observer after reflection from the cliff will be $f_3=\left(\frac{330+v}{330-0}\right)600$

Now these two frequency f_2 and f_3 will produce 10 beats per second therefore $f_3-f_2=10$ by solving we get $v=2.75\ \mathrm{m/s}$ ~

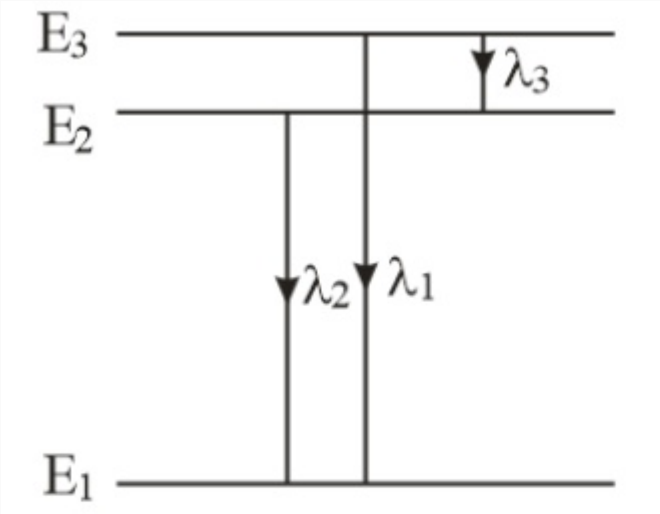
Q14. Solution
Correct Answer: (D)

According to the question
$P_1=\frac{100}{20}=5\ \mathrm{D},\ P_2=\frac{100}{25}=4\mathrm{D}$
Effective power $P=P_1+P_2$
$=\ 5\ +\ 4\ =\ 9\,\mathrm{D}$,

Q15. Solution

Correct Answer: (C)

Let the three energy levels be E_1, E_2, and E_3. The wavelength λ_1, λ_2 and λ_3 of the spectra lines corresponding to the three energy transitions are depicted as shown in figure.



$E = hf = \frac{hc}{\lambda}$ or $E \propto \frac{1}{\lambda}$

(given $\lambda_1 < \lambda_2 < \lambda_3$)

Thus, for the three wavelengths, we have

$E_3 - E_2 = \frac{hc}{\lambda_3} \ldots (i)$

$E_2 - E_1 = \frac{hc}{\lambda_1} \ldots (ii)$

$E_3 - E_1 = \frac{hc}{\lambda_1} \ldots (iv)$

Now, $E_3 - E_1 = (E_3 - E_2) + (E_2 - E_1)$

$\Rightarrow \frac{hc}{\lambda_1} = \frac{hc}{\lambda_3} + \frac{hc}{\lambda_2} \Rightarrow \frac{1}{\lambda_1} = \frac{1}{\lambda_2} + \frac{1}{\lambda_3}$

.

Q16. Solution

Correct Answer: (D)

According to Galileo, uniform motion is possible when no frictional force oppose. ^

Q17. Solution

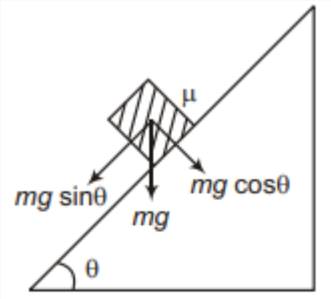
Correct Answer: (B)

Given, Δm for ${}_5\mathrm{B}^{11} = 0.0821$ u
Number of nucleons $= 11$
Binding energy $= (931 \times \Delta\mathrm{m})\mathrm{MeV}$
$= 931 \times 0.081$
$= 75.411$ MeV
Average binding energy
$= \frac{\text{Binding energy}}{\text{Number of nucleons}}$
$= \frac{75.411}{11}$
$= 6.85$ MeV ^

Q18. Solution

Correct Answer: (C)

For upward motion, $F_{\text{up}} = mg(\sin\theta + \mu\cos\theta)$ For downward motion, $F_{\text{down}} = mg(\sin\theta - \mu\cos\theta)$ ...(ii)



According to the question,
$$\begin{aligned} F_{\text{up}} &= 2F_{\text{down}} \\ mg(\sin\theta + \mu\cos\theta) &= 2mg(\sin\theta - \mu\cos\theta) \\ \sin\theta + \mu\cos\theta &= 2\sin\theta - 2\mu\cos\theta \\ 3\mu\cos\theta &= \sin\theta \\ \mu &= \frac{1}{3}\tan\theta \\ \mu &= \frac{1}{3} \times \tan 60^\circ \\ \Rightarrow \quad \mu &= \frac{1}{3}\sqrt{3} = \frac{1}{\sqrt{3}} \end{aligned}$$
^

Q19. Solution

Correct Answer: (A)

From dimension logic, the quantities of same dimensions can be added or subtracted, so $[B\mathrm{X}] = [Dt]$ similarly,

$\Rightarrow \quad \left[\frac{x}{t}\right] = \left[\frac{D}{B}\right] \Rightarrow \left[\frac{D}{B}\right] = \frac{[\mathrm{L}]}{[T} \; [LT^{-1}]$ is the dimension of velocity. !

$\Rightarrow \quad$ Dimension of $\frac{D}{B} = [\mathrm{LT}^{-1}]$

Q20. Solution

Correct Answer: (B)

$\mathrm{T}=2\pi\sqrt{\frac{l}{\mathrm{g}}}$ or $\mathrm{T}\propto\frac{1}{\sqrt{\mathrm{g}}}$

$\therefore \quad \frac{\mathrm{T}'}{\mathrm{T}}=\sqrt{\frac{\mathrm{g}}{\mathrm{g}'}}$

But $\mathrm{g}'=\frac{\mathrm{g}}{\left(1+\frac{\mathrm{h}}{\mathrm{R}}\right)^2}$ or $\frac{\mathrm{g}'}{\mathrm{g}}=\frac{1}{\left(1+\frac{\mathrm{h}}{\mathrm{R}}\right)^2}$

$\therefore \quad \frac{\mathrm{T}'}{\mathrm{T}}=\left(1+\frac{\mathrm{h}}{\mathrm{R}}\right)$

or $\quad \mathrm{T}'=\mathrm{T}\left(1+\frac{\mathrm{h}}{\mathrm{R}}\right)$

Since, $\mathrm{T}'>\mathrm{T}$, the clock will lose the time.

$\therefore \quad \Delta\mathrm{T}=\mathrm{T}'-\mathrm{T}=\mathrm{T}\left(\frac{\mathrm{h}}{\mathrm{R}}\right)$

$\therefore$ Time lost in $t=1$ day is

$$=\frac{(24\times 3600)(200)}{6.4\times 10^6}\ \mathrm{s}=2.7\ \mathrm{s}\ ,$$

Q21. Solution

Correct Answer: (B)

From Einstein photo electric equation

$hv=KE+\phi$

Where, $\phi=$ work function $=hv_0$

$KE=1\ \mathrm{eV}$

$hv_1=1+1=2\ \mathrm{eV}$

$hv_2=1+2=3\ \mathrm{eV}$

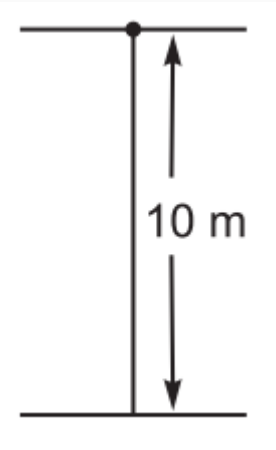
$hv_3=1+3=4\ \mathrm{eV}$

$\Rightarrow \quad v_1\ :v_2\ :v_3=2\ :3\ :4$

Q22. Solution

Correct Answer: (C)

At height 10 m, the kinetic energy is equal to potential energy then $\frac{1}{2}mv_0^2=mgh$ $\frac{1}{2}v_0^2=9.8\times 10$



$v_0^2=2\times 9.8\times 10$ $v_0=\sqrt{196}$ $v_0=14\ \mathrm{m/s}$

Q23. Solution

Correct Answer: (A)

At state 2:

$\mathrm{p}_2=1 \text{ bar}, \ \mathrm{T}_2=200 \mathrm{~K}$

At state 3:

$\mathrm{p}=3 \text{ bar}$

Applying the adiabatic conditions between 2 and 3:

$\mathrm{PT}^{\frac{\gamma}{1-\gamma}}=\text{constant}$

$\left[\frac{\gamma}{1-\gamma}=\frac{5/3}{1-5/3}=\frac{-5}{2}\right]$

$\Rightarrow 1.0(200)^{-\frac{5}{2}}=3(\mathrm{T}_3)^{-\frac{5}{2}} \Rightarrow \mathrm{T}_3=310 \mathrm{~K}$

$\Rightarrow \ \mathrm{W}_{31}=-\mathrm{p}\Delta\mathrm{V}=-\mathrm{R}\Delta\mathrm{T}$

$=-0.082(600-310)$

$=-0.082\times 290=-23.8 \text{ L atm.}$

Q24. Solution

Correct Answer: (B)

In case of soap bubble $\begin{aligned} W &= T\times 2\times \Delta A \\ &= 0.03\times 2\times 40\times 10^{-4} \\ &= 2.4\times 10^{-4} \mathrm{~J}\end{aligned}$

Q25. Solution

Correct Answer: (A)

Time to cross $0.10 \mathrm{~m}$, $t=\frac{0.10}{4\times 10^7}\mathrm{s}$

Distance deviated in this time due to electric field $=\frac{1}{2}\left(\frac{eE}{m}\right).\ t^2$

$=\frac{1}{2}\times\frac{1.6\times 10^{-19}\times 3200}{9.1\times 10^{-31}}\times\left(\frac{0.1}{4\times 10^7}\right)^2 \mathrm{m}$

$=01.76 \text{ mm}$

Q26. Solution

Correct Answer: (B)

Given, the figure shows the relation between speed and time. So, the area of the figure will be displacement. Therefore,
area of first triangular $(d_1) = \frac{1}{2} \times 10 \times 10 = 50 \text{ m}$, area of second triangular $(d_2) = \frac{1}{2} \times (-10) \times 10 = -50 \text{ m}$
Therefore, the total area $(d) =$ total displacement of the particle
$\Rightarrow d_1 + d_2 = 50 - 50 = 0$

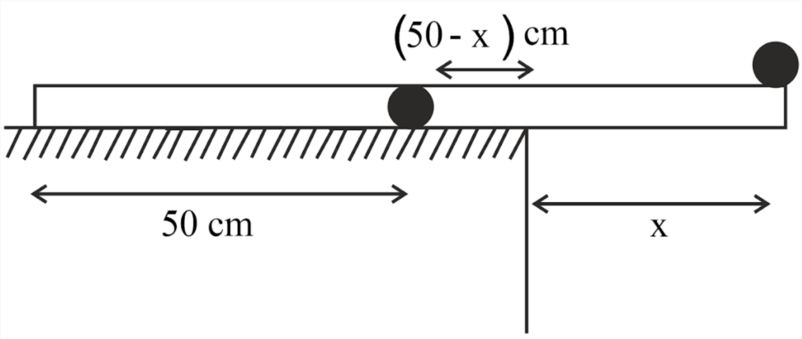
Q27. Solution

Correct Answer: (D)

The moment ball coming to rest mean that the initial potential energy of the ball gets converted to kinetic energy and when this energy is being used to counteract the energy loss during its motion.

