Answer Key

Other (142 Questions)

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

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

Solutions

Q1. Solution

Correct Answer: (A)

Given : Voltage in primary V_p = 200 volt

Current in primary i_p = 2 amp

Voltage in secondary V_s = 2000 volt

The relation for the current in the secondary is

$\frac{V_s}{V_p} = \frac{i_p}{i_s} = \frac{2000}{200} = \frac{2}{i_s}$ or $i_s = \frac{2\times200}{2000} = 0.2$ amp

Q2. Solution

Correct Answer: (C)

As we know the discharging of capacitor is given by $q = q_0\, e^{-\frac{t}{\tau}}$

Also

$V = V_o e^{-\frac{t}{\tau}}$

Here

$V = \frac{9}{10}V_o$

putting the values

$\frac{9}{10}V_o = V_o e^{-\frac{t}{\tau}}$

$\ell_n\left(\frac{9}{10}\right) = -\frac{t}{\tau}$

$\ell_n\left(\frac{10}{9}\right) = \frac{t}{\tau}$

$t = \tau\, \ell_n\left(\frac{10}{9}\right)$

Q3. Solution

Correct Answer: (C)

Maximum coverage range of transmitting antenna, $d = \sqrt{2R_c h}$

Given, $R_c = 6400$ km$= 6400 \times 10^3$ m, $h = 300$ m

$\therefore d = \sqrt{2 \times 6400 \times 10^3 \times 300} = 6.2 \times 10^4$ m $= 62$ km

The receiving station (situated at 80 km) is out of the coverage range of the transmitting antenna, so space wave communication is not possible, the critical frequency (or maximum frequency) of ionospheric propagation is

$f_c = 9\sqrt{N_{\max}} = 9 \times \sqrt{10^{12}}$

$= 9 \times 10^6$ Hz $= 9$ MHz

Single 5 MHz $(< 9$ MHz$)$ is coming via ionosphere mode or skywave propagation.

Q4. Solution

Correct Answer: (B)

Given $\mathrm{PV}^{-2}=$ constant

Comparing with $\mathrm{PV}^{\mathrm{N}}=$ constant, we get

$\therefore \mathrm{N}=-2$

$\mathrm{C}=\mathrm{C}_{\mathrm{v}}+\frac{\mathrm{R}}{1-\mathrm{N}}=\frac{5 \mathrm{R}}{2}+\frac{\mathrm{R}}{1+2}=\frac{5 \mathrm{R}}{2}+\frac{\mathrm{R}}{3}$

$=\frac{15 \mathrm{R}+2 \mathrm{R}}{6}=\frac{17 \mathrm{R}}{6}$

Q5. Solution

Correct Answer: (C)

$\tau=\mathrm{MB} \sin \theta=0.018$

$\mathrm{M}=\frac{0.018}{\mathrm{B} \sin \theta}=\frac{0.018}{0.06 \times 0.5}=0.64 \ A \mathrm{m}^2$

$W=\Delta \mathrm{U}=\mathrm{U}_{\mathrm{f}}-\mathrm{U}_{\mathrm{i}}$

$=-\mathrm{MB} \cos 180^{\circ}-(-\mathrm{MB} \cos 0^{\circ})$

$=2 \mathrm{MB}$

$=2 \times 0.6 \times 0.06$

$=0.072 \mathrm{~J}$

Q6. Solution

Correct Answer: (C)

$\frac{n_g}{n_a}=\frac{c_a}{c_g}$

$\Rightarrow \frac{3}{2}=\frac{3 \times 10^8}{c_g}$

$c_g=2 \times 10^8 \mathrm{~m~s}^{-1}$

$\text{Time}=\frac{\text{Distance}}{\text{Speed}}$

$=\frac{4 \times 10^{-3}}{2 \times 10^8}=2 \times 10^{-11} \mathrm{s}$

Q7. Solution

Correct Answer: (A)

Energy needed = Increment in surface energy $=$ (surface energy of n small drops) $-$ (surface energy of one big drop) $=n 4 \pi r^2 T-4 \pi R^2 T=4 \pi T\left(n r^2-R^2\right)$

Q8. Solution

Correct Answer: (A)

For isothermal process $P_1V_1 = P_2V_2 \Rightarrow P_2 = \frac{P_1V_1}{V_2} = \frac{72\times1000}{900} = 80$ cm Stress
$\Delta P = P_2 - P_1 = 80 - 72 = 8$ cm

Q9. Solution

Correct Answer: (C)

Applying the principle of conservation of angular momentum,
$(I_1 + I_2)\omega = I_1\omega_1 + I_2\omega_2$
$(6 + I_2)\frac{400}{60} \times 2\pi = 6 \times \frac{600}{60} \times 2\pi + I_2 \times 0$
Which gives, $I_2 = 3$ kg m^2

Q10. Solution

Correct Answer: (D)

Number of nuclei decreases exponentially
$N = N_0e^{-\lambda t}$and rate of decay $\left(-\frac{dN}{dt}\right) = \lambda N$
Therefore, decay process lasts upto $t = \infty$.
Therefore, a given nucleus may decay at any time after $t = 0$

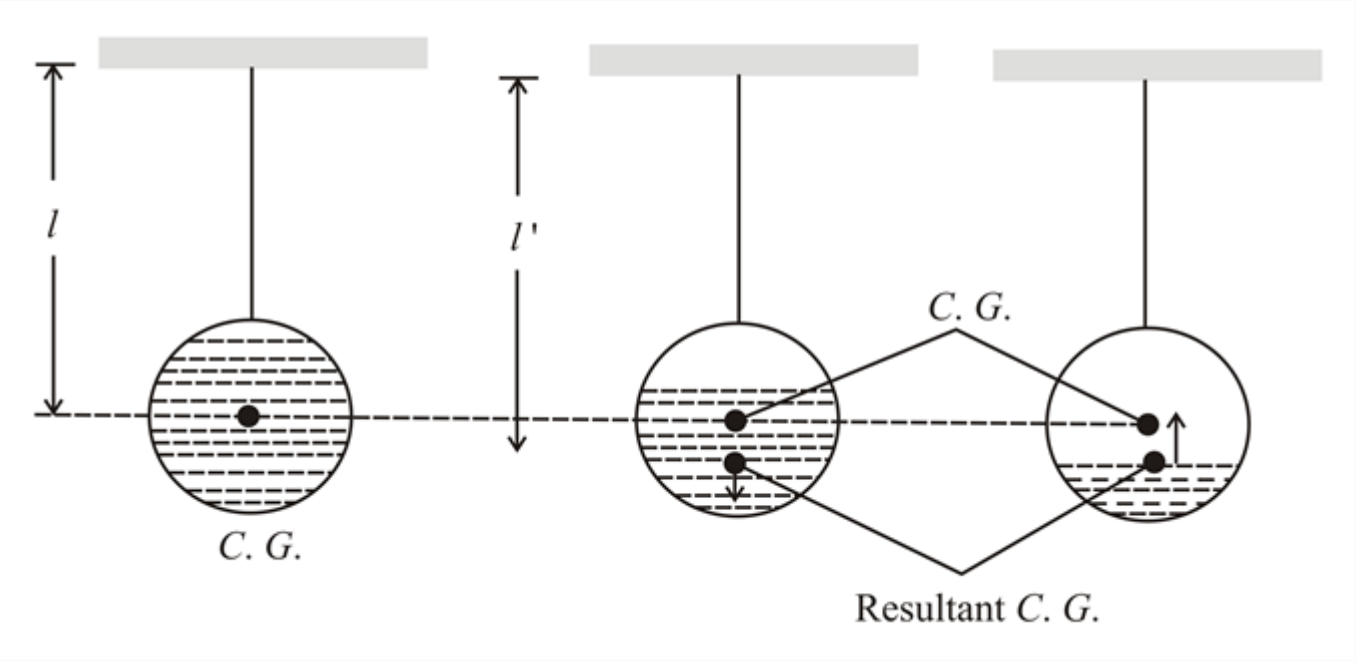
Q11. Solution

Correct Answer: (C)

Due to rotation of earth the effective acceleration due to gravity $g' = g - R\omega^2\cos^2\lambda$.
For a given point on the surface of earth g decreases as ω increases. The angular speed of earth is maximum at equator hence, the value of g on the surface of the earth is smallest. ~

Q12. Solution

Correct Answer: (D)



The given system is like a simple pendulum, whose effective length (ℓ) is equal to the distance between point of suspension and C.G. (Centre of Gravity) of the hanging body.

When water slowly flows out the sphere, the C.G. of the system is lowered, and hence ℓ increases, which in turn increases time period $\left(as \quad T \propto \sqrt{\ell}\right)$.

After some time weight of water left in sphere becomes less than the weight of sphere itself then the resultant C.G. stops lowering further and it moves back o C.G. of sphere itself, i.e., ℓ decreases and hence T decreases.

Finally when the sphere becomes empty, the resulting C.G. is the C.G. of sphere, i.e., length becomes equal to the original length and hence the time period becomes equal to the same value as when it was full of water. ,

Q13. Solution

Correct Answer: (B)

$\frac{1}{2}mv^2{}_{max} = eV = \frac{hc}{\lambda}$

$\Rightarrow \quad \lambda = \frac{hc}{eV} \Rightarrow \lambda_1 = \frac{hc}{eV_1}, \quad \lambda_2 = \frac{hc}{eV_2} \Rightarrow \lambda_1 - \lambda_2 = \frac{hc}{eV_1} - \frac{hc}{eV_2}$

$\Rightarrow \quad \Delta\lambda = \frac{hc}{e}\left[\frac{1}{V_1} - \frac{4}{5V_1}\right] = \frac{hc}{eV_1} \times \frac{1}{5}$

$V_1 = \frac{hc}{5 \cdot e\Delta\lambda}$

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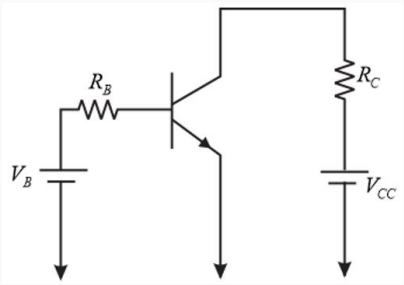
Q14. Solution

Correct Answer: (B)



Given, $\beta = 250$
$R_C = 1000\ \Omega$
$V_{CC} = 10\ \text{V}$

At saturation, $V_{CE} = 0$
$\Rightarrow i_e = \frac{10\,\text{V}}{1000\,\Omega} = 10\,\text{mA}$
Current gain factor, $\beta = \frac{i_e}{i_B}$
$\Rightarrow i_B = \frac{i_e}{\beta} = \frac{10\,\text{mA}}{250}$
$= 40\ \mu\text{A}$

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Q15. Solution

Correct Answer: (A)

$L\ \propto h^a c^b G^c$

$[L]^1 = \left[M^1 L^2 T^{-1}\right]^a \left[LT^{-1}\right]^b \left[M^{-1} L^3 T^{-2}\right]^c$

Solving,

$a = \frac{1}{2},\ c = \frac{1}{2},\ b = -\frac{3}{2}$

$\Rightarrow L = \frac{\sqrt{hG}}{c^{\frac{3}{2}}}$.

Q16. Solution

Correct Answer: (B)

Larger the distance of planet from the sun, larger will be its period of revolution around the sun.
Kepler's third law planetary motion states that the square of the period of revolution of any planet around the sun is directly proportional to the cube of the semi-major axis of its elliptical orbit.

$\therefore\ T^2 \propto R^3$

$\therefore \frac{T_S}{T_c} = \left(\frac{R_S}{R_c}\right)^{3/2}$

$\because\ R_S = 4R_C$

$\therefore \frac{T_S}{T_c} = \left(\frac{4R_c}{R_c}\right)^{3/2}$

Take $T_c = 1$ day then $T_s =$ 8 days.

^

Q17. Solution

Correct Answer: (B)

Here, $I = \frac{70}{5000} = 1.4 \times 10^{-2}\ \text{A}$
$V_{\text{Z}} = 120 - 70$
$= 50\ \text{V}$ (output voltage Across diode)
$I_{\text{L}} = \frac{50}{10000} = 5 \times 10^{-3}\ \text{A} = 0.5 \times 10^{-2}\ \text{A}$
$\Rightarrow \quad I_{\text{Z}} = (1.4 - 0.5) \times 10^{-2}\ \text{A}$
$= 9 \times 10^{-3}\ \text{A}$
$= 9\ \text{mA}$

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Q18. Solution

Correct Answer: (C)

Radius of circular path described by a charged particle in a magnetic field is given by $r = \frac{\sqrt{2mK}}{qB}$; where $K =$ Kinetic energy of electron $\Rightarrow K = \frac{q^2B^2r^2}{2m} = \left(\frac{e}{m}\right)\frac{eB^2r^2}{2}$
$= \frac{1}{2} \times 1.7 \times 10^{11} \times 1.6 \times 10^{-19} \times \left(\frac{1}{\sqrt{17}} \times 10^{-5}\right)^2 \times (1)^2$ By using $E = W_0 + K_{\max}$
$= 8 \times 10^{-20}\ \text{J} = 0.5\text{eV}$
$\Rightarrow W_0 = E - K_{\max} = \left(\frac{12375}{2475}\right)\text{eV} - 0.5\text{eV} = 4.5\text{eV}$ ^

Q19. Solution

Correct Answer: (D)

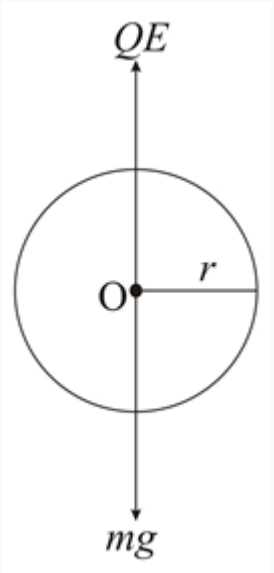
Accuracy is closeness to $\mathrm{true/exact}$ value.
Precision is based on instrument, more decimal places in measurement indicate more precision.
So, 20.1 cm is less precise as compared to 19.65 cm, because 20.1 cm has lesser number of decimal places. !