Q28. Solution

Correct Answer: (D)

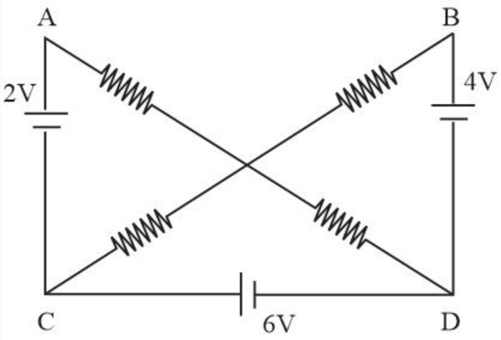


The normal will shift to the edge of table to prevent toppling.

If the distance from one end is x then, torque about the edge
$(50 - x)1 = x(0.25)$
$200 - 4x = x \ \Rightarrow x = 40 \text{ cm}$
$\therefore$ Length on the table $= 100 - 40 = 60 \text{ cm}$

Q29. Solution

Correct Answer: (B)



Apply Kirchhoff"s Voltage Law,

Along wire $ACDB$

$V_{\mathrm{A}}-2-6+4=V_{\mathrm{B}}$

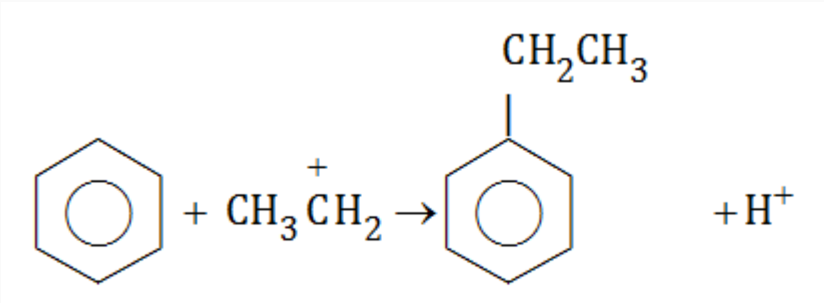
$V_{\mathrm{A}}-V_{\mathrm{B}}=4\ \mathrm{V}$

Q30. Solution

Correct Answer: (A)

It is a case of Friedel crafts reaction

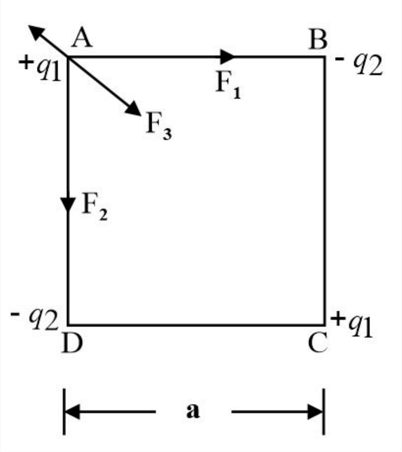
$\mathrm{C_2H_5Cl}+\mathrm{AlCl_3}\rightarrow\mathrm{C_2H_5^+}+\mathrm{AlCl_4^-}$



Q31. Solution

Correct Answer: (B)

The charge A experiences three forces F_1, F_2 and F_3 as shown in the figure.



Now, $F_1 = \frac{1}{4\pi\varepsilon_0}\frac{q_1q_2}{a^2}$ (along AB)

$F_2 = \frac{1}{4\pi\varepsilon_0}\frac{q_1q_2}{a^2}$ (along AD)

$F_3 = \frac{1}{4\pi\varepsilon_0}\frac{q_1^2}{a^2}$

The resultant of F_1 and F_2 should be equal and opposite to F_3 to keep the system in equilibrium.

Resultant of F_1 and $F_2 = F_R = \sqrt{F_1^2 + F_2^2}$

$= \frac{1}{4\pi}\frac{q_1q_1}{\varepsilon_0 a^2}\sqrt{2}$

For equilibrium,

$\frac{1}{4\pi\varepsilon_0}\frac{q_1q_2}{a^2}\sqrt{2} = \frac{1}{4\pi\varepsilon_0}\frac{q_1^2}{a^2}$

$\frac{q_1}{q_2} = \sqrt{2}$

Q32. Solution

Correct Answer: (D)

Beryllium having smallest atomic size in the group 2 has tightly held outermost electrons that do not get excited significantly during flame test.

Q33. Solution

Correct Answer: (D)

Element (X) electronic configuration

$1s^2 2s^2 2p^3$

So, valency of X is 3.

Valency of Mg is 2.

Formula of compound formed by Mg and X will be Mg_3X_2 .

Q34. Solution

Correct Answer: (D)

$$\underset{\substack{2.4g\\0.1mol\\-0.05\\0.05mol}}{\mathrm{Mg}} + \underset{\substack{(1M,100ml)\\0.1mol}}{\mathrm{2HCl}} \rightarrow \mathrm{MgCl_2} + \mathrm{H_2}$$

HCl is a limiting reagent

0.1 mol HCl give $\frac{0.1}{2}$ mol $\mathrm{H_2}$ or 1.12 lit $\mathrm{H_2}$ at STP

0.05 mol Mg left

So option D is wrong.

Q35. Solution

Correct Answer: (C)

(a) There are equal number of octahedral and tetrahedral voids in a unit cell for fcc lattice is incorrect statement. The number of octahedral and tetrahedral void in unit cell for fcc lattice is 4 and 8 respectively. (b) The tetrahedral voids are present at the edge centers is incorrect as they are present on each body diagonal, i.e. diagonal of cubic unit cell. (c) Octahedral voids are present at the body center and edge centers. Statement (c) is correct. (d) Its packing efficiency (PE) is higher than hcp lattice PE is incorrect. The packing efficiency of hcp is 74% and that of fcc is also 74%. It is higher in comparison to packing efficiency of simple cube and bcc which have values 52.4 and 68% respectively.

Q36. Solution

Correct Answer: (A)

$$\left(\mathrm{P}+\frac{\mathrm{a}}{\mathrm{V}^2}\right)(\mathrm{V}-\mathrm{b})=\mathrm{RT}$$

Or $\mathrm{PV}+\frac{\mathrm{a}}{\mathrm{V}}-\mathrm{Pb}-\frac{\mathrm{ab}}{\mathrm{V}^2}=\mathrm{RT}$

When, $\mathrm{P}=0,\ \mathrm{V_M}=\mathrm{V}$

$\mathrm{PV_M}=\mathrm{Pb}+\mathrm{RT}$

for 'r' intercept

$\mathrm{P}\rightarrow\mathrm{O}$

$\therefore \mathrm{P_b}=\mathrm{O}$

$\therefore \mathrm{PV_m}=\mathrm{RT}$

Q37. Solution

Correct Answer: (A)

The lighter gangue particles are carried away by the water while the heavier ore particles settle down.

Q38. Solution
Correct Answer: (A)

As we know
$\frac{p^o - p}{p^o} = x_1 =$ mole fraction of solute
The ratio $\frac{(p^o - p)}{p^o}$ is the relative lowering of vapour pressure, which is equal to 0.0125 here.
So $X_1 = 0.0125$
The relation between the mole fraction and molality is
$\left(\frac{1}{X_1} - 1\right) = \frac{1000}{m \times 18}$ (molecular weight of $H_2O = 18$)
or $\left(\frac{1}{0.0125} - 1\right) = \frac{100}{m \times 18}$ w
$m = 0.70$ m

Q39. Solution
Correct Answer: (C)

Negative colloid is coagulated by positive ion or vice-versa. Greater the valency of coagulating ion, greater will be coagulating power according to Hardy-Schulze rule.

(a) $ZnSO_4 \rightarrow Zn^{2+} + SO_4^{2-}$

(b) $Na_3PO_4 \rightarrow 3Na^+ + PO_4^{3-}$

(c) $AlCl_3 \rightarrow Al^{3+} + 3Cl^-$

(d) $K_4[Fe(CN)_6] \rightarrow 4K^+ + [Fe(CN)_6]^{4-}$

Since, in $AlCl_3$, the valency of positive ion (coagulation ion) is highest, it is the most powerful coagulating agent among the given to coagulate the negative colloid.

Q40. Solution
Correct Answer: (D)

We know that when you assist, you help someone. Save means your help is of a high degree. Similarly, when you request, you ask for help from someone and when you command, you are very strong in a request for what you ask.

Aid means to assist someone.

Oppose is to disagree with someone.
Decry is to depreciate something.

Hence, the correct answer is Command.

Q41. Solution

Correct Answer: (B)

According to the Given information,

Given a series and we need to find next term of this given series,

So, the series is, $2,\ 3,\ 18,\ 115,\ \ 854,\ ?$

Now we see the pattern used in this series is, multiply and add of the square are the same number.

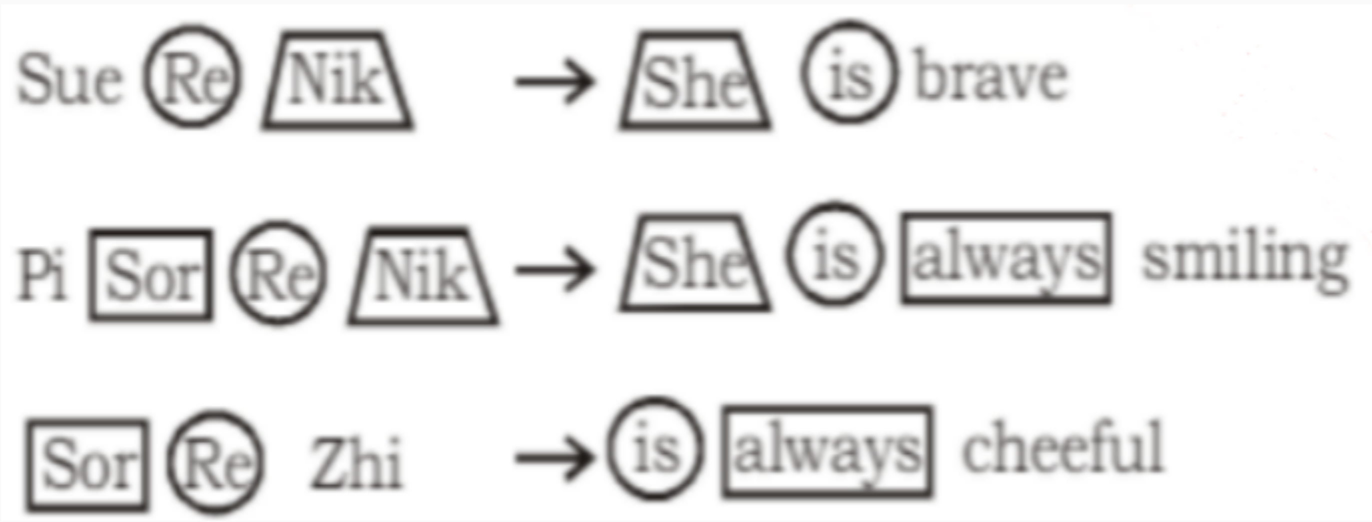
$3\ =\ 2\ \times 1\ +\ 1^2 18\ =\ 3\ \times\ 3\ +\ 3^2 115 =\ 18\ \times 5 + 5^2 854\ =\ 115\ \times\ 7 + 7^2\ 854\ \times\ 9\ +\ 9^2\ =\ 7686\ + 81$

So, the next number of this series is, 7767.

Hence, the answer is 7767.

Q42. Solution

Correct Answer: (C)



It is clear that the code for 'smiling' is 'Pi'.

Q43. Solution

Correct Answer: (B)

$$\underset{(0^\circ\mathrm{C})}{\text{Ice}} \xrightarrow{q_1} \underset{(0^\circ\mathrm{C})}{\text{Water}} \xrightarrow{q_2} \underset{(100^\circ\mathrm{C})}{\text{Water}} \xrightarrow{q_3} \underset{(100^\circ\mathrm{C})}{\text{Vapour}}$$

$q = q_1 + q_2 + q_3$

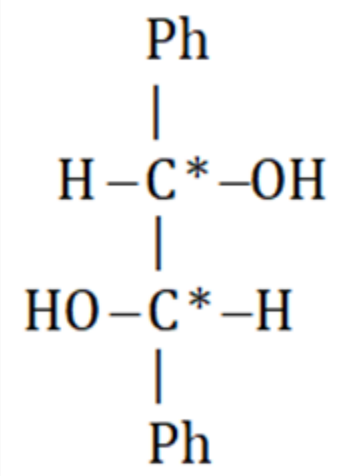
$= (80 \times 5 + \mathrm{msdT} + 540 \times 5)$ cal

$= (80 \times 5 + 5 \times 1 \times 100 + 540 \times 5)$ cal

$= 3600$ cal

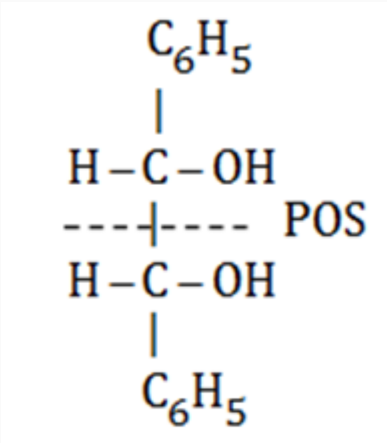
Q44. Solution

Correct Answer: (B)



It has two chiral carbons and the molecule has no plane of symmetry so it is optically active.

Rest all molecules have two chiral carbons atoms and the molecules have plane of symmetry also so they are optically inactive.



Q45. Solution
Correct Answer: (C)

Upon analysing the distances and the points from the given question, we can form the following table:

From the first end		From the second end	
Point	Distance (From 1st end)	Point	Distance (From 2nd end)
First	1 cm	First	35 cm
Second	3 cm	Second	33 cm
Third	6 cm	Third	30 cm
Fourth	10 cm	Fourth	26 cm
Fifth	15 cm	Fifth	21 cm
Sixth	21 cm	Sixth	15 cm
Seventh	28 cm	Seventh	8 cm
Eighth	36 cm	Eighth	0 cm

The points at 0 cm and 36 cm are endpoints. Hence, these two points are excluded.

The four points at 15 cm and 21 cm are common points. Hence, two of these are also excluded.

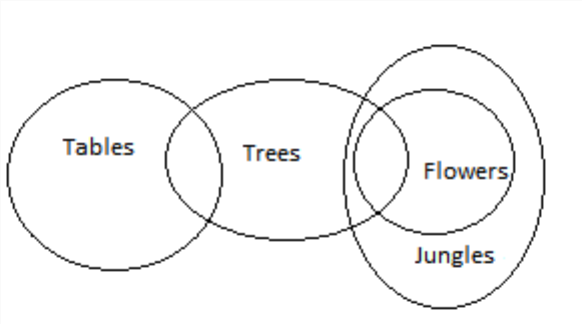
Therefore, the required number of points
$= 16 - 4 = 12$.
Hence, the correct answer is 12.

Q46. Solution
Correct Answer: (A)

We have to use Venn diagram for solve this statement.

So statement are;

Some tables are tree, and some trees are flowers, all flowers are jungles.



As we see conclusion then we got;

Some jungles are tables is fasle conclusion.

some trees are jungles is true.

some flowers are tables is false and all jungles are flowers is false.

So we can sat that only second follows statement.

Thus answer is "only 2 follows".

Q47. Solution
Correct Answer: (D)

II and III have delocalized six π electrons and hence are aromatic.

Q48. Solution
Correct Answer: (C)

Iron can be extracted by smelting.

Q49. Solution
Correct Answer: (D)

Observing the given diagram carefully, we can conclude that region 10 is neither a dancer nor a musician but is professional and not a European

Q50. Solution

Correct Answer: (A)

During chlorination of alkane, if excess of alkane is treated with $\mathrm{Cl_2\,(g)}$ in presence of light or heat, chance of mono–chlorination predomtextnate.

$$\mathrm{C_2H_6\,(excess) + Cl_2 \xrightarrow{\text{UV light}} CH_3\,CH_2\,Cl + HCl}$$

Q51. Solution

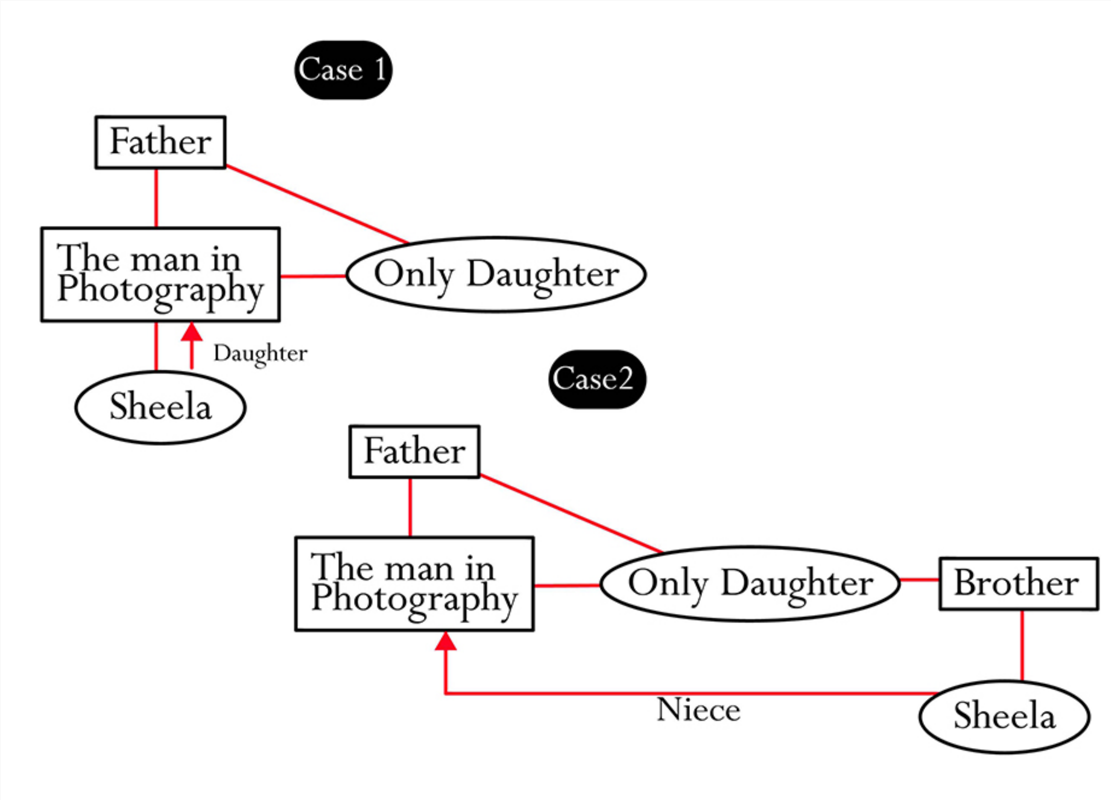
Correct Answer: (A)

The day 30^{th} September is comes after 28^{th} February and in the year (L.Y. + 1) $1996 + 1 = 1997\ (\mathrm{L.Y.})$ So according to chart we add 6 year for celebration on same day $1997 + 6 = 2003$

Q52. Solution

Correct Answer: (D)

We conclude the following relation among the given characters as following into the family tree:



The man can be her father or uncle; so, considering this situation Sheela can be either his daughter or niece.

Q53. Solution
Correct Answer: (B)

The passage does not try to reconcile the two different ideas. It only projects them, therefore, (1) is eliminated, (3) and (4) are the two different ideas but alone neither of them can be the answer. So, the right answer then is (2).

Q54. Solution
Correct Answer: (A)

Correct answer: I am quite satisfied that I have not been negligent in doing whatever was needful for building up their character.
The sentence using the negative statements but it shows the positive effect on subject because subject is satisfied. So we have to use a negative word in this sentence.
Negliegent means not being cautious. Devoted means dedicated to the work. Caring means displaying concern and kindness. Affectionate means showing love and care. Hence, from the options, 'negligent' is the correct answer.