Q20. Solution

Correct Answer: (B)

Let radius of drop is r. According to Millikan, for balance of drop
$QE = mg$, where Q is the charge on the drop, E is electric field, m is the mass of the drop and g is the acceleration due to gravity.

or $Q\frac{V}{d} = \left[\left(\frac{4}{3}\pi r^3\right)\rho\right]g$, where $E = \frac{V}{d}$,



where, V is potential difference and ρ is charge density of drop

$\therefore\ \frac{Q_1}{Q_2} = \left(\frac{r_1}{r_2}\right)^3 \times \frac{V_2}{V_1}$

$\therefore\ \frac{Q}{Q_2} = \left(\frac{r}{\frac{r}{2}}\right)^3 \times \frac{600}{2400} = 2$

$\therefore\ Q_2 = \frac{Q}{2}$

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Q21. Solution

Correct Answer: (A)

In the case of self-inductance, magnetic flux (ϕ) is directly proportional to the current (i) flowing in the coil. The relation is given as $N\phi = Li$, here N is the number of turns and L is inductance.

So putting the given values, we get

$400 \times \phi = 8 \times 10^{-3} \times 5 \times 10^{-3}$

The magnetic flux, $\phi = 10^{-7}$ Wb.

We know that the permeability of free space has the value $\mu_0 = 4\pi \times 10^{-7}$.

So, $\phi = \frac{\mu_0}{4\pi}$ Wb.

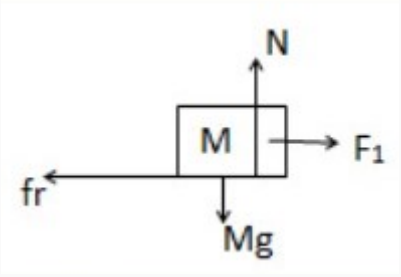
Q22. Solution

Correct Answer: (D)

$R = 91 \times 10^2 \approx 9.1\text{k}\Omega$

Q23. Solution

Correct Answer: (C)



$\text{Mg} \leq \text{F} \leq \text{Mg}\sqrt{1+\mu^2}$

If $F_1 = 0$ So contact force will only have Normal which is equal to Mg So F will be Mg Now as F_1 increases fr keeps increasing till it reaches limiting value i.e., $\mu N = \mu$ mg So, in that case, contact force F will be

$\sqrt{N^2 + f_r^2} = \sqrt{(Mg)^2 + (\mu Mg)^2}$ This means contact force F will lie between $Mg \leq F \leq Mg\sqrt{1+\mu^2}$

$F = Mg\sqrt{1+\mu^2}$

Q24. Solution

Correct Answer: (A)

$_1\text{H}^1 + {}_1\text{H}^1 \longrightarrow {}_2\text{He}^4$

Mass defect $\Delta m = 2 \times$ mass of $_1\text{H}^1 -$ mass of $_2\text{He}^4$
$= 2 \times 2.0141 - 4.0024$
$= 0.0258$

Energy released $= \Delta m \times 931\text{MeV}$
$= 0.0258 \times 931 = 24\text{MeV}$

Q25. Solution

Correct Answer: (B)

Coefficient of self inductance is given as $L = \frac{\mu N^2 A}{l}$, where μ is relative permeability of soft iron core, N is the number of turns in coil, A is area of cross-section of coil and l is length of coil.

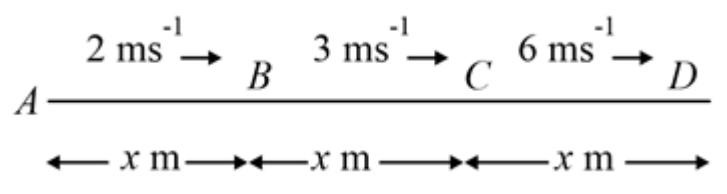
When geometry of coil is fixed, then we can write,

$\frac{L_1}{L_2} = \frac{\mu_1}{\mu_2} \Rightarrow L_2 = \frac{\mu_2}{\mu_1} L_1 = \frac{900}{1} \times 0.18 \Rightarrow L_2 = 162 \text{ mH}$

Q26. Solution

Correct Answer: (A)

Let the total distance be $3x$ m.



For first $\frac{1}{3}$rd distance x m, let time be t_1.

$\because$ time $= \frac{\text{distance}}{\text{speed}}$

$\therefore t_1 = \frac{x}{2}$ s $\ldots$ (i)

For second $\frac{1}{3}$rd distance x m, let time be t_2.

$\because$ time $= \frac{\text{distance}}{\text{speed}}$

$\therefore t_2 = \frac{x}{3}$ s $\ldots$ (ii)

and for third $\frac{1}{3}$rd distance x m, let time be t_3.

$\Rightarrow t_3 = \frac{x}{6}$ $\ldots$ (iii)

$\therefore$ Average velocity for entire journey.

$v_{\text{av}} = \frac{\text{total displacement}}{\text{total time}}$

$\Rightarrow v_{\text{av}} = \frac{3x}{t_1 + t_2 + t_3}$

$= \frac{3x}{\frac{x}{2} + \frac{x}{3} + \frac{x}{6}}$

$= \frac{3x}{x\left(\frac{3+2+1}{6}\right)} = 3 \text{ m s}^{-1}$

Q27. Solution

Correct Answer: (D)

In the propagation of a longitudinal wave (like a sound wave in air or any medium): Energy is transferred through the medium. Linear momentum is also transferred in the direction of wave propagation. However, mass is not transported — the particles of the medium oscillate about their mean positions but do not travel with the wave.

Q28. Solution

Correct Answer: (C)

$m_1 : m_2$

$Y = \frac{Fl}{A\Delta l}$

$\Delta l = \frac{Fl}{YA}$

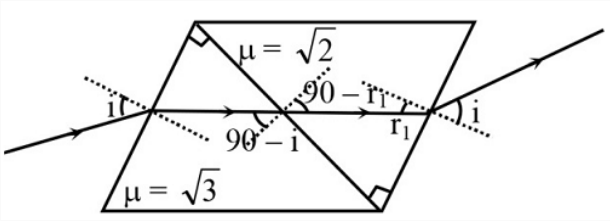
$m = \rho V = \rho \times A \times l$

$A \, \alpha \, m$

$\frac{\Delta l_1}{\Delta l_2} = \frac{A_2}{A_1} = \frac{m_2}{m_1}$

Q29. Solution

Correct Answer: (A)



$\sqrt{3} \cos i = \sqrt{2} \cos r_1$ Snell's law....(1)

$\text{Sin } i = \sqrt{2} \sin r_1$ Snell law... (2)

$(1)^2 + (2)^2$ will give

$3 \cos^2 i + \sin^2 i = 2$

$i = 45^\circ$

Q30. Solution

Correct Answer: (D)

$$W = \int F.dx = \int_0^5 \left(7 - 2x + 3x^2\right) dx$$

$$= \left[7x - \frac{2x^2}{2} + \frac{3x^3}{3}\right]_0^5$$

$$= 35 - 25 + 125 = 135 \text{ J}$$

Q31. Solution

Correct Answer: (C)

Hint : Let us assume $R = K[A]^x[B]^y$ Where x and y are orders wrt A and B respectively $\therefore$ We can write from

$100 = \mathrm{k}(1)^{\mathrm{x}}(10)^{\mathrm{y}} \quad ----(1)$

given data $1 = \mathrm{k}(1)^{\mathrm{x}}(1)^{\mathrm{y}} \quad ----(2)$ $2 \div 1$ gives $\frac{1}{100} = \frac{\mathrm{k}(1)^{\mathrm{x}}(1)^{y}}{\mathrm{k}(1)^{\mathrm{x}}(10)^{y}}, \quad \frac{1}{100} = \left(\frac{1}{10}\right)^{\mathrm{y}}$

$10 = \mathrm{k}(10)^{\mathrm{x}}(1)^{\mathrm{y}} \quad ----(3)$ $\mathrm{y} = 2$

$3 \div 1$ gives $\frac{10}{1} = \frac{K(10)^x(1)^y}{k(1)^x(1)^y}$ So reaction is 2 nd order w.r.t B but 1 st order w.r.t A.

$10 = (10)^x \quad x = 1$

Q32. Solution

Correct Answer: (A)

$\mathrm{CH_3CN} \xrightarrow{\mathrm{H_2O}} \mathrm{CH_3COOH} + \mathrm{NH_3}$

Q33. Solution

Correct Answer: (A)

When amino acids with free alpha-amino groups are treated with an excess of ninhydrin, they yield a purple coloured product. The colour intensity depends on the concentration of amino acid.

Ninhydrin, which is originally yellow, when reacts with amino acid, it turns deep purple. It reacts with the free amino group. This group is present in all the amino acids, proteins or peptides. Theoretically, only amino acids produce colour with the ninhydrin reagent.

Q34. Solution

Correct Answer: (B)

Any real gas can show ideal gas behaviour at high temperature which means more close to ideal gas behaviour more is temperature.

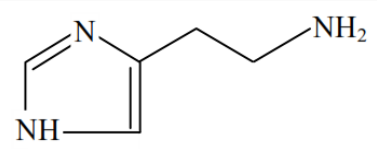
Here the correct order of temperature is $\mathrm{T_1} > \mathrm{T_2} > \mathrm{T_3} > \mathrm{T_4}$.

Hint; Real gas approaches ideal behaviour with increase in temperature.

Q35. Solution

Correct Answer: (C)

The structure of Histamine is



Molecular formula $= C_5H_9N_3$

Molecular mass $= 111$

% of N $= \frac{w}{M} \times 100$

% of N $= \frac{42}{111} \times 100 = 37.84\%$

Q36. Solution

Correct Answer: (A)

$\Delta S = S_{xy_3} - \frac{1}{2}S_{x_2} - \frac{3}{2}S_{y_2}$

$\Delta S = 50 - \frac{1}{2} \times 60 - \frac{3}{2} \times 40$

$= -40 \text{ J K}^{-1}\text{mol}^{-1}$

At equilibrium $\Delta G = 0$

$\Delta G = \Delta H - T\Delta S$

$0 = -30 - \left(-40 \times 10^{-3} \times T\right)$

$T = 750K$

Q37. Solution

Correct Answer: (B)

$$Ph - NO_2 \xrightarrow{Sn/HCl} Ph - NH_2 \xrightarrow{NaNO_2/HCl}$$

$$Ph - N = N - Cl \xrightarrow{CuBr/HBr} Ph - Br$$

Q38. Solution

Correct Answer: (A)

$\therefore PV = nRT$

$1 \times V = \frac{1.415 \times 10^{22}}{6.023 \times 10^{23}} \times 0.0821 \times 273$

$\therefore V = 0.526 \text{ L}$

Q39. Solution

Correct Answer: (B)

For H atom & H like species

The electronic energy in the nth orbit is

$E_n = -13.6\frac{z^2}{n^2}$ eV

$(E_n)_{Li^{2+}} = \frac{-13.6\times 9}{n^2}$ eV$= \frac{-122.4\text{ eV}}{n^2}$

If n = 2

$(E_2)_{Li^{2+}} = \frac{-122.4}{2^2} = -30.6$ eV

Q40. Solution

Correct Answer: (B)

$\Delta n_g = n_p - n_r$ $\begin{cases} n_p = \text{number of moles of products (gaseous)} \\ n_r = \text{number of moles of reactants (gaseous)} \end{cases}$

$\Delta n_g = 2 - 4$

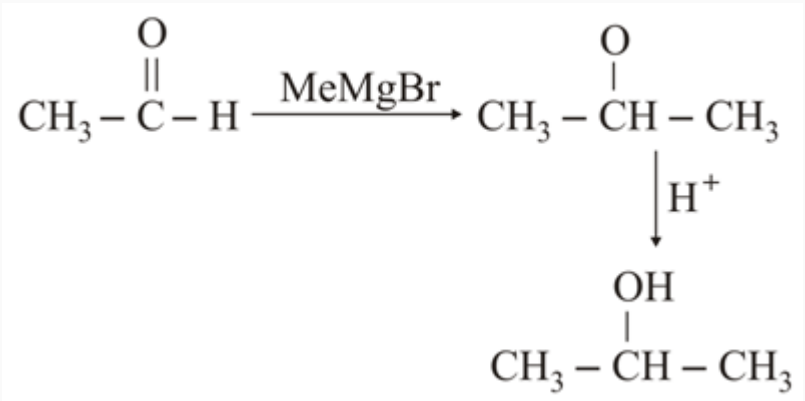
$= -2$

$K_C = \frac{K_P}{(RT)^{\Delta ng}}$

$Kc = \frac{1.44\times 10^{-5}}{(0.082\times 773)^{-2}}$ (T in K and R in L atm mole^{-1} K^{-1}).

Q41. Solution

Correct Answer: (B)



Q42. Solution

Correct Answer: (D)

Ellingham diagrams are a particular graphical form of the principle that the thermodynamic feasibility of a reaction depends on the sign of ΔG, the Gibbs free energy change, which is equal to $\Delta H - T\Delta S$, where ΔH is the enthalpy change and ΔS is the entropy change. Hence, element below in Ellingham diagram can reduce oxide of element above it.

C can reduce FeO at 600 ºC.

Q43. Solution

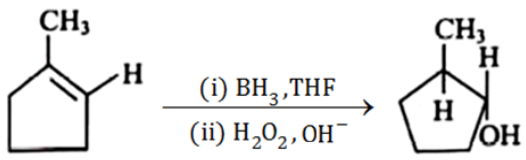
Correct Answer: (D)

O_2 has bond order $= 2$ while O_2^+ has bond order 2.5 .
According to MOT, $N_2^{\oplus}$, paramagnetic and O_2^+ is also paramagnetic

Q44. Solution

Correct Answer: (A)

This reaction occurs according to Antimarkonikov rule and addition takes place via syn addition.



Q45. Solution

Correct Answer: (D)

From Rault's law for non-volatile solute, we know that $\frac{p^\circ - p_s}{p^\circ} = \frac{n_2}{n_1+n_2}$ For dilute solution, relative lowering of

$$n_2 = \frac{18}{180} = 0.1$$

vapour pressure, $n_1 = \frac{90}{18} = 5$

$$\frac{p^\circ - p_s}{p^\circ} = \frac{0.1}{5} = 0.02$$

Q46. Solution

Correct Answer: (D)

(i) $Cr_2O_3 + 2Al(\text{R. A.}) \xrightarrow{\Delta} Al_2O_3 + 2Cr; \Delta H = -\text{ve}$
(ii) Mg is extracted by electrolysis of fused $MgCl_2$ and NaCl
(iii) $PbO + C \rightarrow Pb + CO$
(iv) Red Bauxite is purified by Baeyer's process
Hence (ii) and (iv) statement are false here while (i) and (iii) are true.

Q47. Solution

Correct Answer: (C)

Ni in $[Ni(Co)_4]$ is in 0 oxidation state and Co is a strong field ligand. Since there are no unpaired electrons, the complex is diamagnetic.

Q48. Solution

Correct Answer: (D)

In $CH_3 - \overset{+}{C}H - OCH_3$, the oxygen atom of the methoxy group has a lone pair of electrons which is in conjugation with the positively charged carbon. Due to this, the electrons are delocalised over the carbocation making it highly stable.

In $CH_3 - \overset{+}{C}H - CH_3$, two alkyl groups are bonded to a positively charged carbon. Alkyl groups show $+I$ effect, therefore, increases the electron density on the positively charged carbon, thereby stabilising it. But this stabilising effect is less than that of delocalisation.

In $CH_3 - \overset{+}{C}H - COCH_3$, the $C = O$ group of ketone is in conjugation with the positively charged carbon, and due to high electronegativity of oxygen, the shared pair of electrons in $C = O$ bond shifts on the oxygen atom. As a result, the carbocation becomes more electron deficient and is destabilised.

Hence, the order of stability is: $II > I > III$.

Q49. Solution

Correct Answer: (C)

Chromium has atomic number of 24 , its electronic configuration is $1s^2 2s^2 2p^6 3s^2 3d^5 4s^1$

Q50. Solution

Correct Answer: (D)

Artificial sweeteners are used to reduce calorie intake, and saccharin (ortho-sulphobenzimide) is first artificial sweetener which is 550 time more sweeter than sucrose.

Q51. Solution

Correct Answer: (A)

$pH = pk_a + \log\left[\frac{\text{Salt}}{\text{Acid}}\right]$
$\Rightarrow 6 = 5 + \log \frac{\text{Salt}}{\text{Acid}}$
$\Rightarrow 1 = \log \frac{\text{Salt}}{\text{Acid}}$
$\Rightarrow \log 10 = \log \frac{\text{Salt}}{\text{Acid}}$
$\frac{\text{Salt}}{\text{acid}} = \frac{10}{1}$

Q52. Solution

Correct Answer: (B)

AgBr show both Frenkel and Schottky defect. KBr and CsCl show Schottky defect while ZnS shows Frenkel defect.

Highly ionic solids with more coordination number show Schottky defect while Less ionic solids with low coordination number show Frenkel defect.

Q53. Solution

Correct Answer: (A)

$(NH_4)_2SO_4 \xrightarrow{\Delta} 2NH_3(g)+H_2SO_4$

$Ba(N_3)_2(s) \xrightarrow{\Delta} Ba + 3N_2(g)$

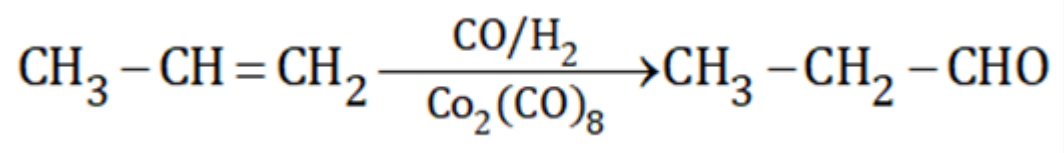
$(NH_4)_2Cr_2O_7(s) \rightarrow N_2(g) + Cr_2O_3(s) + 4H_2O$

$NH_4NO_2 \xrightarrow{\Delta} N_2(g) + 2H_2O$

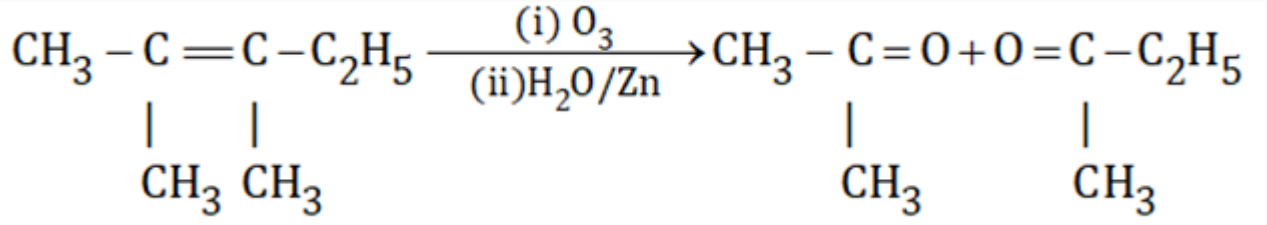
Q54. Solution

Correct Answer: (B)

Here reaction in option B gives aldehyde



All other reactions give Ketone here for e.g.



Q55. Solution

Correct Answer: (C)

Here only Ti^{3+} has one unpaired electron so it gives colour in aqueous solution due to d-d e^- transition. Rest ions are colourless as they don't any un-paired electron so no d-d electronic transition.

Q56. Solution

Correct Answer: (B)

Liquid solution

$P_{gas} = K_H \times X_{gas} as K_H \propto \frac{1}{X_{gas}}$

So, more is K_H less is solubility. Solubility of gases is less at higher temperature. So more is the temperature more is the K_H as $K_H \propto \frac{1}{\text{solubility}} \propto$ temperature.

Q57. Solution

Correct Answer: (C)

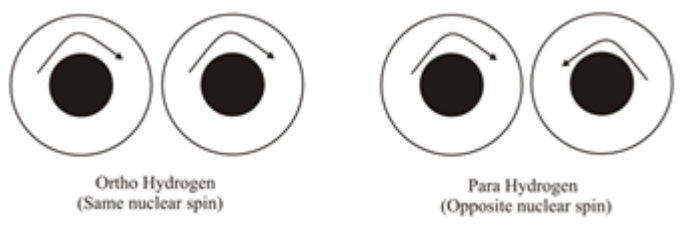
Br - Br is a non - polar whereas I - Cl is a polar bond because of electronegativity difference between I and Cl. Polarity in the bond increases the bond - energy and thus the boiling point.

$Br_2\ \mu = 0\ ;\ ICl\ \mu \neq 0$

Strong intermolecular force of attractions amongst ICl molecules

Q58. Solution

Correct Answer: (B)



These are nuclear isotopes and have distinct physical properties but similar chemical properties. This is because both isotopes have similar electronic arrangement but different spin of nuclei.

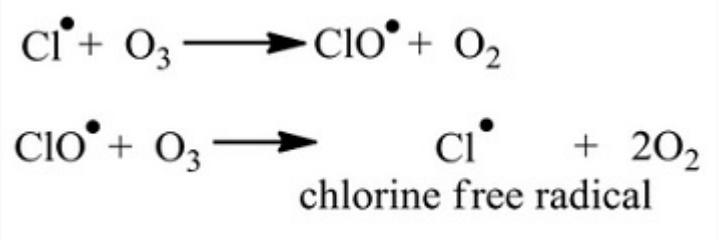
Q59. Solution

Correct Answer: (D)

Freons or chlorofluoro carbons are responsible for depletion of the ozone layer in the upper strata of the atmosphere. They are used as propellants, aerosol spray caps, refrigerants, fire fighting reagents etc. They are stable and chemically inert compounds. They absorb UV-radiation and break down liberating free atomic chlorine which causes decomposition of ozone through free radical reaction. This results in the depletion of the ozone layer.

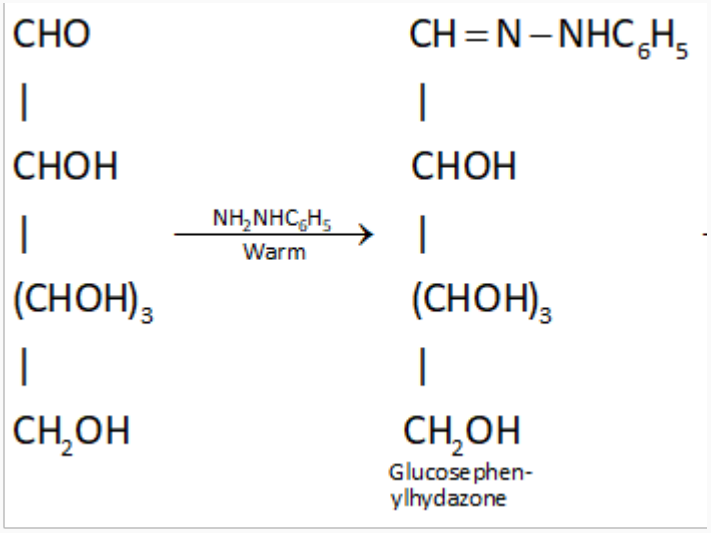
Freons are mainly freon-1

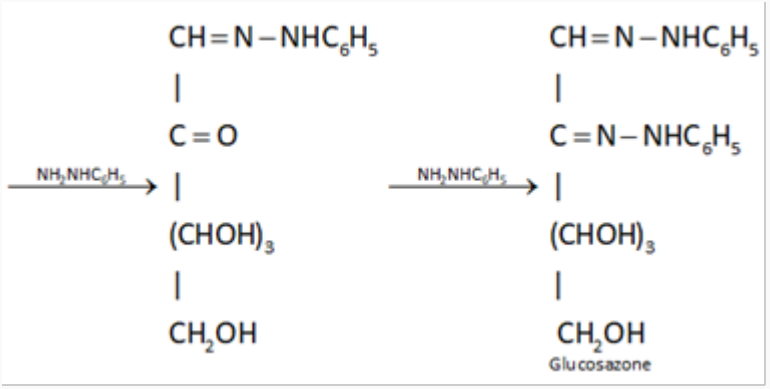
($CFCL_3$) and freon − 12 (CF_2Cl_2). They form free radical of chlorine in the presence of UV- radiation. Such free radical decomposes O_3 as follows



Q60. Solution

Correct Answer: (B)





Q61. Solution

Correct Answer: (A)

If the seventh day of a month is three days earlier than Friday.

According to the question, we have to find out the day on the nineteenth day of the month.

By the above statement, it is mentioned that the seventh day of the month is three days earlier than Friday,

Thus, Friday - 3 = Tuesday.

So, according to the question, the nineteenth day will be Sunday as per the calculation given below.

Tuesday $+ 19 = 2 + 19$ (Code of Tuesday is 2)

$= \frac{21}{7}$

= 0 odd day

The code of 0 is Sunday.

Therefore, the nineteenth day, it will be Sunday.

So, the correct answer is Sunday.

Hence, this is the correct answer.

Q62. Solution

Correct Answer: (A)

According to the question,

Given information is, $17,\ 18,\ 37,\ 112,\ 449,\ ?$

Now we find the next term of the given series,

So, now we see the pattern used in this, series is, $\times 1 + 1,\ \times 2 + 1,\ \times 3 + 1,\ \times 4 + 1,\ \times 5 + 1$

/

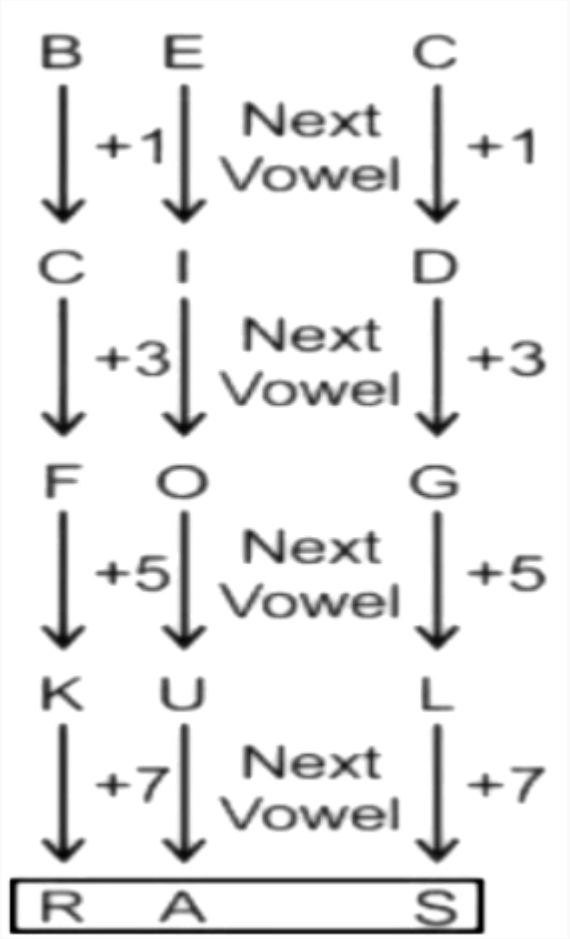
$18 = 17 \times 1 + 1\ 37 = 18 \times 2 + 1\ 112 = 37 \times 3 + 1\ 449 = 112 \times 4 + 1\ ? = 449 \times 5 + 1 = 224$

So, the next term of this series is 2246.