Q55. Solution
Correct Answer: (A)

$\mathrm{pH} = \mathrm{pK_a} + \log\frac{[\mathrm{Salt}]}{[\mathrm{Acid}]}$
$\mathrm{pH} = -\log\left(1.8 \times 10^{-5}\right) + \log\frac{[10]}{[100]}$
$= -\log 1.8 + 5 + \log 10^{-1}$
$= -0.2553 + 5 - 1 = 3.7447$

Q56. Solution
Correct Answer: (B)

We use past perfect tense to talk about something that happened before another action in the past, which is usually expressed by the past simple.
In the given sentence, we need to use past perfect form of the verb 'rang' which is 'had rung'.
The structure is:
Past perfect tense + before + past simple.
Hence, the option 'had rung' is the correct answer choice.

Q57. Solution
Correct Answer: (D)

The passage says that unless we have a broad general education, our outlook will remain narrow (last line). This means that general education broadens our outlook. It is not at all suggested that without general education, one cannot get a job or one can't achieve specialization.

Q58. Solution
Correct Answer: (C)

With a keen eye not only to using proven methods, but also to developing new and innovative techniques.

Q59. Solution
Correct Answer: (B)

‘Banquet’ means a formal dinner for many people usually to celebrate a special event. ‘Feast’ means a special meal with large amounts of food and drink. ‘Banquet’ and ‘feast’ are related to the meal as stated in their meanings. Therefore, they are synonyms.

‘Palace’ means the official home of a king, queen, president, etc. ‘Ornament’ means a small, fancy object that is put on something else to make it more attractive. ‘Table’ means a piece of furniture that has a flat top and one or more legs. ‘Palace’ is eliminated because it is the name of a building and not a meal. ‘Ornament’ is eliminated because it is the name of an object and not a meal. ‘Table’ is eliminated because it is the name of a piece of furniture and not a meal.

Therefore, the correct answer is ‘feast’.

Q60. Solution
Correct Answer: (A)

As $\sin x > \cos x,\ \forall x \in \left(\frac{\pi}{4}, \frac{\pi}{2}\right)$
$\Rightarrow e^{\sin x} > e^{\cos x}$
$\therefore \frac{e^{\sin x}+1}{e^{\cos x}+1} > \frac{e^{\cos x}+1}{e^{\sin x}+1}$
$\Rightarrow \int\limits_{\frac{\pi}{4}}^{\frac{\pi}{2}} \frac{e^{\sin x}+1}{e^{\cos x}+1} dx > \int\limits_{\frac{\pi}{4}}^{\frac{\pi}{2}} \frac{e^{\cos x}+1}{e^{\sin x}+1}$
$\Rightarrow \mathrm{I}_1 > \mathrm{I}_2 > 0$

Q61. Solution
Correct Answer: (C)

Given:

$\frac{dy}{dx} - y \tan x = -y^2 \sec x$

$\frac{1}{y^2} \frac{dy}{dx} - \frac{1}{y} \tan x = -\sec x$

Let $\frac{1}{y} = v \Rightarrow \frac{-1}{y^2} \frac{dy}{dx} = \frac{dv}{dx}$

$\frac{-dv}{dx} - v \tan x = -\sec x$

$\frac{dv}{dx} + v \tan x = \sec x$

This is a linear differential equation of the type $\frac{dv}{dx} + Pv = Q$

Here, $P = \tan x,\ Q = \sec x$

$\text{I. F.} = e^{\int \tan x dx} = \sec x$

Solution is given by

$v[\text{I. F.}] = \int Q \times [\text{I. F.}] dx + C$

$v \sec x = \int \sec^2 x dx + C$

Hence, the solution is

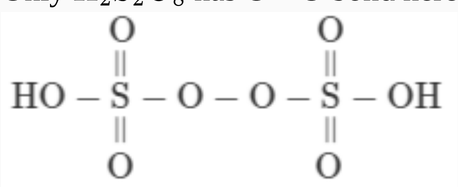
$y^{-1} \sec x = \tan x + C$

Q62. Solution
Correct Answer: (D)

Ameliorate means 'make (something bad or unsatisfactory) better.

Q63. Solution
Correct Answer: (D)

Only $H_2S_2O_8$ has O – O bond here



Q64. Solution

Correct Answer: (C)

Ziegler-Natta catalyst is used to prepare high density polythene.

Q65. Solution

Correct Answer: (C)

Slope of tangent to $x^2 + y^2 = 1$ at $\left(\frac{1}{\sqrt{2}}, \frac{1}{\sqrt{2}}\right)$

$x^2 + y^2 = 1$

$2x + 2yy^{'} = 0$

$y^{'} = -\frac{x}{y} = -1$

Given that, $y = mx + c$, is perpendicular to L_1,

So, $m = 1 \Rightarrow y = x + c$

Now distance of $(3, 0)$ from $y = x + c$ is

$\left|\frac{c+3}{\sqrt{2}}\right| = 1$

$c^2 + 6c + 9 = 2$

$c^2 + 6c + 7 = 0.$

Q66. Solution

Correct Answer: (B)

Chord of contact of $(-1, 2)$ is $yy_1 = 2a\left(x + x_1\right)$ or $y = x - 1.$

Q67. Solution

Correct Answer: (A)

ψ^2 is known as probability density and is always positive. From the value of ψ^2 at different points within an atom it is possible to predict the region around the nucleus where electron will most probably be found.

Q68. Solution

Correct Answer: (A)

The IUPAC name of $[\mathrm{Co}(\mathrm{NH}_3)_4\mathrm{Cl}(\mathrm{NO}_2)]\mathrm{Cl}$ is tetraaminechloridonitrito-N-cobalt (III) chloride

Q69. Solution

Correct Answer: (D)

Binomial expansion for negative and fractional index

$\left(1+x\right)^{n}=1+nx+\frac{n(n-1)}{1.2}x^{2}+\frac{n(n-1)(n-2)}{1.2.3}x^{3}+\ldots\ldots\ldots\ldots\ldots\infty\ (|\,x\,|<1).$

Given $\frac{(1+x)^{3/2}-\left(1+\frac{1}{2}x\right)^{3}}{(1-x)^{1/2}}$

$=\frac{\left(1+\frac{3}{2}x+\frac{3}{2}\frac{1}{2}\frac{1}{2!}x^{2}+\ldots\right)-\left(1+3\cdot\frac{1}{2}x+\frac{3\cdot2}{2!}\cdot\frac{1}{4}x^{2}+\ldots\right)}{(1-x)^{1/2}}$

$=-\frac{3}{8}x^{2}(1-x)^{-1/2}=-\frac{3}{8}x^{2}\left[1+\frac{1}{2}x+\frac{1}{2}\cdot\frac{3}{2}\cdot\frac{1}{2!}x^{2}+\ldots\right]$

= $-\frac{3}{8}x^{2}$ + higher power of x^{2}.

Q70. Solution

Correct Answer: (B)

Given $f(x)$ is differentiable at $x=0$. Hence, $f(x)$ will be continuous at $x=0$.

$\therefore \lim_{x\to0^-}\left(e^{x}+ax\right)=\lim_{x\to0^+}b(x-1)^{2}$

$\Rightarrow e^{0}+a\times0=b(0-1)^{2}\Rightarrow b=1\ldots(i)$

But $f(x)$ is differentiable at $x=0$, then

$Lf'(x)=Rf'(x)\Rightarrow\frac{d}{dx}\left(e^{x}+ax\right)=\frac{d}{dx}b(x-1)^{2}$

$\Rightarrow e^{x}+a=2b(x-1)$

At $x=0, e^{0}+a=-2b\Rightarrow a+1=-2b\Rightarrow a=-3$

$\Rightarrow(a,b)=(-3,1).$

Q71. Solution

Correct Answer: (D)

$\because\ \alpha,\beta$ are the roots of $x^{2}+px+q=0$

Then, $\alpha+\beta=-p\ \&\ \alpha\beta=q\ldots.(1)$

Also α,β are roots of $x^{3900}+p^{1950}x^{1950}+q^{1950}=0$

$\Rightarrow\alpha^{1950}+\beta^{1950}=-p^{1950}\ \&\ \alpha^{1950}\beta^{1950}=q^{1950}\ldots.(2)$

Now $\frac{\alpha}{\beta}$ is a root of $x^{n}+1+(x+1)^{n}=0$

Then, $\left(\frac{\alpha}{\beta}\right)^{n}+1+\left(\frac{\alpha}{\beta}+1\right)^{n}=0$

$\Rightarrow\alpha^{n}+\beta^{n}+(\alpha+\beta)^{n}=0$

$\Rightarrow\alpha^{n}+\beta^{n}+(-p)^{n}=0\quad(\because\alpha+\beta=-p)$

$\Rightarrow\alpha^{n}+\beta^{n}=-(-p)^{n}\ldots.(3)$

Comparing Eqs. (2) & (3), we get $\Rightarrow n=1950$

Q72. Solution

Correct Answer: (B)

Let $I = \int_0^\pi x \sin^3 x dx$ ...(i) Also $I = \int_0^\pi (\pi - x) \sin^3 x dx$ ....(ii) Adding (i) and (ii), we get

$$2I = \pi \int_0^\pi \sin^3 x dx = \frac{\pi}{4} \int_0^\pi \{3 \sin x - \sin 3x\} dx$$

$$= \frac{\pi}{4} \left[-3 \cos x + \frac{\cos 3x}{3}\right]_0^\pi = \frac{\pi}{4}\left[3 - \frac{1}{3} + 3 - \frac{1}{3}\right] = \frac{4\pi}{3}$$

Hence, $I = \frac{2\pi}{3}$.

Q73. Solution

Correct Answer: (D)

$X = A^{-1}B$

$$X = \begin{bmatrix} 3 & -1/2 & -1/2 \\ -4 & 3/4 & 5/4 \\ 2 & -1/4 & -3/4 \end{bmatrix} \begin{bmatrix} 9 \\ 52 \\ 0 \end{bmatrix} \Rightarrow X = \begin{bmatrix} 1 \\ 3 \\ 5 \end{bmatrix}$$

Q74. Solution

Correct Answer: (B)

$\tan\ 30^\circ = \frac{\frac{b^2}{a}}{2ae}$

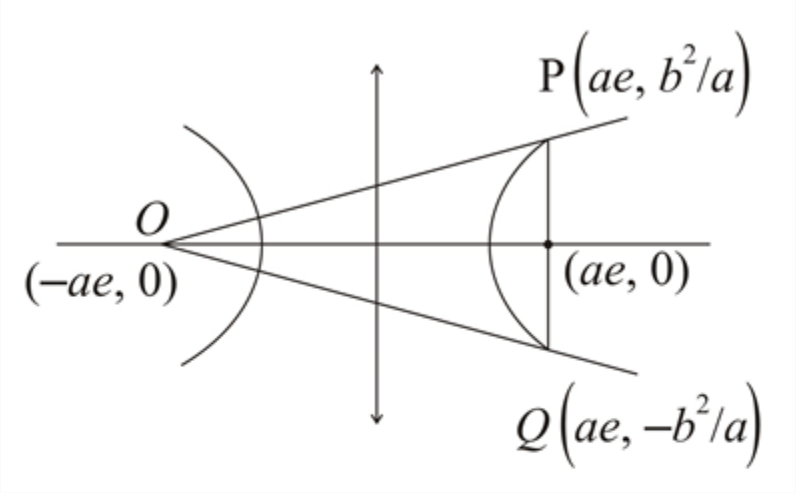
$\Rightarrow \frac{2}{\sqrt{3}} e = e^2 - 1$

$\Rightarrow \sqrt{3} e^2 - 2e - \sqrt{3} = 0$

$\Rightarrow e = \frac{2 \pm \sqrt{4+12}}{2\sqrt{3}}$

$= \frac{2 \pm 4}{2\sqrt{3}}$

$\Rightarrow e = \frac{3}{\sqrt{3}} = \sqrt{3}$



Q75. Solution

Correct Answer: (A)

$2HSO_4^- \rightarrow S_2O_8^{2-} + 2H^+ + 2e^-$

So, required rate = 1 mol/hr of $S_2O_8^{2-}$ = 2 moles of $HSO_4{}^-$

$= \frac{2\times96500C}{3600s} = \frac{2\times965}{36}A \simeq 53.6\ A$

So required current $= \frac{4}{3} \times 53.6\ A = 71.47\ A$

Q76. Solution

Correct Answer: (A)

Proteins are polypeptides. They are linear chains of amino acids linked by peptide bonds. Each protein is a polymer of amino acids. As there are 20 types of amino acids (e.g., alanine, cysteine, proline, tryptophan, lysine, etc.), a protein is a heteropolymer and not a homopolymer. A homopolymer has only one type of monomer repeating 'n' number of times.

Q77. Solution

Correct Answer: (D)

Let $A \equiv$ event of selecting first purse
$B \equiv$ event of selecting second purse
$C \equiv$ event of drawing a copper coin from first purse
$D \equiv$ event of drawing a copper coin from second purse
Then given event has two disjoint cases: AC and BD
$\therefore$ reqd.prob. $= P(AC + BD) = P(AC) + P(BD)$
$= P(A)P(C) + P(B)P(D)$
$\frac{1}{2} \cdot \frac{4}{7} + \frac{1}{2} \cdot \frac{6}{8} = \frac{37}{56}.$

Q78. Solution

Correct Answer: (A)

Let, $A = \{1,\ 2,\ 3,\ 4,\ 5,\ 6\}$
The relation R is defined on set A is $R = \{(a,\ b)\ :\ b = a + 1\}$. Therefore,
$R = \{(1,\ 2),\ (2,\ 3),\ (3,\ 4),\ (4,\ 5),\ (5,\ 6)\}$

Now, $6\ \in\ A$ but $(6,\ 6)\ \notin\ R$.
Therefore, R is not reflexive.
It can be observed that $(1,\ 2)\ \in\ R$ but $(2, 1)\ \notin R$. Therefore, R is not symmetric.

Now, $(1,\ 2),\ (2,\ 3)\ \in\ R$ but $(1,\ 3) \notin\ R$. Therefore, R is not transitive.
Hence, R is neither reflexive nor symmetric nor transitive.

Q79. Solution

Correct Answer: (C)

Since $y=\frac{a^2}{x}, \therefore \frac{dy}{dx}=-\frac{a^2}{x^2} \therefore$ At (x_1, y_1), $\frac{dy}{dx}=\frac{-a^2}{x_1^2}$ Thus tangent to the curve will be $y-y_1=\frac{-a^2}{x_1^2}(x-x_1)$ $\Rightarrow yx_1^2-y_1x_1^2=-a^2x+a^2x_1 \Rightarrow a^2x+x_1^2y=x_1\left(x_1y_1+a^2\right)=2a^2x_1, \left(\because x_1y_1=a^2\right)$ This meets the x-axis where $y=0 \therefore a^2x=2a^2x_1, \therefore x=2x_1 \therefore$ Point on the x-axis is $(2x_1, 0)$ Again tangent meets the y-axis where $x=0 \because x_1^2y=2a^2x_1, \quad \therefore y=\frac{2a^2}{x_1}$ So point on the y-axis is $\left(0, \frac{2a^2}{x_1}\right)$ Required area $=\frac{1}{2}(2x_1)\left(\frac{2a^2}{x_1}\right)=2a^2.$

Q80. Solution

Correct Answer: (D)

$$\left|\vec{a}\right|=\left|\vec{b}\right|=\left|\vec{c}\right|=2$$

Given: $\vec{a}.\ \vec{b}=\vec{b}.\ \vec{c}=\vec{c}.\ \vec{a}=2$

$$\Rightarrow \left|\vec{a}\right|^2=\left|\vec{b}\right|^2=\left|\vec{c}\right|^2=4$$

$$\Rightarrow \vec{a}.\vec{a}=\vec{b}.\vec{b}=\vec{c}.\vec{c}=4$$

Volume of tetrahedron $=\frac{1}{6}\left[\vec{a}\,\vec{b}\,\vec{c}\right]$

Now, $\left[\vec{a}\,\vec{b}\,\vec{c}\right]^2=\begin{vmatrix}\vec{a}\cdot\vec{a} & \vec{a}\cdot\vec{b} & \vec{a}\cdot\vec{c}\\ \vec{b}\cdot\vec{a} & \vec{b}\cdot\vec{b} & \vec{b}\cdot\vec{c}\\ \vec{c}\cdot\vec{a} & \vec{c}\cdot\vec{b} & \vec{c}\cdot\vec{c}\end{vmatrix}=\begin{vmatrix}4 & 2 & 2\\ 2 & 4 & 2\\ 2 & 2 & 4\end{vmatrix}$

$$=4(12)+2(-4)+2(-4)=32$$

$$\therefore \left[\vec{a}\,\vec{b}\,\vec{c}\right]=\sqrt{32}=4\sqrt{2}$$

Volume $=\frac{1}{6}\times 4\sqrt{2}=\frac{2\sqrt{2}}{3}$

Q81. Solution

Correct Answer: (C)

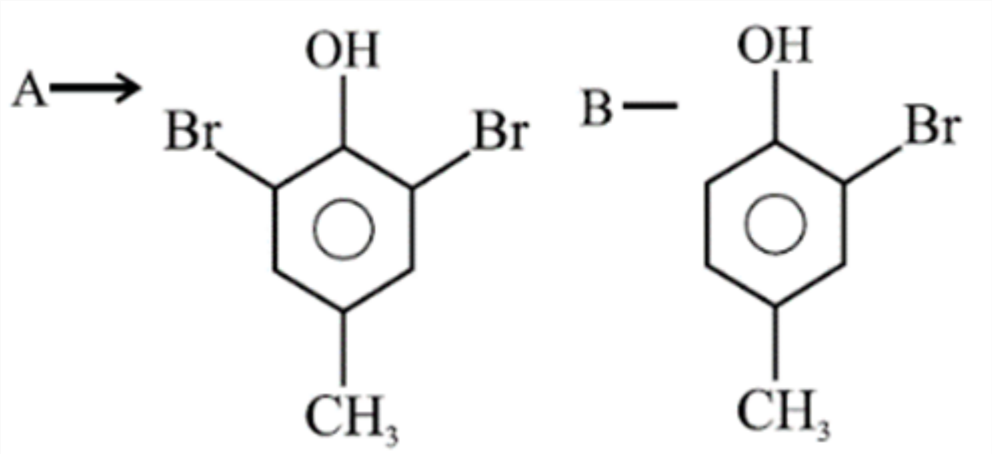
Vitamin B_{12} helps to produce red blood cells. Due to deficiency of vitamin B_{12} the sufficient amount of red blood cells will not be produced. As a result, RBC deficiency in haemoglobin is known as pernicious anaemia.

Q82. Solution
Correct Answer: (C)

for first order reactions
$t_{75} = 2 \times t_{50}$
$t_{1/2} = \frac{32}{2} = 16 \text{ min}$

Q83. Solution
Correct Answer: (A)

Bromination of phenol is solvent dependent reaction i.e. polarity of solvents.



Q84. Solution
Correct Answer: (C)

This compound which contain methyl ketonic linkage or which can change to methyl ketonic linkage can give a positive iodoform test. So, all secondary Alcohol can’t be given positive iodoform test therefore option (C) is correct.

Q85. Solution
Correct Answer: (B)

In F_2O, F is more electronegative which attracts the bond pair electrons away from central oxygen atom. Which decreases the repulsion between bond pair of electrons, hence bond angle decreases.

Q86. Solution

Correct Answer: (B)

Photochemical smog is initiated by the photochemical dissociation of NO_2 and the resulting secondary reactions involving unsaturated hydrocarbons, other organic compounds and free radicals, leading to the formation of organic peroxides and ozone.

$$NO_2(g) \xrightarrow{\text{UV light}} NO(g) + [O]$$

$$O_2(g) + [O] \rightarrow O_3(g)$$

$$O_3 + NO \rightarrow \underset{\substack{\text{Brown gas} \\ \text{(In high concentration} \\ \text{Forms haze)}}}{NO_2} + O_2$$

Hydrocarbons $+O_3,\ O_2,\ O, NO_2,\ NO$; peroxides, peroxyacetyl nitrate, formaldehyde, ozone aldehyde, acrolein, etc. oxidised hydrocarbons and ozone in the presence of humidity cause photochemical smog, which dissipates at night.

Q87. Solution

Correct Answer: (C)

$P(n) = n^4 - 2n^3 - n^2 + 2n - 26$

$= n^3(n-2) - n(n-2) - 26$

$= \left(n^3 - n\right)(n-2) - 26$

$= \ n(n+1)(n-1)(n-2) - 26 - 22 + 22$

$= \ n(n+1)(n-1)(n-2) - 48 + 22$

We know the product of 4 consecutive natural numbers is a multiple of 24.