Q63. Solution

Correct Answer: (A)

Vowel changes to next vowel in cyclic way (i.e. $A \rightarrow E \rightarrow I \rightarrow O \rightarrow U$).



Hence, the correct answer is "RAS".

Q64. Solution

Correct Answer: (C)

Chemistry is conducted exactly after two tests are held.

Day 1	
Day 2	
Day 3	Chemistry
Day 4	

The Physics test is held before the test which is conducted after Biology. This means that Physics and Biology are not held on Day 4. Therefore.

Mathematics is held on day 4.

Day 1	
Day 2	
Day 3	Chemistry
Day 4	Mathematics

Hence, option 3 is the correct answer.

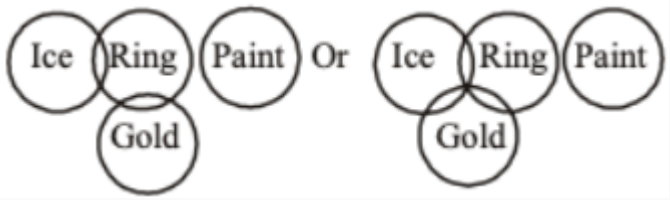
Q65. Solution

Correct Answer: (A)

Given statements: $K = P < C; P > Q; Q > L$ On combining: $L < Q < K = P < C$ Conclusions: I. $Q < C \rightarrow$ True (as $L < Q < K = P < C$ gives $Q < C$). II. $K > L \rightarrow$ True (as $L < Q < K = P < C$ gives $K > L$). Hence, the correct answer is "Both conclusions I and II are true".

Q66. Solution

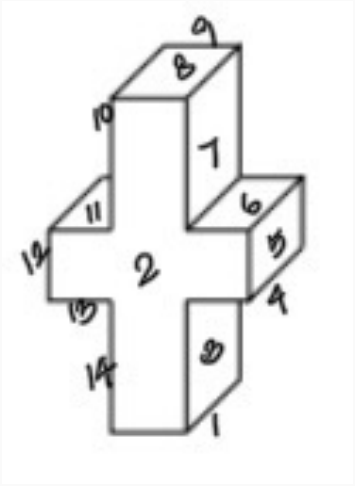
Correct Answer: (D)

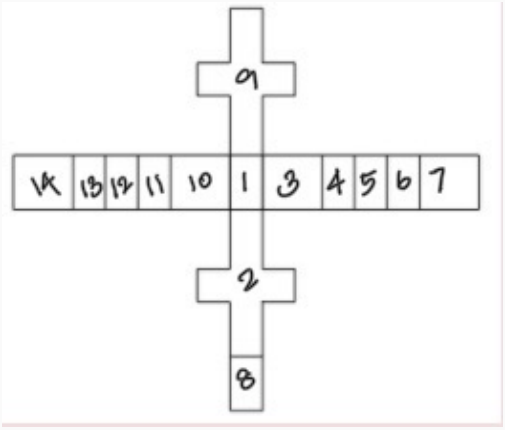


or

Q67. Solution

Correct Answer: (D)

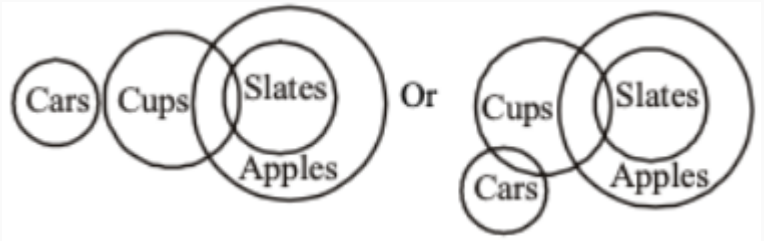




As you match the numbers in the given figures, faces opening out can be understood

Q68. Solution

Correct Answer: (D)

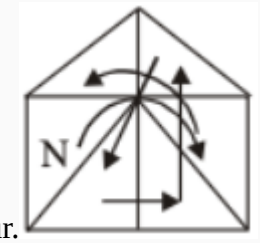


Either conclusion II or IV and III follows.

Q69. Solution

Correct Answer: (B)

(2) In first figure from second, the designs inside the pentagon change their places as follows : The design ' ↑ ' rotates 90° in clockwise direction and a new design comes at the place on N and design ' ● ' or ' ■ ' comes without colour.



Q70. Solution
Correct Answer: (C)

Given:

BELIEF is Coded as AFKKDH.
We can easily get that,

BELIEF is coded by subtracting '1' from its odd positioned letter and by adding '$1,\ 2,\ 2$' to the corresponding even positioned letters.

i.e.,

B $\overset{-1}{\rightarrow}$ A

E $\overset{+1}{\rightarrow}$ F

L $\overset{-1}{\rightarrow}$ K

I $\overset{+2}{\rightarrow}$ K

E $\overset{-1}{\rightarrow}$ D

F $\overset{+2}{\rightarrow}$ H

Similarly,

S $\overset{-1}{\rightarrow}$ R

E $\overset{+1}{\rightarrow}$ F

L $\overset{-1}{\rightarrow}$ K

D $\overset{+2}{\rightarrow}$ F

O $\overset{-1}{\rightarrow}$ N

M $\overset{+2}{\rightarrow}$ O

Hence, SELDOM is coded as RFKFNO.

Q71. Solution
Correct Answer: (C)

Inserting the letters of choice (3), in place of the blanks, we get a series which is $a\ \underline{a}\ b\ \underline{b}\ \underline{c}\ \underline{c}\ a\ a\ \underline{b}\ b\ c\ \underline{c}$. Hence, the missing letters in the sequence are abccbc.

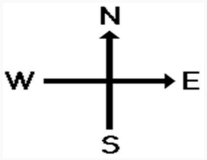
Q72. Solution

Correct Answer: (A)

In the given letter sequence $\underset{}{\text{spruatpghjtkp}}\underset{1}{\underline{\text{ser}}}\underset{}{\text{pl}}\underset{2}{\underline{\text{mij}}}\underset{}{\text{km}}\underset{3}{\underline{\text{por}}}\underset{}{\text{kg}}\underset{4}{\underline{\text{luwra}}}\underset{}{\text{b}}\underset{5}{\underline{\text{l}}}\underset{}{\text{t}}\underset{6}{\underline{\text{up}}}\underset{}{\text{qm}}$ There are six instances where a vowel is immediately preceded and is followed by a consonant.

Q73. Solution

Correct Answer: (D)

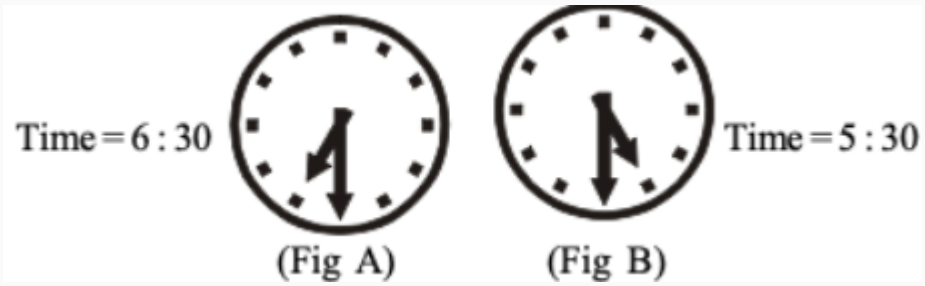


From the given information, it is given that Qadir travels towards the East and Mona travels towards the North. Now, Tina travels towards the right of Qadir means that Tina travels towards the South. Therefore, Sanjay travels towards the North because Sanjay and Tina travel in the opposite direction.

Hence, it is definitely true that Mona and Sanjay travel in the same direction and it is in the North direction.

Q74. Solution

Correct Answer: (B)

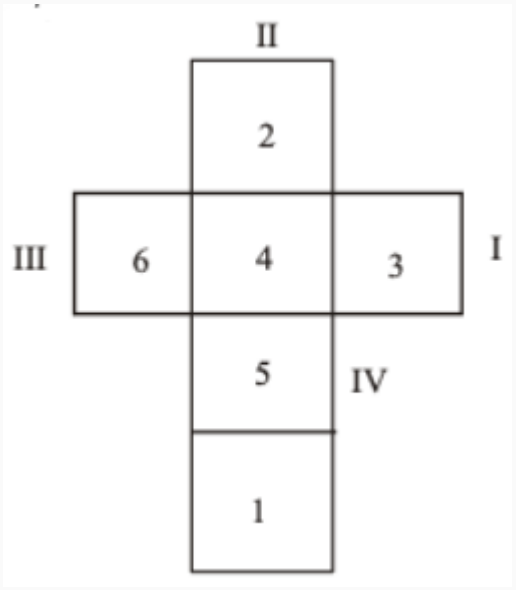


Clearly, fig (A) shows the time $(6:30)$ in the clock as it appears in a mirror. Then its mirror-image i.e. Fig (B) shows the actual time in the clock i.e. $5:30$. You can solve it quickly if you remember that the sum of actual time and image time is always 12 hours.

Q75. Solution

Correct Answer: (C)

The above question, where only two positions of a dice are given, can easily be solved with the following method.



Step I : The dice, when unfolded, will appear as shown in the figure given on the right side. Step II : Write the common number to both the dice in the middle block. Since common number is 4 , hence number 4 will appear in the central block. Step III : Consider the figure (i) and write the first number in the anti-clockwise direction of number 4, (common number) in block I and second number in block II. Therefore, numbers 3 and 2 being the first and second number to 4 in anticlockwise directions respectively, will appear in block I and II respectively.

Q76. Solution

Correct Answer: (C)

Clearly, the answer is (3). In all other pairs, second is the noise produced by the first. The group of letters can be in natural or in reverse order, jumping letters, repetitive letters, even combination of capital letters, small letters, vowels or consonants.

Q77. Solution

Correct Answer: (C)

The given numbers are in binary system, converting these into the decimal system we get, 1011

$$\Rightarrow 1 \times 2^3 + 0 \times 2^2 + 1 \times 2^1 + 1 \times 2^0$$

$$= 8 + 2 + 1 = 11$$

$$1101 \Rightarrow 1 \times 2^3 + 1 \times 2^2 + 0 \times 2^1 + 1 \times 2^0$$

$$= +4 + 1 = 13$$

$$1111 \Rightarrow 1 \times 2^3 + 1 \times 2^2 + 1 \times 2^1 + 1 \times 2^0$$

$$= +4 + 2 + 1 = 15$$

All the given numbers except 15 are prime numbers.

$$0001 \Rightarrow = 1 \times 2^4 + 0 \times 2^3 + 0 \times 2^2 + 0 \times 2^1 + 1 \times 2^0$$

$$= 16 + 1 = 17$$

$$111 = 1 \times 2^2 + 1 \times 2^1 + 1 \times 2^6$$

$$= 4 + 2 + 1 = 7$$

Q78. Solution
Correct Answer: (A)

There are five members Ram, Shyam, Ritu, Neha and Ramesh. Shyam is the son of Ramesh, but Ramesh is not the mother of Shyam.

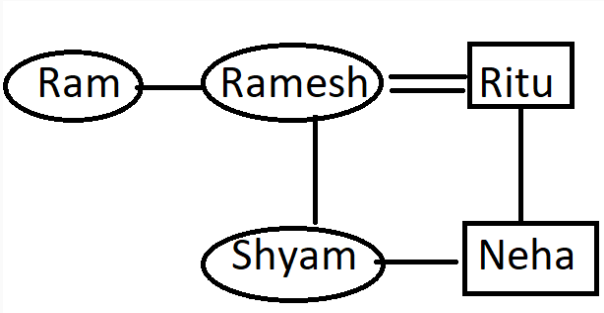
Ramesh is the father of Shyam.

Ritu and Ramesh are a married couple. Ritu is the mother of Shyam.

Ram is the brother of Ramesh and Ram is the Uncle of Shyam.

Neha is the daughter of Ritu. So, Neha and Shyam are siblings.

From the above information, we can make a family tree diagram as follows:



Hence, Shyam is the son of Ritu.

Q79. Solution
Correct Answer: (D)

After observing all the conditions we get that,

A-10, B-10, C-10, D-10, E-10, F-10

F borrows 2 Cards from A, and gives away 5 to C

A-8, B-10, C-15, D-10, E-10, F-7

C gives 3 to B

A-8, B-13, C-12, D-10, E-10, F-7

B gives 6 to D who passes on 1 to E

A-8, B-7, C-12, D-15, E-11, F-7

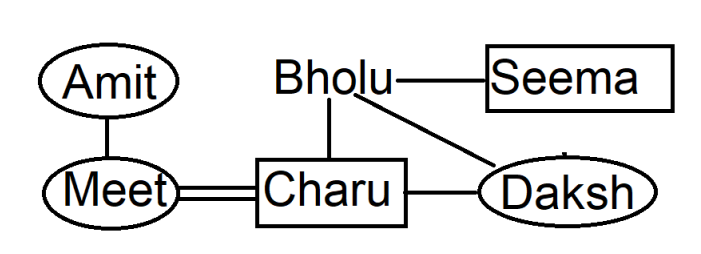
The number of cards with D is 15.

Hence option (D) is correct.

Q80. Solution
Correct Answer: (C)

In the following diagram, the circle represents the male and the square represents the female. Dash (−) represents siblings. The vertical lines represent the relation between parents and children and the horizontal lines represent the relation between husband and wife.

By applying all the conditions, the relationship between all of them are as follows:



From the above diagram it is clear that Meet is son of Amit. Meet is married to Charu who is the daughter of Bholu. Daksh is the son of Bholu. Seema is sister of Bholu. So, Daksh is Brother-in-law of Meet.

Hence, 'Brother-in-law' is the correct answer.

Q81. Solution
Correct Answer: (C)

Option (a) is not the main idea of the passage but an introduction.
Option (b) is an incomplete summary.
Option (d) does not touch upon the point of ethical conduct.
Hence, 'Ethical conduct of business also includes the treatment of their staff'. The Assam Company's green frog seal was revoked recently due to negligence in observing the safety of employees.' best summarises the passage.

Q82. Solution
Correct Answer: (D)

In the given question, the given statement is 'Throughout the first decade of the 21st century, net increases in Indian direct investments in the Far East (funds outflows) exceeded net new Far East direct investment in India.'

It is required to answer Each of the following, if true, could help to account for this trend except:

To find the required solution, read the statement carefully. Identify the reason and find the conclusions that can be made from this.

The statement is in present tense and the answer is 'Corporate liquidity was lower in India than in the Far East.'

Q83. Solution
Correct Answer: (C)

In the above-given sentence, a person's most striking (remarkable) quality is being talked about. The characteristics of a person or thing are the qualities or features that belong to them and make them recognisable. Hence, option C is the correct answer.

Q84. Solution
Correct Answer: (C)

BDCA is the logical sequence as in B analysts have analysed the appeal of the new machines in the potential market. The promise of lower maintenance cost in D naturally follows B which is followed by C and then by A which is an extension of sentence C as individual buyers in America pickup Desktop computers for less than 2000 dollars spend thousands more on hardware upgrades and software overhauls.

Q85. Solution
Correct Answer: (C)

Option (3) is the most appropriate answer to fill the sentence B, because sentence A is talking about warm & sticky weather so the prediction of weather is forcast for tomorrow on behalf of today's weather.

Q86. Solution
Correct Answer: (A)

'Prophylactic' is a term used for a medicine or a course of action to prevent disease/done or used in order to prevent disease.

The adjective 'preventive': a medicine or other treatment designed to prevent disease.

Superficial: appearing to be true or real.

Depend: be able to trust or rely on.

Obvious: easily understood; clear.

Therefore, this option is correct.

Q87. Solution
Correct Answer: (A)

'Gesticulation' means to emphasize something with the movement of hands or to express something in a dramatic way. Among all the options, 'dynamics' is the synonym of 'gesticulation'. It can be understood with the sentence:

His gesticulations got bigger and wilder while explaining the matter.

Whereas, 'notion' refers to have a belief over something. Respite refers to a pause before something unpleasant happening. Jumble refers to a state of confusion for something.

Q88. Solution
Correct Answer: (C)

'Prohibition' means the act of not allowing something to be used or done. 'Consent' means to agree to do or allow something which is the correct answer because 'Prohibition' is to not allow and 'consent' is to agree. Therefore, they are antonyms.

Meanings of the other alternatives:

'Vindication' means to show that (someone) should not be blamed for a crime, mistake, etc. 'Vigour' means strength, energy, or determination. The other options are eliminated because they are not related to the word.

Therefore, the correct answer is consent.

Q89. Solution
Correct Answer: (C)

Among the options, the most appropriate adverb is 'beautifully' with 'decoration.' The adverb 'beautifully' means 'in a way that pleases the senses or mind aesthetically.'

Enigmatically means difficult to be solved. Greatly means to a large extent. Scarcely means barely. These options do not fit the context. Hence, 'beautifully' is the correct answer.

Q90. Solution
Correct Answer: (B)

'Associate with others' is the keyword here. It means man prefers to be in the company of others.

'Sentimental' means emotional.
'Gregarious' means sociable and correctly fits the blank.
'Selfish' is incorrect in the given context.
'Perverse' means wicked or corrupt.
Therefore, the correct sentence will be - Man is essentially a gregarious animal and tends to associate with others.

Q91. Solution

Correct Answer: (D)

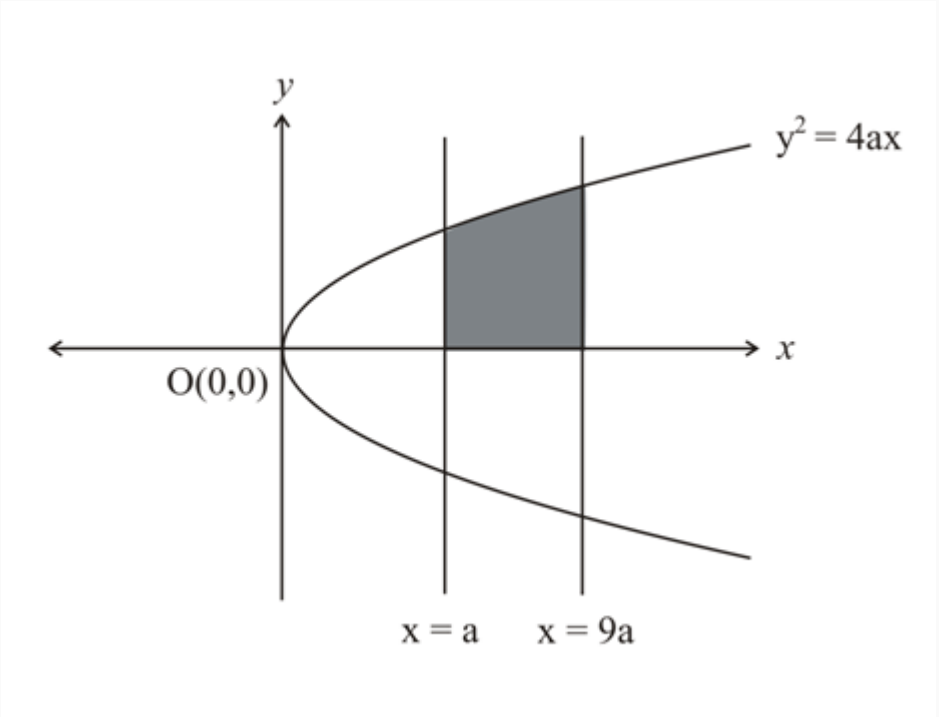
$x = at^2,\ y = 2at$

$x - \text{axis} \qquad 1 \le t \le 3$

$\{t = 1;\ \ x = a;\ \ y = 2at = 3;\ x = 9a;\ y = 6a\}$

$x = at^2;\ t = \left(\frac{y}{2a}\right)$

$\Rightarrow y^2 = 4ax$



Required area

$= \int_a^{9a} \sqrt{4ax}dx$

$= 2\sqrt{a}\frac{x^{3/2}}{3/2}\Big|_a^{9a}$

$= \frac{4}{3}\sqrt{a}\left\{(9a)^{3/2} - (a)^{3/2}\right\}$

$= \frac{4}{3}a^2(26)$

$= \frac{104}{3}a^2\ \text{sq. units}$

Q92. Solution

Correct Answer: (B)

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

$=\left(x-\frac{1}{x}\right)\left(x^2-\frac{1}{x^2}\right)^3$

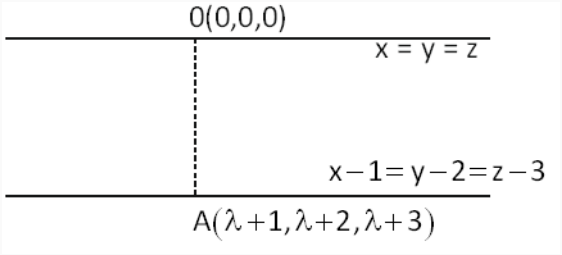
$=\left(x-\frac{1}{x}\right)\left(x^6-3x^2+3\frac{1}{x^2}-\frac{1}{x^6}\right)$

There is no term containing $\frac{1}{x}$ and x in the second bracket.

So, the expansion will not contain any term independent of x .

Q93. Solution

Correct Answer: (B)



From diagram,
OA is perpendicular to line $L_2 = 0$
$\Rightarrow 1(\lambda+1)+1(\lambda+2)+1(\lambda+3)=0 \Rightarrow \lambda=-2$
So, coordinates of point A are $(-1,0,1)$
$\overrightarrow{OA}=-\hat{i}+\hat{k}$
$\because$ A normal vector to required plane is $\overrightarrow{OA}$
Equation of the required plane is $-1(x-0)+1(z-0)=0$
$\Rightarrow -x+z=0$
$\Rightarrow 10x-10z=0$
$b=0, c=-10, d=0$

Q94. Solution
Correct Answer: (B)

Given,

$\sin^{-1}x + \sin^{-1}y = \frac{2\pi}{3} \quad \ldots (i)$
and $\cos^{-1}x - \cos^{-1}y = \frac{\pi}{3} \quad \ldots (ii)$

We know that $\sin^{-1}x + \cos^{-1}x = \frac{\pi}{2}$

Using the above concept, we can write
$\Rightarrow \left(\frac{\pi}{2} - \sin^{-1}x\right) - \left(\frac{\pi}{2} - \sin^{-1}y\right) = \frac{\pi}{3}$
$\Rightarrow \quad -\sin^{-1}x + \sin^{-1}y = \frac{\pi}{3} \quad \ldots (iii)$
On adding equation (i) and (iii), we get
$\sin^{-1}y = \frac{\pi}{2} \Rightarrow y = 1$
On subtracting equation (i) from equation (iii), we get
$\sin^{-1}x = \frac{\pi}{6} \Rightarrow x = \frac{1}{2}$
$\therefore \quad (x, y) = \left(\frac{1}{2}, 1\right)$

Q95. Solution
Correct Answer: (B)

Cyclic determinant $\begin{vmatrix} a & b & c \\ b & c & a \\ c & a & b \end{vmatrix} = 0 \Rightarrow a + b + c = 0 \text{ or } a = b = c$

$\Rightarrow x^2 + 1 + 2x^3 + x = 0$ or $x^2 + 1 = 2x^3 = x$ (reject)

$\Rightarrow 2x^3 + x^2 + x + 1 = 0$

$f(x) = 2x^3 + x^2 + x + 1$

$f'(x) = 6x^2 + 2x + 1 > 0, \forall x \in \mathbb{R}$, as $D < 0$ so $f(x)$ is strictly increasing.

$\therefore$ $f(x) = 0$ has exactly one real root as $f(x)$ is odd degree polynomial.

Q96. Solution

Correct Answer: (C)

$$A = \begin{bmatrix} 1 & 2 & 3 \\ 1 & 3 & 5 \\ 2 & 1 & 6 \end{bmatrix}$$

$$|A| = 1(18-5) - 2\langle(6-10) + 3(1-6)$$
$$= 13 + 8 - 15 = 6$$

We have, $\text{Adj } A = \begin{bmatrix} 13 & -9 & 1 \\ 4 & 0 & -2 \\ -5 & 3 & 1 \end{bmatrix}$ Now, Adj $\langle$ Adj $A) = |A|A$

$$A^{-1} = \frac{\text{Adj } A}{|A|} = \frac{1}{6}\begin{bmatrix} 13 & -9 & 1 \\ 4 & 0 & -2 \\ -5 & 3 & 1 \end{bmatrix}$$

$\text{Adj}(\text{Adj } A) = 6 \text{ A } \langle\text{Adj}\langle \text{ Adj } A)\rangle^{-1} = \langle 6A)^{-1} = \frac{1}{36}\begin{bmatrix} 13 & -9 & 1 \\ 4 & 0 & -2 \\ -5 & 3 & 1 \end{bmatrix}$

$\therefore (\text{Adj}(\text{Adj } A)\rangle^{-1} = \frac{1}{36}\begin{bmatrix} 13 & -9 & 1 \\ 4 & 0 & -2 \\ -5 & 3 & 1 \end{bmatrix}$

Q97. Solution

Correct Answer: (D)

Given that $(A-3I)(A-5I) = 0$

$\therefore \quad A^2 - 3A - 5A + 15I = 0$

$\therefore \quad A^2 - 8A + 15I = 0$

$\therefore \quad A^2 + 15I = 8A$

Multiplying entire equation by $\frac{A^{-1}}{2}$, we get $\frac{1}{2}A + \frac{15}{2}A^{-1} = 4I$

Comparing with $\alpha\text{A} + \beta\text{A}^{-1} = 4\text{I}$, we get $\alpha = \frac{1}{2}$ and $\beta = \frac{15}{2}$

$$\therefore \quad \alpha + \beta = \frac{1}{2} + \frac{15}{2} = 8$$

Q98. Solution

Correct Answer: (D)

$\int \text{e}^{-x}(\sec x - \sec x \ \tan x)\text{d}x$

put $t = -x$

$= -\int \text{e}^{t}\left(\sec t + \sec t \ \tan t\right) \text{dt}$

$= -\text{e}^{-x} \sec x + c$

Q99. Solution

Correct Answer: (B)