$\therefore\ n(n+1)(n-1)(n-2) - 48$ is divisible by 24

Hence, Remainder left out when $n^4 - 2n^3 - n^2 + 2n - 26$ is divided by 24 is equal to 22.

Q88. Solution
Correct Answer: (B)

Given curve is $y=2x^2-x+1$

On differentiating w.r.t. x, we get

$\frac{dy}{dx}=4x-1$

Since, this is parallel to the given curve $y=3x+9$

$\therefore$ These slopes are equal

$\Rightarrow \quad 4x-1=3 \quad \Rightarrow \quad x=1$

At $x=1, \quad y=2(1)^2-1+1 \quad \Rightarrow y=2$

Thus, the point is (1, 2).

Q89. Solution
Correct Answer: (C)

Solvay process is used in the manufacture of sodium carbonate, $\mathrm{Na_2CO_3}$. This process involves following reactions.

$$\begin{array}{l} \mathrm{NH_3+H_2O+CO_2 \longrightarrow NH_4HCO_3} \\ \underline{\mathrm{NH_4HCO_3+NaCl \longrightarrow NaHCO_3+NH_4Cl}} \\ \mathrm{NH_3+H_2O+CO_2+NaCl \longrightarrow NaHCO_3+NH_4Cl} \end{array}$$

The sodium bicarbonate obtained on heating gives sodium carbonate.

$$\mathrm{NaHCO_3 \xrightarrow{\Delta} Na_2CO_3+H_2O+CO_2}$$

Note: This process cannot be used in the manufacture of potassium carbonate as potassium bicarbonate is soluble in the solution of $\mathrm{NH_4Cl}$ and KCl.

Q90. Solution
Correct Answer: (C)

$$\mathrm{C_8H_{18}(g)+\frac{25}{2}O_2(g) \rightarrow 8CO_2(g)+9H_2O(l)}$$
$$\Delta \mathrm{H}^{\circ}=8\times(-394)+9\times(-286)-(-250)=-5476$$

Q91. Solution
Correct Answer: (C)

$$\mathrm{4H_3PO_3 \xrightarrow{\Delta} 3H_3PO_4+PH_3}$$

In the reaction, the acid in +3 oxidation state of P tends to disproportionate to higher (+5) and lower (-3) oxidation state in $\mathrm{H_3PO_4}$ and $\mathrm{PH_3}$ respectively.

Q92. Solution
Correct Answer: (B)

From the given words,

Kerosene, petrol , diesel exists in same state of matter i.e., liquid.

But LPG is a gas which is different state of matter.

Hence, second option is different among all.

Q93. Solution
Correct Answer: (A)

From the figure (i), (ii) and (iv) we find that numbers 6, 1,5 and 2 appear on the adjacent surfaces to the number 3. Therefore, number 4 will be opposite to number 3. Hence option (1) is the answer.

Q94. Solution
Correct Answer: (B)

According to the Given information, Given a series and we need to find missing number of this given series, So, the series is, $2890, \ (?), \ 1162, \ 874, \ 730, \ 658$ Now we find the missing number of this series. Now we solve take reverse series, The difference of two numbers is multiple of 72
$658 + \ 72 \ = \ 730$ $730 \ + \ 144 \ = \ 874$ $874 \ + \ 288 \ = \ 1162$ $1162 \ + 576 \ = \ 1738$ So, a missing number of this series is, 1738. Hence, the answer is , 1738

Q95. Solution
Correct Answer: (A)

Let the age of X be a years.

Then,

Age of W $= a - 9$ years

Age of V $= a - 9 + 3 = a - 6$ years

Age of U $= a - 6 - 8 = a - 14$ years

Age of T $= a - 14 + 5 = a - 9$ years

It is clear from above that the ages of W and T are the same.

Q96. Solution
Correct Answer: (C)

According to the question,

In 2010, the income of doctor was 10 thousands.

In 2011, the income of doctor was 12.5 thousands.

So, the increment was 2.5 thousands.

Similarly,

10 + 2.5 = 12.5 thousands

12.5 + 5 = 17.5 thousands

17.5 + 7.5 = 25 thousands

25 + 10 = 35 thousands

Hence, the correct answer is 35 thousands.

Q97. Solution
Correct Answer: (D)

According to the question:

$4 - 3 - 2 = 24$

$6 - 1 - 2 = 12$

As we know, that there is some logic hidden in above equations. Therefore, we try to find the logical relation between both equations, and hence we find that given equations will only be true when the subtraction signs are replaced by multiplication signs, as shown below:

$4 \times 3 \times 2 = 24$

$6 \times 1 \times 2 = 12$

Similarly, the signs will be changed in the incomplete equation as shown below:

$5 \times 4 \times 1 = 20$

Hence, option D is correct.

Q98. Solution
Correct Answer: (C)

The relation between the first, second and third terms of series are as follows:

$L + 3 = O,\ O + 3 = R, R + 3 = U, U + 3 = X$

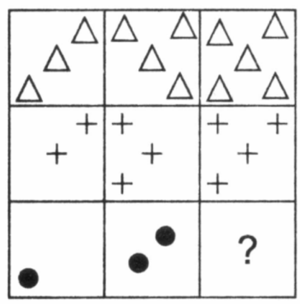
$O + 2 = Q,\ Q + 2 = S,\ S + 2 = U,\ U + 2 = W$

$Q + 1 = R,\ R + 1 = S,\ S + 1 = T,\ T + 1 = U$

Thus the missing term is UUT.

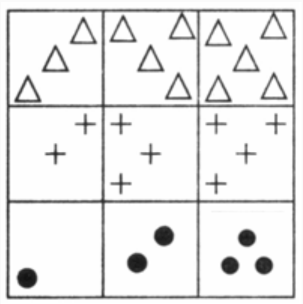
Q99. Solution
Correct Answer: (A)

Given question figure is:

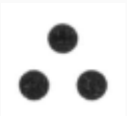


We can see that number of figures in the first and second row increases by one when moving from left to right. So, applying the same rule in the third row, we get 3 dots.

The complete figure is shown below:



Hence, the correct answer is



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Q100. Solution
Correct Answer: (D)

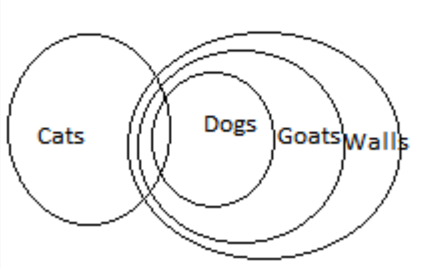
The figure rotates 900 clockwise at each stage and a different section is shaded in tum.

Q101. Solution
Correct Answer: (D)

In this question to understand the statement we use Venn diagram.

So given statements are:

Some cats are dogs
All dogs are goats
All goats are walls

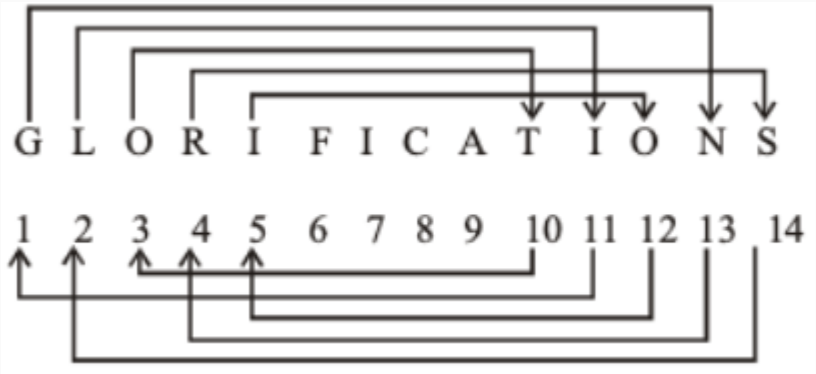


Conclusion:
Some walls are dogs
Some walls are cats

After using Venn diagram we can see that both conclusion follow the statement.

So some walls are dogs is true and some walls are cats is true

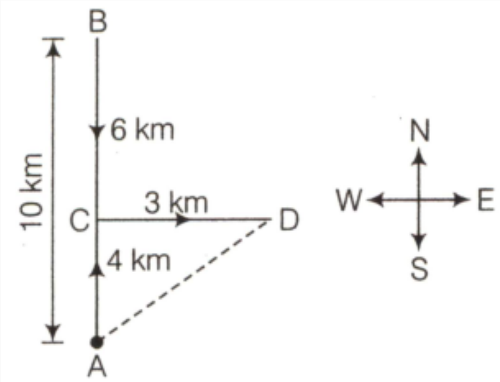
Q102. Solution
Correct Answer: (D)



The new letter sequence is NITSOFICAOLIGR. The twelfth letter from the right is T.

Q103. Solution
Correct Answer: (B)

Let Kabeer starts from the point A, we will use the information given in the problem and draw Kabeer's movement as shown below:



Final point where Kabeer ends his walk is D.

So, the required distance is AD,

$$\mathrm{AD} = \sqrt{(\mathrm{CD})^2 + (\mathrm{AC})^2}\mathrm{AD} = \sqrt{(3)^2 + (4)^2}\mathrm{AD} = \sqrt{9 + 16}\mathrm{AD} = 5 \ \mathrm{km}$$

Hence, Kabeer is 5 km far and in North-East direction with respect to his the starting point.

Q104. Solution
Correct Answer: (D)

Supporters of the 'first theory' i.e. pupils should concentrate on a narrow range of subject, will not agree with absence of specialised work. The first theory lays all emphasis on specialised work. The first theory lays all emphasis on specialisation and believes specialised experts have contributed more to the world.

Q105. Solution
Correct Answer: (B)

The adjective 'Parochial' means something which has limited scope.

'Reluctant' means to be shy or hesitant.
'Narrow-minded' refers to a person with a limited outlook who is unwilling to consider alternative ideas and it best expresses the meaning of Parochial.
'Drown' means soak or immerse.
'Gloomy' means to appear dark and disheartened.

Q106. Solution
Correct Answer: (C)

The letter ‘M’ is not present in the word ‘OBSTETRICIAN’. Hence, the word ‘TERMITE’ cannot be made from its letters.

All other options such as, SIREN, RETAIN, and SOBER have letters that are present in the given word 'OBSTETRICIAN'.