Coterminus edges of a parallelopiped are $4\hat{\mathbf{i}}+5\hat{\mathbf{j}}+\hat{\mathbf{k}}$, $-\hat{\mathbf{j}}+\hat{\mathbf{k}}$ and $3\hat{\mathbf{i}}+9\hat{\mathbf{j}}+p\hat{\mathbf{k}}$ Volume of parallelopiped $=34$

$$\Rightarrow \begin{vmatrix} 4 & 5 & 1 \\ 0 & -1 & 1 \\ 3 & 9 & p \end{vmatrix} = 34 \Rightarrow 4\begin{vmatrix} -1 & 1 \\ 9 & p \end{vmatrix} - 5\begin{vmatrix} 0 & 1 \\ 3 & p \end{vmatrix} + 1\begin{vmatrix} 0 & -1 \\ 3 & 9 \end{vmatrix} = 34$$

$$\Rightarrow \quad 4(-p-9)-5(-3)+1(3)=34 \Rightarrow \quad -4p-36+15+3=34 \Rightarrow \quad 4p=-36+18-34$$

$$\Rightarrow \quad p=-\tfrac{52}{4}=-13$$

Q100. Solution

Correct Answer: (C)

$\because$ $\left(3,-\frac{9}{2}\right)$ lies on $\frac{x^2}{a^2}+\frac{y^2}{b^2}=1 \Rightarrow \frac{9}{a^2}+\frac{81}{4b^2}=1$ .....(1)

Equation of the tangent at $\left(3,-\frac{9}{2}\right)$ is $\frac{3x}{a^2}+\frac{-\frac{9}{2}y}{b^2}=1$

& given equation of the tangent is:

$x-2y=12 \Rightarrow \frac{x}{12}+\frac{-y}{6}=1$

On comparing these equations:

$\frac{a^2}{3}=12 \Rightarrow a^2=36 \Rightarrow a=6$

$\frac{2b^2}{9}=6 \Rightarrow b^2=27 \Rightarrow b=3\sqrt{3}$

Therefore, the length of latus rectum

$=\frac{2b^2}{a}=\frac{2\times 27}{6}=9$

Q101. Solution

Correct Answer: (D)

$N_1+N_2+N_3+N_4+N_5=$ Total ways – {when no odd}

Total ways $={}^9C_5$

Number of ways when no odd number is selected is 0 ($\because$ only available even are $2,\ 4,\ 6,\ 8$)

$\therefore\ {}^9C_5-0=126$

Q102. Solution

Correct Answer: (C)

Using Newton-Leibnitz rule i.e., differentiation under integral sign. The rule states that :

Let $h(x) = \int_{\varphi(x)}^{\psi(x)} f(t)dt$, then

$h\prime(x) = f(\psi(x))\psi\prime(x) - f(\phi(x))\phi\prime(x)$.

Now, the given question of Limit is of $\frac{0}{0}$ form. So applying L'Hospital Rule and Newton-Leibnitz we get,

$\lim\limits_{x\to 0}\left(\frac{\int_0^{x^2}\sec^2 t\ dt}{x\sin x}\right) = \lim\limits_{x\to 0}\frac{\sec^2 x^2.2x}{\sin x + x\cos x}$

$= \lim\limits_{x\to 0}\ \frac{2x.\sec^2 x^2}{x\left(\frac{\sin x}{x}+\cos x\right)}$ cancelling x we get,

$= \frac{2\times 1}{1+1} = 1\ \left[\because\ \lim\limits_{x\to 0}\frac{\sin x}{x} = 1\right]$

& $\cos 0 = sec0 = 1$

Hence option 3 is correct..

Q103. Solution

Correct Answer: (D)

The system of equation will have a non-trivial solution of and only if

$\Delta = 0$ where

$$\Delta = \begin{matrix} \lambda & 1 & 1 \\ -1 & \lambda & 1 \\ -1 & -1 & \lambda \end{matrix} = \lambda^3 + 3\lambda = \lambda\left(\lambda^2+1\right)$$

Thus, $\Delta = 0,\ \lambda \in R\ \Rightarrow \lambda = 0$

Q104. Solution

Correct Answer: (C)

Let $h(x) = |x|$, then
$g(x) = |f(x)| = h\ f(x)$
Since, composition of two continuous functions is continuous, is g continuous if f is continuous.
Now, $f(x)$ is an onto function. Since, co-domain of x is R and range of x is R. But $g(x)$ is into function. Since, range of $g(x)$ is $[0,\ \infty]$ but co-domain is given R.
Let $f(x) = x => g(x) = |x|$ Now, $f(x)$ is one-one function but $g(x)$ is many-one function.
Let $f(x) = x => g-(x) = |x|$. Now, $f(x)$ is differentiable for all $x \in R$ but $g(x) = |x|$ is not differentiable at $x = 0$.

Q105. Solution
Correct Answer: (B)

$\lambda = \sin^2(5^\circ) + \sin^2(10^\circ) + \ \ldots\ldots\ldots + \sin^2(85^\circ) = \left(\sin^2(5^\circ) + \sin^2 85^\circ\right) + \left(\sin^2(10^\circ) + \sin^2(80^\circ)\right) + \ \ldots\ldots$

$= \left(\sin^2(5^\circ) + \sin^2(90^\circ - 5^\circ)\right) + \left(\sin^2(10^\circ) + \sin^2(90^\circ - 10^\circ)\right) + \ \ldots\ldots\ldots + \left(\sin^2(40^\circ) + \sin^2(90^\circ - 40^\circ)\right) +$

$= \left(\sin^2(5^\circ) + \cos^2 5^\circ\right) + \left(\sin^2(10^\circ) + \cos^2(10^\circ)\right) + \ \ldots\ldots\ldots + \left(\sin^2(40^\circ) + \cos^2(40^\circ)\right) + \sin^2(45^\circ)$

$= 1 + 1 + 1 + 1 + 1 + 1 + 1 + 1 + \frac{1}{2}$
$\lambda = 8 + \frac{1}{2} = \frac{17}{2}$
$2\lambda - 8 = 9$
Number of the positive divisor of 9 are $1,\ 3,\ 9$

total 3 divisiors

Q106. Solution
Correct Answer: (B)

Roots of $x^3 - 9x^2 + ax - 24 = 0$ are in A.P.

$\Rightarrow 3c = 9 \Rightarrow c = 3$

$\Rightarrow a = 2,\ d = 4$

$\Rightarrow 2,\ 3,\ 4$ also roots of equation $5x^4 + px^3 + qx^2 + rx + s = 0$

$\Rightarrow 2,\ b,\ 3,\ 4$ are in $H.P.$

$\Rightarrow b = \frac{12}{5} \Rightarrow \ \frac{P(x)}{Q(x)} \ = \ \frac{5(x-2)(x-3)(x-4)\left(x-\frac{12}{5}\right)}{1\cdot(x-2)(x-3)(x-4)} \ = |(5x - 12)|$

Q107. Solution
Correct Answer: (A)

$l(m, n) = \int_0^1 t^m (1 + t)^n dt$

By using integration by parts

$\Rightarrow l(m, n) = \left[(1 + t)^n \cdot \frac{t^{m+1}}{m+1}\right]_0^1 - \frac{n}{m+1} \int_0^1 (l + t)^{n-1} \cdot t^{m+1} dt$

$\Rightarrow l(m, n) = \frac{2^n}{m+1} - \frac{n}{m+1} I(m + 1,\ n - 1)$

Q108. Solution

Correct Answer: (B)

Given differential equation can be rewritten as,

$\frac{dy}{dx} = \frac{x^3+y^3}{xy^2}$

It is a homogeneous differential equation.

Put $y = vx \Rightarrow \frac{dy}{dx} = v + x\frac{dv}{dx}$

$\therefore\ x\frac{dv}{dx} + v = \frac{x^3+v^3x^3}{x^3v^2}$

$\Rightarrow \frac{xdv}{dx} = \frac{1}{v^2}$

$\Rightarrow v^2dv = \frac{dx}{x}$

On integrating both sides, we get,

$\Rightarrow \frac{v^3}{3} = \log x + \log c$

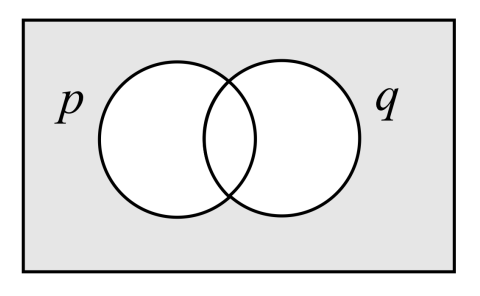
$\Rightarrow \frac{1}{3}\left(\frac{y}{x}\right)^3 = \log x + \log c$

$\Rightarrow y^3 = 3x^3 \log (cx).$

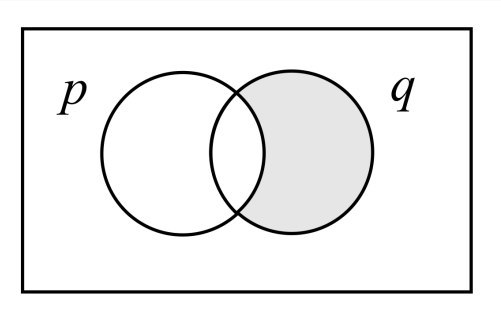
Q109. Solution

Correct Answer: (B)

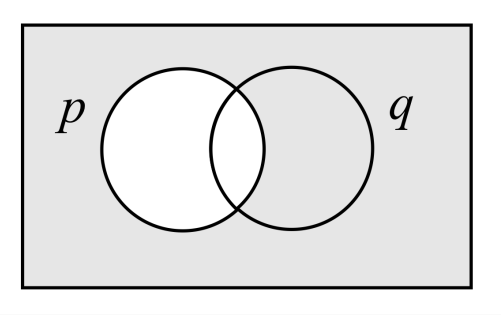
Venn diagram of $\sim(p \vee q)$



Venn diagram of $(\sim p \wedge q)$



Venn diagram of $\sim(p \vee q) \vee (\sim p \wedge q)$



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

Q110. Solution

Correct Answer: (D)

$\lim_{n\to\infty}\left(\frac{(n+1)\ (n+2)\ldots 3n}{n^{2n}}\right)^{\frac{1}{n}}$

Let $y=\left(\frac{(n+1)\,(n+2)\ldots(2n+n))}{n^{2n}}\right)^{\frac{1}{n}}$

$y=\left(\frac{(n+1)}{n}\cdot\frac{(n+2)}{n}\ldots\ldots\frac{(2n+n)}{n}\right)^{\frac{1}{n}}$

$\log y=\frac{1}{n}\left[\log\left(1+\frac{1}{n}\right)+\log\left(1+\frac{2}{n}\right)+\ldots..\log(1+2)\right]$

As $n\to\ \infty$

$\log y=\int_0^2\log(1+x)\,dx$

$=(x\,.\log(1+x))_0^2-\int_0^2\frac{1}{1+x}\,xdx$

$=(x\log(1+x))_0^2-\int_0^2\left(\frac{1+x}{1+x}\right)dx+\int_0^2\frac{1}{1+x}dx$

$(x\log(1+x))_0^2-(x)_0^2+(\log(1+x))_0^2$

$(2\log 3-0)-(2-0)+(\log 3-\log 1)$

$3\log 3-2$

$\log y\ =3\log 3-2$

$y=\frac{e^{\log 27}}{e^2}=\frac{27}{e^2}$

$=\frac{27}{e^2}$

Q111. Solution

Correct Answer: (C)

Here, we are having $x = t^2 + t + 1,\ y = t^2 - t + 1,$

On subtracting y from x, we get

$x - y = t^2 + t + 1 - \left(t^2 - t + 1\right)$

$\Rightarrow x - y = 2t$ or $t = \frac{x-y}{2},$

On putting the value of t, in x, we get

$x = \left(\frac{x-y}{2}\right)^2 + \left(\frac{x-y}{2}\right) + 1,$

On further simplification, we get

$x = \frac{x^2 - 2xy + y^2}{4} + \frac{x-y}{2} + 1,$

$\Rightarrow 4x = x^2 - 2xy + y^2 + 2x - 2y + 4,$

Final equation, we get as $x^2 - 2xy + y^2 - 2x - 2y + 4 = 0,$

On comparing, this with the general equation of second degree, i.e.,
$ax^2 + 2hxy + by^2 + 2gx + 2fy + c = 0,$

we will get $a = 1,\ h = -1,\ b = 1,\ g = -1,\ f = -1,\ c = 4.$

Now, to check for the type of conic, we will check

$\Delta = abc + 2fgh - af^2 - bg^2 - ch^2$ and $h^2 - ab.$

$\Delta = 4 - 2 - 1 - 1 - 4 = -4 \neq 0,$

Now, $h^2 - ab = 1 - 1 = 0.$

As, we are having $\Delta \neq 0$ and $h^2 - ab = 0,$ which is the condition for a parabola.