Q107. Solution
Correct Answer: (B)

Let (x_1, y_1) be the point which is at a distance d from the $(1,1)$ then we have:
$\sqrt{(x_1-1)^2+(y_1-1)^2}=d \Rightarrow (x_1-1)^2+(y_1-1)^2=d^2 \ldots (i)$ $\because$ Point (x_1, y_1) is at the same distance from the line $\Rightarrow d=\frac{x_1+y_1+1}{\sqrt{1+1}}=\frac{x_1+y_1+1}{\sqrt{2}} \ldots (ii)$ From equations (i) \& (ii)

$$(x_1-1)^2+(y_1-1)^2=\frac{1}{2}(x_1+y_1+1)^2$$

$$\Rightarrow 2\left[x_1^2+1-2x_1+y_1^2+1-2y_1\right]$$
$$=x_1^2+y_1^2+1+2x_1y_1+2x_1+2y_1$$
$$\Rightarrow x_1^2+y_1^2-2x_1y_1-6x_1-6y_1+3=0$$
$$\Rightarrow (x_1-y_1)^2-6(x_1+y_1)+3=0$$

Taking locus of point (x_1, y_1), we get:

$$(x-y)^2-6(x-y)+3=0$$

Q108. Solution
Correct Answer: (C)

$$\Delta=10!\ 11!\ 12!\begin{vmatrix}1 & 11 & 12\times 11\\ 1 & 12 & 13\times 12\\ 1 & 13 & 14\times 13\end{vmatrix}$$

$R_3 \rightarrow R_3-R_2,\ R_2 \rightarrow R_2-R_1$

$$=(10!\ 11!\ 12!)\begin{vmatrix}1 & 11 & 12\times 11\\ 0 & 1 & 2\times 12\\ 0 & 1 & 2\times 13\end{vmatrix}=2(10!\ 11!\ 12!)$$

Q109. Solution

Correct Answer: (D)

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

$\Rightarrow f'(x)=\frac{2(x^2-1)}{(x^2+x+1)^2}$

$f'(x)$ is positive in $(-\infty,-1)\cup(1,\infty)$ and negative in $(-1,1)$
Hence, $f(x)$ is many-one.
For Range of $f(x)$, let $y=\frac{x^2-x+1}{x^2+x+1}$
$\Rightarrow (y-1)x^2+(y+1)x+(y-1)=0$
$\Rightarrow$ since $x\in R, D\geq 0$

$\Rightarrow (y+1)^2-4(y-1)^2\geq 0$

$\Rightarrow -3y^2+10y-3\geq 0$

$\Rightarrow y\in\left[\frac{1}{3},3\right]$
Hence $f(x)$ is into

Q110. Solution

Correct Answer: (B)

Given, $\left|z+\frac{2}{z}\right|=2$

$$\Rightarrow |z|-\frac{2}{|z|}\leq 2$$

$$\Rightarrow |z|^2-2|z|-2\leq 0$$

$$\Rightarrow |z|\leq\frac{2\pm\sqrt{4+8}}{2}\leq 1\pm\sqrt{3}$$

Hence, max. value of $|z|$ is $1+\sqrt{3}$

Q111. Solution

Correct Answer: (A)

$\lim\limits_{x\to 2}=\frac{\sqrt{1+\sqrt{2+x}}-\sqrt{3}}{x-2}$

$=\lim\limits_{x\to 2}\frac{\left(1+\sqrt{2+x}-3\right)}{(x-2)\left(\sqrt{1+\sqrt{2+x}}+\sqrt{3}\right)}$

$=\lim\limits_{x\to 2}\frac{x-2}{(x-2)\left(\sqrt{1+\sqrt{2+x}}+\sqrt{3}\right)\left(\sqrt{2+x}+2\right)}$

$=\lim\limits_{x\to 2}\frac{1}{\left(\sqrt{1+\sqrt{2+x}}+\sqrt{3}\right)\left(\sqrt{2+x}+2\right)}$

$=\frac{1}{\left(\sqrt{1+2}+\sqrt{3}\right)\left(\sqrt{2+2}+2\right)}=\frac{1}{8\sqrt{3}}$

Q112. Solution

Correct Answer: (B)

Let T_n be the n^{th} term of the series
$\frac{1}{1+1^2+1^4}+\frac{2}{1+2^2+2^4}+\frac{3}{1+3^2+3^4}+\ldots\ldots$
Then $T_n=\frac{n}{1+n^2+n^4}=\frac{n}{(1+n^2)^2-n^2}$
$=\frac{n}{(n^2+n+1)(n^2-n+1)}$
$=\frac{1}{2}\left[\frac{1}{n^2-n+1}-\frac{1}{n^2+n+1}\right]$
$=\frac{1}{2}\left[\frac{1}{1+(n-1)n}-\frac{1}{1+n(n+1)}\right]$
Now $\sum_{r=1}^{n} T_r=\frac{1}{2}\left[\frac{1}{1}-\frac{1}{1+1.2}\right]+\frac{1}{2}\left[\frac{1}{1+1.2}-\frac{1}{1+2.3}\right]$
$+\frac{1}{2}\left[\frac{1}{1+2.3}-\frac{1}{1+3.4}\right]+\ldots\ldots\ldots+\frac{1}{2}\left[\frac{1}{1+(n-1)n}-\frac{1}{1+n(n+1)}\right]$
$=\frac{1}{2}\left[1-\frac{1}{1+n(n+1)}\right]=\frac{n(n+1)}{2(n^2+n+1)}.$
Trick: Checking for $n=1,2$. $S_1=\frac{1}{3}$ and $S_2=\frac{3}{7}$ which are given by (b).

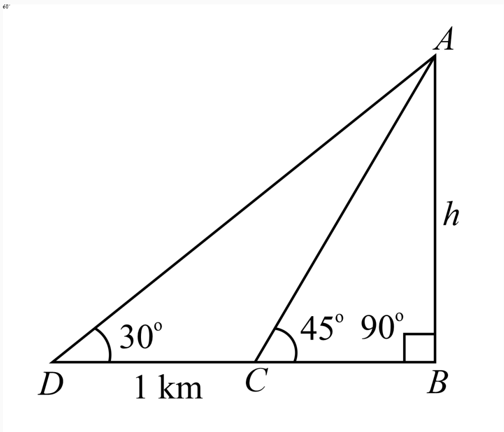
Q113. Solution

Correct Answer: (A)

$\sin x-\sin 2x+\sin 3x=0$ $\sin x-2\sin x\cdot\cos x+3\sin x-4\sin^3 x=0$
$4\sin x-4\sin^3 x-2\sin x\cdot\cos x=0$ $2\sin x\left(1-\sin^2 x\right)-\sin x\cdot\cos x=0$
$2\sin x\cdot\cos^2 x-\sin x\cdot\cos x=0$ $\sin x\cdot\cos x(2\cos x-1)=0$ $\therefore\quad \sin x=0,\cos x=0,\cos x=\frac{1}{2}$
$\therefore\quad x=0,\frac{\pi}{3}\quad\because\quad x\in\left[0,\frac{\pi}{2}\right)$

Q114. Solution
Correct Answer: (C)

A person is walking along a straight road, observes the pole from two points that are 1 km apart.



$h = \frac{1000}{\cot 30^\circ - \cot 45^\circ}$

$= \frac{1000}{\sqrt{3}-1}$

Hence, on rationalising we get, $500\left(\sqrt{3}+1\right)$ m.

Thus, option C is the correct answer.

Q115. Solution
Correct Answer: (B)

As given $d = a_2 - a_1 = a_3 - a_2 = \ldots. = a_n - a_{n-1}$

$\therefore \sin d \left\{\operatorname{cosec} a_1 \operatorname{cosec} a_2 + \ldots.. + \operatorname{cosec} a_{n-1} \operatorname{cosec} a_n\right\}$

$= \frac{\sin\left(a_2 - a_1\right)}{\sin a_1 \cdot \sin a_2} + \ldots.. + \frac{\sin\left(a_n - a_{n-1}\right)}{\sin a_{n-1} \sin a_n}$

$= (\cot a_1 - \cot a_2) + (\cot a_2 - \cot a_3) + \ldots.$

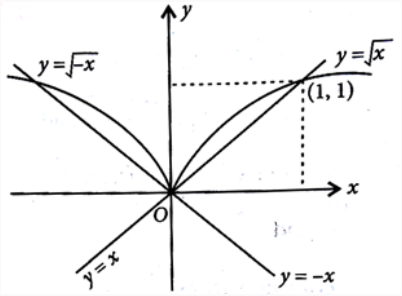
$\quad + (\cot a_{n-1} - \cot a_n)$

$= \cot a_1 - \cot a_n.$

Q116. Solution

Correct Answer: (C)

Intersection point of $y=\sqrt{x}$ and $y=x$ is $(1,1)$



$\therefore$ Required area

$=2\int_0^1(\sqrt{x}-x)dx=2\left[\frac{x^{\frac{3}{2}}}{\frac{3}{2}}\right]_0^1-2\left[\frac{x^2}{2}\right]_0^1$

$=2\times\frac{2}{3}-\frac{2}{2}(1)=\frac{4-3}{3}=\frac{1}{3}$ sq. unit

Q117. Solution

Correct Answer: (C)

$\mathrm{h(x)}=\frac{1}{1-x},\ \mathrm{x}\neq 1\Rightarrow \mathrm{h\,(h(x))}\ =\frac{\mathrm{x-1}}{\mathrm{x}},\ \mathrm{x}\neq 0,\ 1$

$\therefore\ \mathrm{h(h(h(x)))=x,\ x\neq 0,\ 1}$

Also, $\mathrm{g(x)}\ \geq\ 0\,\forall\,\mathrm{x}\ \in\ \mathrm{R}\Rightarrow\ \mathrm{f(x)}\ \geq\ \mathrm{x}\Rightarrow\ \mathrm{f(f(x))}\ \geq\ \mathrm{f(x)}\Rightarrow\ \mathrm{x}$

$[\because\ \mathrm{f(x)}$ is increasing$]$

$\Rightarrow \mathrm{f(f(f(x)))}\geq\ \mathrm{f(x)}\ \geq\ \mathrm{x}\Rightarrow\ \mathrm{f(f(f(x)))-x}\ \geq\ 0$

$\forall\,\mathrm{x}\ \in\ \mathrm{R}-\{0,\ 1\}$

$\because\ \phi(\mathrm{x})$ is defined for all $\mathrm{x}\ \in\ \mathrm{R}-\{0,\ 1\}$

Q118. Solution

Correct Answer: (C)

Let equation of plane be

$a(x-1)+b(y-2)+c(z-2)=0$ ....(i)

Since (i) is perpendicular to the given planes, then

Dot product of the normal vectors of the perpendicular planes is 0.