Q112. Solution

Correct Answer: (A)

Sum of the coefficients in the expansion of
$(x - 2y + 3z)^n$ is $(1 - 2 + 3)^n = 2^n$
(Put $x = y = z = 1$)
$\therefore\ 2^n = 128$
$\Rightarrow\ n = 7$
$\Rightarrow\ (1 + x)^7 = 1 + 7x + 21x^2 + 35x^3 + 35x^4 + 21x^5 + 7x^6 + x^7$
Therefore, the greatest coefficient in the expansion of $(1 + x)^7$ is ${}^7C_3$ or ${}^7C_4$ because both are equal to **35**

Q113. Solution
Correct Answer: (A)

Probability of at least one failure $= 1 - P(\text{no failure}) = 1 - p^5$

Now $1 - p^5 \geq \frac{31}{32}$

$\Rightarrow\ p^5 \leq \frac{1}{32}$

$\Rightarrow\ p \leq \frac{1}{2}$

$\therefore\ p \in \left[0, \frac{1}{2}\right]$

Q114. Solution
Correct Answer: (B)

Four digits number which is

divisible by 7 are $1001, 1008, 1015, \ldots 9996$

Hence, total number of such numbers
$= 1286$

$\left(\frac{N}{2}\right)^{th}$observation

Median $= \frac{+\left(\frac{N}{2}+1\right)^{\text{th}} \text{ observation}}{2}$

$[\because N$ is even $]$

$\left(\frac{1286}{2}\right)^{\text{th}}$ observation

Median $= \frac{+\left(\frac{1286}{2}+1\right)^{\text{th}} \text{ observation}}{2}$

$= \frac{643^{\text{th}}+644^{\text{th}}}{2}$

$= \frac{(1001+(642)7)+(1001)+(643)7)}{2}$

$= \frac{2(1001)+7(642+643)}{2}$

$= \frac{2(1001)+7(1285)}{2}$

$= 1001 + 4497.5 = 5498.5$

Q115. Solution

Correct Answer: (D)

Let, $L = \lim\limits_{x \to \frac{\pi}{4}} \frac{\tan x - 1}{\cos 2x}$

$= \lim\limits_{h \to 0} \frac{\tan\left(\frac{\pi}{4} + h\right) - 1}{\cos 2\left(\frac{\pi}{4} + h\right)}$

(Putting $x = \frac{\pi}{4} + h$)

$= \lim\limits_{h \to 0} \frac{\left(\frac{1 + \tan h}{1 - \tan h}\right) - 1}{\cos\left(\frac{\pi}{2} + 2h\right)}$

$= \lim\limits_{h \to 0} \frac{1 + \tan h - 1 + \tan h}{-\sin 2h(1 - \tan h)}$

$= \lim\limits_{h \to 0} \frac{-2 \tan h}{2 \sin h \cos h\ (1 - \tan h)}$

$= \lim\limits_{h \to 0} \frac{-1}{\cos^2 h(1 - \tan h)}$

$= -1.$

Q116. Solution

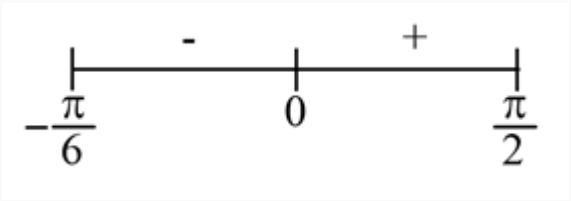
Correct Answer: (D)

$f(x) = 3\sin^4 x + 10\sin^3 x + 6\sin^2 x - 3,\ \mathrm{x} \in \left[-\frac{\pi}{6}, \frac{\pi}{2}\right]$

$\Rightarrow f'(x) = 12\sin^3 x \cos x + 30\sin^2 x \cos x + 12 \sin x \cos x$

$= 6 \sin x \cos x\left(2\sin^2 x + 5\sin x + 2\right)$

$= 6 \sin x \cos x(2\sin x + 1)(\sin x + 2)$



From wavy curve, we can say $f\prime(x) < 0$ in $\left(-\frac{\pi}{6}, 0\right)$

So, the function is Decreasing in $\left(-\frac{\pi}{6}, 0\right)$

Q117. Solution

Correct Answer: (B)

Equation of plane passing through $(2,\ 2,\ 1)$ is

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

also passes through $(9,\ 3,\ 6)$

$\therefore 7a+b+5c=0$ and $\perp$ to $2x+6y+6z-1=0$

$\therefore\ 7a+b+5c=0$ and $2a+6b+6c=0$

$\therefore\ \frac{a}{-24}=\frac{b}{-32}=\frac{c}{40}$ i.e. $\frac{a}{3}=\frac{b}{4}=\frac{c}{-5}$

$\therefore\ 3x+4y-5z=9$

Q118. Solution

Correct Answer: (B)

Given $f(g(x))=x$

Where, $f(x)=2^{10}x+1$, $g(x)=3^{10}x-1$.

$\Rightarrow f\left(3^{10}x-1\right)=2^{10}\left(3^{10}x-1\right)+1=x$

$\Rightarrow 2^{10}\left(3^{10}x-1\right)+1=x$

$\Rightarrow x\left(6^{10}-1\right)=2^{10}-1$

$\Rightarrow x=\frac{2^{10}-1}{6^{10}-1}=\frac{\frac{2^{10}-1}{2^{10}}}{\frac{(2\times3)^{10}-1}{2^{10}}}$

$=\frac{1-2^{-10}}{3^{10}-2^{-10}}$

Q119. Solution

Correct Answer: (A)

$$\begin{vmatrix} a+1 & a & a \\ a & a+1 & a \\ a & a & a+1 \end{vmatrix} = 0 \Rightarrow a+1+a+a=0 \Rightarrow a=-\frac{1}{3}$$

$\overrightarrow{P}=\frac{2}{3}\hat{i}-\frac{1}{3}\hat{j}-\widehat{k}$

$\overrightarrow{Q}=\frac{1}{3}\left(-\hat{i}+2\hat{j}-\widehat{k}\right)$

$\overrightarrow{R}=\frac{1}{3}\left(-\hat{i}-\hat{j}+2\widehat{k}\right)$

$\overrightarrow{P}.\overrightarrow{Q}=\frac{1}{9}(-2-2+1)=-\frac{1}{3}$

$$\overrightarrow{R}\times\overrightarrow{Q}=\frac{1}{9}\begin{vmatrix} i & j & k \\ -1 & 2 & -1 \\ -1 & -1 & 2 \end{vmatrix}=\frac{1}{9}(i(4-1)-j(-2-1)+k(1+2))=\frac{1}{9}(3i+3j+3k)=\frac{i+j+k}{3}$$

$$\left|\overrightarrow{R}\times\overrightarrow{Q}\right|=\frac{1}{3}\sqrt{3}\Rightarrow\left|\overrightarrow{R}\times\overrightarrow{Q}\right|^2=\frac{1}{3}\;3\left(\overrightarrow{P}.\overrightarrow{Q}\right)^2-\lambda\left|\overrightarrow{R}\times\overrightarrow{Q}\right|^2=0$$

$3.\frac{1}{9}-\lambda.\frac{1}{3}=0\Rightarrow\lambda=1$

Q120. Solution

Correct Answer: (C)

Let $I = \int_{-3}^{2}(|x+1| + |x+2| + |x-1|\ )dx$

Again, let $f(x) = |x+1| + |x+2| + |x-1|$

$$= \begin{cases} -(x+1) - (x+2) - (x-1), & -3 < x \le -2 \\ -(x+1) + x + 2 - (x-1), & -2 < x \le -1 \\ 1 + x + x + 2 - (x-1) & -1 < x \le 0 \\ 1 + x + x + 2 - (x-1) & 0 \le x < 1 \\ 1 + x + x + 2 + x - 1 & 1 \le x < 2 \end{cases}$$

$$= \begin{cases} -3x - 2, & -3 < x \le -2 \\ -x + 2, & -2 < x \le -1 \\ x + 4, & -1 \le x < 1 \\ 3x + 2, & 1 \le x < 2 \end{cases}$$

$\therefore I = \int_{-3}^{-2}(-3x-2)dx + \int_{-2}^{-1}(-x+2)dx$

$+ \int_{-1}^{1}(x+4)dx + \int_{1}^{2}(3x+2)dx$

$= \left[-\frac{3x^2}{2} - 2x\right]_{-3}^{-2} + \left[-\frac{x^2}{2} + 2x\right]_{-2}^{-1}$

$+ \left[\frac{x^2}{2} + 4x\right]_{-1}^{1} + \left[\frac{3x^2}{2} + 2x\right]_{1}^{2}$

$= \left[-6 + 4 - \left(-\frac{27}{2} + 6\right)\right] + \left[-\frac{1}{2} - 2 - \left(-2 - 4\right)\right]$

$+ \left[\frac{1}{2} + 4 - \left(\frac{1}{2} - 4\right)\right]\left[6 + 4 - \left(\frac{3}{2} + 2\right)\right]$

$= \frac{11}{2} + \frac{7}{2} + 8 + \frac{13}{2}$

$= \frac{31}{2} + 8 = \frac{47}{2}$

Alternate

Let $I = \int_{-3}^{2}\{|x+1| + |x+2| + |x-1|\}dx$

$= \int_{-3}^{-1}|x+1|dx + \int_{-1}^{2}|x+1|dx + \int_{-3}^{-2}|x+2|dx$

$+ \int_{-2}^{2}|x+2|dx + \int_{-3}^{1}|x-1|dx$

$+ \int_{1}^{2}|x-1|dx$

$= -\int_{-3}^{-1}(x+1)dx + \int_{-1}^{2}(x+1)dx - \int_{-3}^{-2}(x+2)dx$

$+ \int_{-2}^{2}(x+2)dx - \int_{-3}^{1}(x-1)dx + \int_{1}^{2}(x-1)dx$

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

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

$= \frac{47}{2}$

Q121. Solution

Correct Answer: (D)

$2y = \left(\cot^{-1}\frac{\sqrt{3}\cos x+\sin x}{\cos x-\sqrt{3}\sin x}\right)^2$

$= \left(\cot^{-1}\left(\frac{\sqrt{3}+\tan x}{1-\sqrt{3}\tan x}\right)\right)^2$

$= \left(\cot^{-1}\tan\left(\frac{\pi}{3}+x\right)\right)^2$

$= \left(\cot^{-1}\cot\left(\frac{\pi}{2}-\left(\frac{\pi}{3}+x\right)\right)\right)^2$

$\Rightarrow 2y = \begin{cases}\left(\frac{\pi}{6}-x\right)^2, & x\in\left(0,\frac{\pi}{6}\right)\\ \left(\pi+\frac{\pi}{6}-x\right)^2, & x\in\left(\frac{\pi}{6},\frac{\pi}{2}\right)\end{cases}$

$\Rightarrow \frac{2dy}{dx} = 2\left(\frac{\pi}{6}-x\right).(-1) \Rightarrow \frac{dy}{dx} = x-\frac{\pi}{6},\ x\in\left(0,\frac{\pi}{6}\right)$

And $\frac{dy}{dx} = x-\frac{7\pi}{6},\ x\in\left(\frac{\pi}{6},\frac{\pi}{2}\right)$

Left Hand and Right Hand Derivatives are not same so function is non derivable at $x = \frac{\pi}{6}$.

Hence, $\frac{dy}{dx}$ does not exist for all values in the given interval.

Q122. Solution

Correct Answer: (D)

$I = \int \sqrt{\frac{x-5}{x-7}}\, dx$

Multiplying and dividing by $\sqrt{x\ -\ 5}$

$I\ = \int \frac{x-5}{\sqrt{x^2-12x+35}} dx$

$I = \frac{1}{2} \int \frac{2x-10}{\sqrt{x^2-12x+35}} dx$

$I\ = \frac{1}{2} \int \frac{2x-12+2}{\sqrt{x^2-12x+35}} dx$

$I\ = \frac{1}{2} \int \frac{2x-12}{\sqrt{x^2-12x+35}} dx + \int \frac{dx}{\sqrt{x^2-12x+36-1}}$

$I = I_1\ +\ I_2 \qquad \ldots\ldots (\mathrm{i})$

now

$I_1 = \frac{1}{2} \int \frac{2x-12}{\sqrt{x^2-12x+35}} dx$

taking

$x^2 - 12x + 35 = t$

$(2x - 12)dx = dt$ substituting in I_1

$I_1\ = \frac{1}{2} \int \frac{dt}{\sqrt{t}}$

$I_1\ = \frac{1}{2} \times \frac{t^{\frac{1}{2}}}{\frac{1}{2}} + c$

$I_1 = \sqrt{t} + c$

$I_1 = \sqrt{x^2 - 12x + 35} + C_1$

Similarly

$I_2 = \int \frac{dx}{\sqrt{x^2-12x+36-1}}$

$I_2 = \int \frac{dx}{\sqrt{(x-6)^2-1}}$

by using formula

$\left\{ \int \frac{dx}{\sqrt{x^2-a^2}} = \log\left(\ x\ +\ \sqrt{x^2+a^2}\ \right) + c \right\}$

$I_2 = \log\ x - 6 + \sqrt{x^2 - 12x + 35}\ + C_2$

Substituting the values in equation (i)

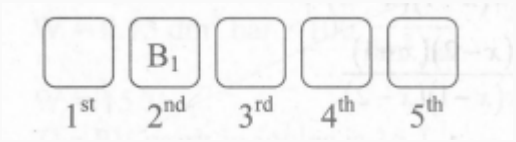
$I = \frac{1}{2}2\sqrt{x^2-12x+35} + C_1 + \int \frac{dx}{\sqrt{(x-6)^2-1}} + C_2$

$= \sqrt{x^2-12x+35} + \log\, x-6+\sqrt{x^2-12x+35}\ + C$

$\Rightarrow A = 1$

Q123. Solution

Correct Answer: (C)



There are 5 positions. Given that B_1 occupies 2^{nd} position $\therefore$ B_1 can be arranged in 1 way. As G_1 and G_2 are always together, none of them can take 1^{st} position. $\therefore$ G_1, G_2 and one of the remaining students can be arranged on 3^{rd} , 4^{th} and 5^{th} position when G_1 and G_2 are always together in $2! \times 2$! Ways. And remaining 2 students can be arranged in 2 ! Ways. $\therefore$ The required number of arrangements $= 2! \times 2! \times 2! = 8$

Q124. Solution

Correct Answer: (A)

Let the tine number is in AP are $(a-2d), (a-d), a, (a+d), (a+2d)$ where, $d \neq 0$ Given, 1 st, $3rd$ and 4 th terms are in GP. $\Rightarrow \quad a^2 = (a-2d)(a+d)$ $\Rightarrow \quad a^2 = a^2 - 2ad + ad - 2d^2$ $\Rightarrow \quad 2d^2 + ad = 0 \Rightarrow d(2d+a) = 0$ $\because \quad d \neq 0$ $\therefore \quad a + 2d = 0 \Rightarrow a = -2d$ Hence, terms are $-4d, -3d, -2d, -d, 0$ $\therefore$ The fifth term is always 0.

Q125. Solution

Correct Answer: (D)

$$\left(z+\frac{1}{z}\right)^3 + \left(z^4+\frac{1}{z^4}\right)^3 = \left(\frac{z^2+1}{z}\right)^3 + \left(\frac{z^8+1}{z^4}\right)^3$$

$$= \left(-\frac{z}{z}\right)^3 + \left(\frac{z^8+1}{z^4}\right)^3 \quad \left[\because z^2+z+1=0 \Rightarrow z^2+1=-z\right]$$

Given, $z^2+z+1=0$ Again, squaring it

$$= -1 + \left(\frac{z^8+1}{z^4}\right)^3$$

$\because \quad z^2+1=-z$, squaring both side,

$z^4+1+2z^2 = z^2 \Rightarrow z^4+1 = -z^2$

$\Rightarrow z^8+1+2z^4 = z^4 \Rightarrow \quad z^8+1 = -z^4$ Putting in Eq. (i), we get

$\left(z+\frac{1}{z}\right)^3 + \left(z^4+\frac{1}{z^4}\right)^3 = -1 + \left(-\frac{z^4}{z^4}\right)^3$

$= -1 + (-1) = -2$

Q126. Solution

Correct Answer: (A)

Given, $F(x) = \int_1^x t^2 g(t) dt$

By Leibnitz rule we get,

$F'(x) = x^2 g(x)$

$\Rightarrow F'(1) = 1.\, g(1) = 0\ (\because g(1) = 0)$

Now $F''(x) = 2xg(x) + x^2 g'(x)$

$\Rightarrow F''(x) = 2xg(x) + x^2 f(x)\ (\because g'(x) = f(x))$

$\Rightarrow F''(1) = 0 + 1 \times 3$

$\Rightarrow F''(1) = 3$

$F(x)$ has a local minimum at $x = 1$.

Q127. Solution

Correct Answer: (C)

Given, equation of the circle, $x^2 + y^2 + 6x - 4y - 3 = 0$

Length of tangent$= \sqrt{S_1}$ where, S_1 is the value got after putting the given point in the equation of the circle.

$\Rightarrow \sqrt{S_1} = \sqrt{5^2 + 1^2 + 30 - 4 - 3} = 7$

Q128. Solution

Correct Answer: (A)

Here, general term $T_k = \frac{1}{(k+2)\sqrt{k}+k\sqrt{k+2}}$

Rationalising the expression, we get,

$\Rightarrow T_k = \frac{(k+2)\sqrt{k}-k\sqrt{k+2}}{k(k+2)^2-k^2(k+2)}$

$\Rightarrow T_k = \frac{(k+2)\sqrt{k}-k\sqrt{k+2}}{2k(k+2)} = \frac{1}{2}\left(\frac{1}{\sqrt{k}} - \frac{1}{\sqrt{k+2}}\right)$

Now, $T_1 = \frac{1}{2}\left(\frac{1}{\sqrt{1}} - \frac{1}{\sqrt{3}}\right)$,

$T_2 = \frac{1}{2}\left(\frac{1}{\sqrt{2}} - \frac{1}{\sqrt{4}}\right)$,

$T_3 = \frac{1}{2}\left[\frac{1}{\sqrt{3}} - \frac{1}{\sqrt{5}}\right]$ and so on

$T_k = \frac{1}{2}\left(\frac{1}{\sqrt{k}} - \frac{1}{\sqrt{k+2}}\right)$

Adding all the terms, we get,

$T_1 + T_2 + \ldots T_k = \frac{1}{2}\left(1 + \frac{1}{\sqrt{2}} - \frac{1}{\sqrt{k+1}} - \frac{1}{\sqrt{k+2}}\right)$

Now, if $k \to \infty$

$\sum_{k=1}^{\infty} T_k = \frac{1}{2}\left(1 + \frac{1}{\sqrt{2}} - 0 - 0\right)$

$= \frac{\sqrt{1}+\sqrt{2}}{2\sqrt{2}}$

$\frac{\sqrt{1}+\sqrt{2}}{\sqrt{8}} = \frac{\sqrt{2}+\sqrt{4}}{\sqrt{16}}$

As, $c \in [1, 15] \Rightarrow c = 8, a = 1, b = 2$

$\Rightarrow$ any other solution is not possible

$\Rightarrow a + b + c = 11$

Q129. Solution

Correct Answer: (D)

We have, $N = 1! + 2! + \ldots\ldots + 2005!$

$= (1! + 2! + 3! + 4!) + (5! + \ldots\ldots\ldots + 2005!)$

$= 33+$ an integer having 0 in its unit's place

$=$an integer having 3 in its unit's place

Now, 3^1 has 3 at its unit place.

3^2 has 9 at its unit place.

3^3 has 7 at its unit place.

3^4 has 1 at its unit place.

3^5 has 3 at its unit place.

Therefore, $3^m,\ m \in N$ has $3,\ 9,\ 7,\ 1$ at its unit place.

$3^{500} = 3^{125\times4} = \left(3^4\right)^{125}$

Hence, N^{500} is an integer having 1 in its unit's place.

Q130. Solution

Correct Answer: (B)

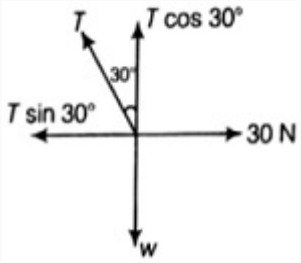
Probability of student (if he no miss test)=$\left(1 - \frac{1}{5}\right)$

Probability of student if he no miss test twice(if he miss no test)
$= \left(1 - \frac{1}{5}\right) \times \left(1 - \frac{1}{5}\right)$
$= \frac{16}{25}$
Hence, probability that he will miss atleast one test
$= 1 - P\left(no\ miss\ test\right) = 1 - \frac{16}{25} = \frac{9}{25}$

Q131. Solution

Correct Answer: (B)

Horizontal and vertical components of tension are shown in the figure.



From the figure, $T\sin 30^o = 30$ .....(i)

$T\cos 30^o = w$ .....(ii)

By solving Equations (i) and (ii), we get

$w = 30\sqrt{3}$ N

and $T = 60$ N

Q132. Solution

Correct Answer: (B)

Given,

Longitudinal strain, $\frac{\Delta l}{l} = 2 \times 10^{-3}$

Poisson's ratio, $\mu = 0.5$

Let the rod be cylindrical having radius r, then its volume be $V = \pi r^2 l$

Differentiating both sides, $\mathrm{d}V = 2\pi r \mathrm{d}r + \pi r^2 \mathrm{d}l$

$\Rightarrow \frac{\mathrm{d}V}{V} = 2\frac{\mathrm{d}r}{r} + \frac{\mathrm{d}l}{l} \Rightarrow \frac{\mathrm{d}V}{V} = (1 + 2\mu)\frac{\mathrm{d}l}{l} \left[\frac{\mathrm{d}r}{r} = \mu\frac{\mathrm{d}l}{l}\right]$

The volumetric strain of the rod is given by,

$\frac{\Delta V}{V} = (1 + 2\mu)\frac{\Delta l}{l}$

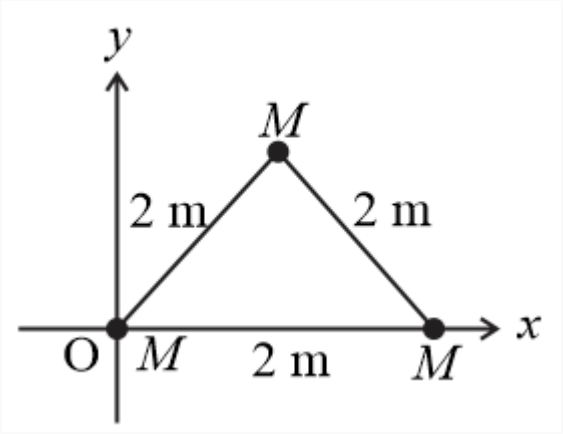
$\Rightarrow \frac{\Delta V}{V} = (1 + 2 \times 0.5) \times 2 \times 10^{-3} \Rightarrow \frac{\Delta V}{V} = 4 \times 10^{-3}$

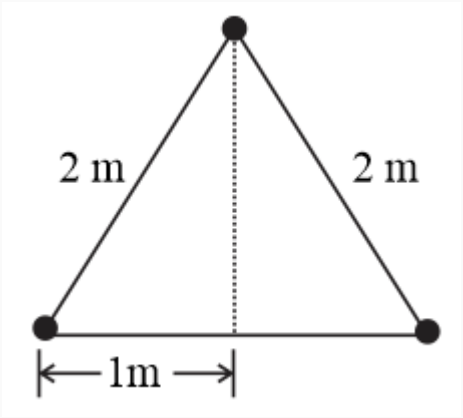
$\therefore$ Percentage change in volume $= \frac{\Delta V}{V} \times 100 = 0.4\%$

Q133. Solution

Correct Answer: (D)

The x coordinate of centre of mass is





$x_{com} = \frac{\sum M_i x_i}{\sum M_i}$

$= \frac{M \times 0 + M \times 1 + M \times 2}{M+M+M} = 1$

$y_{com} = \frac{\sum m_i y_i}{\sum m_i}$

$= \frac{M \times 0 + M \times (2 \sin 60) + M \times 0}{M+M+M}$

$y_{com} = \frac{\sqrt{3}M}{3M} = \frac{1}{\sqrt{3}}$

Position vector of centre of mass is $\left(\hat{\mathbf{i}} + \frac{\hat{\mathbf{j}}}{\sqrt{3}}\right)$.

Q134. Solution

Correct Answer: (B)

While moving along a group from top to bottom, acidic nature of oxides decreases and along a period left to right, acidic nature increases.

	Al	Si	P	S
Z	13	14	15	16
	Al_2O_3	SiO_2	P_2O_3	SO_2
	Amphoteric	acidic		max. acidic

So, $Al_2O_3 < SiO_2 < P_2O_3 < SO_2$

Q135. Solution
Correct Answer: (B)

B, Al & Ga is not a Dobereiner's triad because the atomic weight of Al is not equal to average atomic weight of /B/ and /Ga/ .

Q136. Solution
Correct Answer: (A)

The given words are

Dog, Crow, Goat, and Camel.

By observing the given options closely, we can identify that the similarity is that all the options are living beings.

The difference between them is that the crow is a bird while the rest are animals.

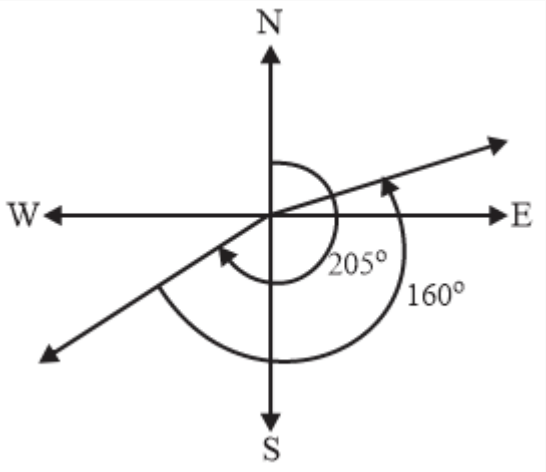
So, tcrow is odd among all.

Hence, this is the correct answer.

Q137. Solution
Correct Answer: (A)

According to the question,

Facing North, X first turns 205° clockwise, and then 160° anti-clockwise.



From the above-shown direction image, after the first turn, he is facing south-west, and after the second turn, the final direction is North-East.

So, he is facing in the north-east direction at the final position.

Hence, this is the correct answer.

Q138. Solution

Correct Answer: (A)

According to Bronsted and Lowry's concept conjugate bases obtained from weak acids are strong.

Q139. Solution

Correct Answer: (A)

Given, income on the first day = ₹ 1

Again, income on the second day = ₹ 1×2 = ₹ 2^1

Now, income on the third day = ₹ 2 × ₹ 2^1

= ₹ 2^2 and so on.

Therefore, income on the nth day = ₹ 2^{n-1}

So, income on the 10th day =₹ 2^{10-1} = ₹ 2^9

Hence, ₹ 2^9 is the correct answer.

Q140. Solution

Correct Answer: (D)

Since, the quadratic expression $x^2+2x+2=(x+1)^2+1 \in [1,\infty), \forall x \in R$ $\Rightarrow \quad \frac{1}{(x+1)^2+1} \in (0,1]$ For $f(x)=\frac{1}{x^2+2x+2}, \forall x \in R$ is surjective, then set $A=(0,1]$

Q141. Solution

Correct Answer: (C)

Total number of words formed by 4 letters given from eight different letters with repetition $=8^4$ and number of words with no repetition $={}^8P_4 \therefore$ Required number of words $=8^4-{}^8P_4$

Q142. Solution

Correct Answer: (B)

Mean $=1007$ Variance $\sigma^2=\frac{1}{1007}\left(1^2+3^2+\ldots\ldots+2013^2\right)-1007^2=338016$

$\therefore \ d=\sigma=\sqrt{338016}=581.39$