$a-b+2c=0$

$2a-2b+c=0$

Solving above equations $c=0$ and $a=b$ equation of plane (i) becomes $x+y-3=0$

Distance from $(1,\ -2,\ 4)$ will be

$D=\frac{|1-2-3|}{\sqrt{1+1}}=\frac{4}{\sqrt{2}}=2\sqrt{2}$

Q119. Solution

Correct Answer: (B)

Let, $\sin x = t \in [0{,}1]$
$\therefore f(t) = t^3 - 3t + 4$
Now, $f'(t) = 3t^2 - 3$
$= 3(t-1)(t+1)$
$\therefore f'(t) \leq 0\ \forall t \in [0, 1]$
$\therefore \max(f(t)) = 0 - 0 + 4 = 4$
Also, $f(x)$ is continuous in $[0{,}1]$ and differentiable in $(0{,}1)$, hence LMVT is applicable.
But, $f(0) \neq f(1)$, hence Rolle's theorem is not applicable

Q120. Solution

Correct Answer: (D)

Required number $= {}^{20}C_2 - {}^{4}C_2 + 1 = \frac{20\times19}{2} - \frac{4\times3}{2} + 1 = 190 - 6 + 1 = 185.$

Q121. Solution

Correct Answer: (D)

Required mean $= \frac{(ax_1+b)+(ax_2+b)+\ldots\ldots+(ax_n+b)}{n} = \frac{a(x_1+x_2+\ldots\ldots+x_n)+nb}{n} = a\bar{x} + b\left(\because \frac{x_1+x_2+\ldots\ldots+x_n}{n} = \bar{x}\right).$

Q122. Solution

Correct Answer: (C)

Consider $\frac{x-3}{1} = \frac{y-4}{2} = \frac{z-5}{2} = r.$

Any point on the line is $(r+3,\ 2r+4,\ 2r+5)$. It lies on the plane $x + y + z = 17.$

$\therefore (r+3) + (2r+4) + (2r+5) = 17$ i.e., $5r + 12 = 17 = r = 1$

Thus, the point of intersection of the plane and the line is $(4, 6, 7)$.

Required distance=Distance between $(3, 4, 5)$ and $(4, 6, 7)$

$$= \sqrt{\left\{(4-3)^2 + (6-4)^2 + (7-5)^2\right\}} = \sqrt{1+4+4} = 3$$

Q123. Solution

Correct Answer: (C)

Given equation is $\tan^{-1}\frac{a+x}{a} + \tan^{-1}\frac{a-x}{a} = \frac{\pi}{6}$
$\Rightarrow \tan^{-1}\left(\frac{\frac{a+x}{a}+\frac{a-x}{a}}{1-\frac{a+x}{a}\cdot\frac{a-x}{a}}\right) = \frac{\pi}{6}$
$\Rightarrow \frac{2a^2}{x^2} = \tan\frac{\pi}{6} = \frac{1}{\sqrt{3}} \Rightarrow x^2 = 2\sqrt{3}a^2$

Q124. Solution

Correct Answer: (A)

p	q	$\sim p$	$\sim q$	$p \wedge \sim q$	$\sim p \vee q$	$(p \wedge \sim q) \wedge (\sim p \vee q)$
T	T	F	F	F	T	F
T	F	F	T	T	F	F
F	T	T	F	F	T	F
F	F	T	T	F	T	F

Clearly the truth value of given statement $(p\ \wedge \sim q) \wedge (p\ \vee \sim q)$ is false (F). Hence it is a contradiction.

Q125. Solution

Correct Answer: (C)

Given,

$f(x) = \frac{2-x\cos x}{2+x\cos x}$, $g(x) = \log_e x$

$\Rightarrow g(f(x)) = \log_e\left(\frac{2-x\cos x}{2+x\cos x}\right)$

$\Rightarrow g(f(-x)) = \log_e\left(\frac{2-(-x)\cos(-x)}{2+(-x)\cos(-x)}\right)$

$\Rightarrow g(f(-x)) = \log_e\left(\frac{2+x\cos x}{2-x\cos x}\right)$

$\Rightarrow g(f(-x)) = -\log\left(\frac{2-x\cos x}{2+x\cos x}\right)$

$\Rightarrow g(f(-x)) = -g(f(x))$

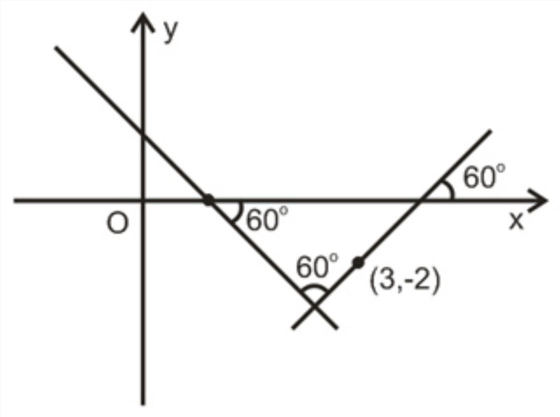
Hence, $g(f(x))$ is an odd function.

By using the property of definite integration, $\int_{-a}^{a} f(x)\ \mathrm{d}\ x = \begin{cases} 2\int_0^a\ f(x)dx, & f(-x) = f(x) \\ 0, & f(-x) = -f(x) \end{cases}$, we can write

$\int\limits_{-\frac{\pi}{4}}^{\frac{\pi}{4}} g(f(x))dx = 0 = \log_e 1$

Q126. Solution

Correct Answer: (B)



$\sqrt{3}x + y = 1 \Rightarrow y = -\sqrt{3}x + 1$

Slope of line=$-\sqrt{3}$

Let slope of second line=m

For angle between two lines ,

$\tan\theta = \pm\frac{m_1 - m_2}{1 + m_1 m_2} \tan 60^{\circ} = \pm\left(\frac{-\sqrt{3}-m}{1-\sqrt{3}m}\right)\sqrt{3} = \pm\left(\frac{-\sqrt{3}-m}{1-\sqrt{3}m}\right) \Rightarrow \sqrt{3}\left(1-\sqrt{3}m\right) = -\sqrt{3} - m \; or \; \sqrt{3}\left(1-\sqrt{3}m\right)$

But line intersects Xaxis, therefore $m \neq 0$

Slope of req. line $= \sqrt{3}$
Eq. is $(\mathrm{y} + 2) = \sqrt{3}(\mathrm{x} - 3)$
i.e.$\mathrm{y} - \sqrt{3}\mathrm{x} + 2 + 3\sqrt{3} = 0$

Q127. Solution

Correct Answer: (B)

Given, $\frac{dy}{dx} = y(e^x + 1)$

This is the variable separable form of differential equation. So,

$\frac{dy}{y} = (e^x + 1)dx$

Integrating both sides, we have

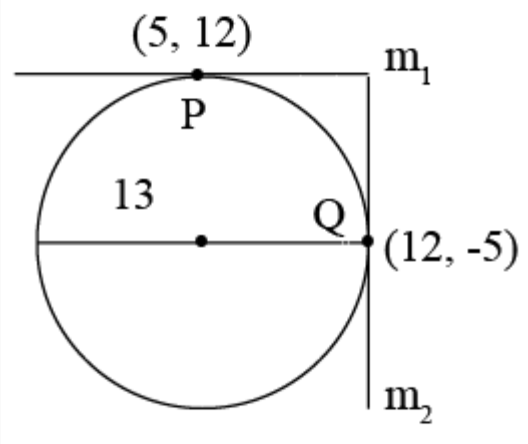
$\int \frac{dy}{y} = \int (e^x + 1)dx$

$\log y = e^x + x + c$

Q128. Solution

Correct Answer: (D)

Both Point P and Q are in circle because When we put the coordinate in equ. we get 169



$x^2 + y^2 = 169 \therefore r^2 = 169\ r = 13$ (radius of circle) Now $x^2 + y^2 = 169$ differentiate w.r.t x $2x + 2y\frac{dy}{dx} = 0$

$$\text{At P(5,12) } \left.\frac{dy}{dx}\right|_p = -\frac{5}{12} = m_1$$

$\therefore \frac{dy}{dx} = -\frac{x}{y}$ $\text{At d(12,-5) } \left.\frac{dy}{dx}\right|_d = -\left(\frac{12}{-5}\right) = \frac{12}{5} = m_2$ When slope of two lines is -1 there are they are at

$$\text{Now } m_1 m_2 = -\frac{5}{12} \times \frac{12}{5}$$

$$m_1 m_2 = -1$$

90° therepre they are at 90° or perpendicular $\therefore \tan\theta = \frac{m_1 - m_2}{1 + m_1 m_2} = \infty\ \theta = 90^\circ$

Q129. Solution

Correct Answer: (A)

$|z_1 + z_2| \leq |z_1| + |z_2| = |24 + 7i| + 6 = 25 + 6 = 31$

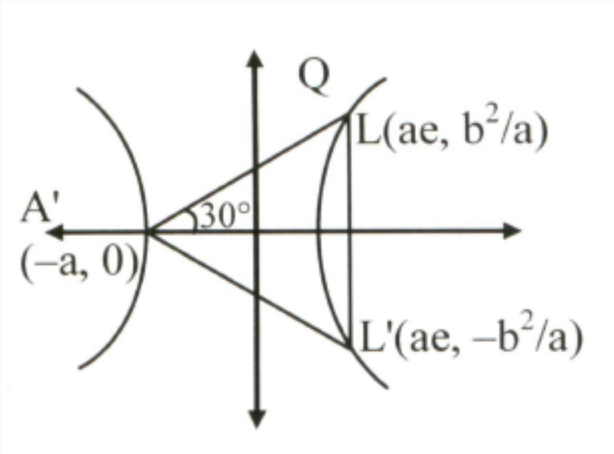
Also, $|z_1 + z_2| = |z_1 - (-z_2)| \geq ||z_1| - |z_2||$

$\Rightarrow |z_1 + z_2| \geq |25 - 6| = 19$

Hence the least value of $|z_1 + z_2|$ is 19 and the greatest value is 31.

Q130. Solution

Correct Answer: (A)



Angle between two lines $\tan\,\theta\ =\ \frac{m_1-m_2}{1+m_1m_2}$.

$\tan 30^{\circ} = \frac{\frac{b^2}{a}}{a+ae}$

$\Rightarrow \frac{1+e}{\sqrt{3}} = e^2 - 1$

$\Rightarrow e - 1 = \frac{1}{\sqrt{3}} \Rightarrow e = \frac{\sqrt{3}+1}{\sqrt{3}}$