Answer Key

Other (142 Questions)

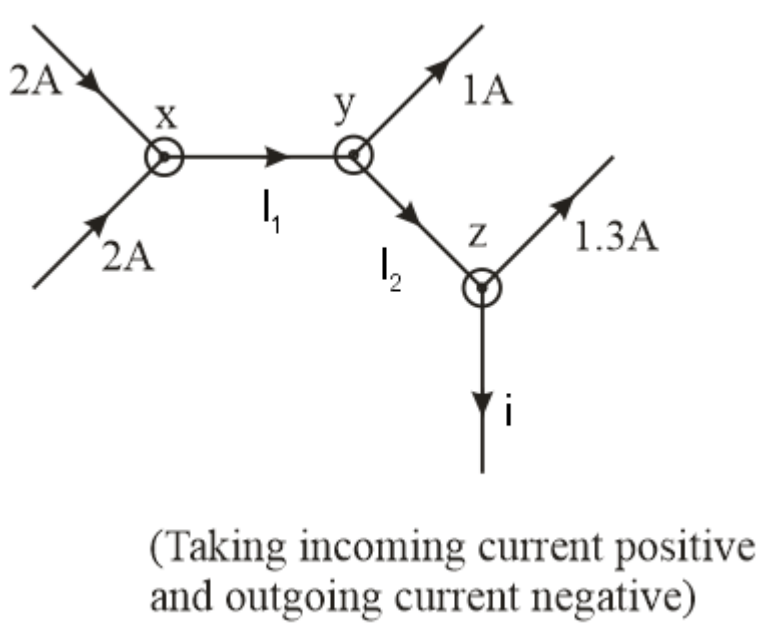
Q1. (A)	Q2. (B)	Q3. (C)	Q4. (B)	Q5. (B)
Q6. (A)	Q7. (B)	Q8. (C)	Q9. (B)	Q10. (C)
Q11. (D)	Q12. (C)	Q13. (D)	Q14. (A)	Q15. (A)
Q16. (A)	Q17. (A)	Q18. (B)	Q19. (C)	Q20. (A)
Q21. (A)	Q22. (B)	Q23. (B)	Q24. (A)	Q25. (A)
Q26. (B)	Q27. (C)	Q28. (A)	Q29. (B)	Q30. (B)
Q31. (C)	Q32. (A)	Q33. (D)	Q34. (A)	Q35.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

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

Solutions

Q1. Solution

Correct Answer: (A)



Applying KCL at x,

$2 + 2 - I_1 = 0$

$I_1 = 4A$

Applying KCL at y,

$I_1 - 1 - I_2 = 0$

$I_2 = I_1 - 1$

$I_2 = 4 - 1 = 3A$

Applying KCL at z,

$I_2 - 1.3 - i = 0$

$i = I_2 - 1.3$

$i = 3 - 1.3 = 1.7\ \text{A}$

Q2. Solution
Correct Answer: (B)

Gravitational field is a conservative force field. In a conservative force field work done is path independent.

$\therefore \qquad W_1 = W_2 = W_3$

Q3. Solution
Correct Answer: (C)

According to the given question,
When capacitor is removed, tangent of angle between current and voltage is
$\tan 60^o = \frac{\omega L}{R} \ldots \left(i\right)$

When the inductor only is removed, tangent of angle between current and voltage is

$\tan 60^o = \frac{\frac{1}{\omega C}}{R} \ldots \left(ii\right)$

From $(i)\ and\ (ii)$

$\therefore \quad \omega L = \left(\frac{1}{\omega C}\right)\ (case\ of\ resonance)$

The impedance of the LCR circuit is

$Z = \sqrt{R^2 + \left(\omega L - \frac{1}{\omega C}\right)^2}$

Where $R,\ \omega,\ L,\ C$ are resistance, frequency, inductance, capacitance respectively.

$\Rightarrow Z = 100\ \Omega$

The current through the circuit is
(current) $I_{rms} = \frac{E_{rms}}{Z} = \frac{200\ V}{100\ \Omega} = 2\ A$

Where E_{rms} is the RMS voltage of the source.

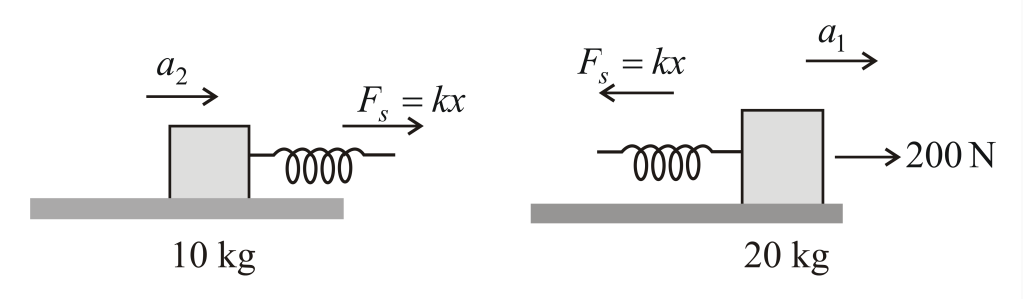
Q4. Solution
Correct Answer: (B)

One femtometre is equivalent to 10^{-15} m

$ie, \qquad 1\text{fm} = 10^{-15}\ \text{m}$

Q5. Solution

Correct Answer: (B)



From the free body diagram for the block of mass 10 Kg as it has acceleration $12\ \mathrm{m\ s^{-2}}$ which is because of spring force $(F_\mathrm{s} = kx)$.

where, K is spring constant and x is the extension of spring.

So,

$F_\mathrm{s} = 10a_2$

$\Rightarrow F_\mathrm{s} = 10 \times 12 = 120\ \mathrm{N}\ (\because a_2 = 12\ \mathrm{m\ s^{-2}})$

Hence, spring applies 120 N force on it.

Therefore, spring will apply 120 N of force on 20 kg of mass in the backward direction.

Then,

$\therefore$ The net forward force on 20 kg mass$= 200 - 120 = 80$ N.

Hence, acceleration of 20 kg is

$\because\ a = \frac{F_\mathrm{net}}{M}$

$\therefore\ a_1 = \frac{80}{20} = 4\ \mathrm{m\ s^{-2}}$

Q6. Solution
Correct Answer: (A)

In centre of mass, frame acceleration of centre of mass is zero.

Hence, using Newton's second law of motion,

$F_{\text{net}} = ma_{\text{cm}} = m \times 0 = 0$

Also, $F_{\text{net}} = F_{\text{ext}} + P_{\text{S}} = 0$

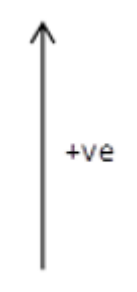
and in ground frame, $F_{\text{ext}} = ma_{\text{cm}}$

From above two equations, we get,

$P_{\text{S}} = -F_{\text{ext}} = -ma_{\text{cm}}$

Hence, both Assertion and Reason are true and the Reason is correct explanation of the Assertion.

Q7. Solution
Correct Answer: (B)



velocity of jet plane w.r.t ground $\text{vJG} = 500\ \text{km h}^{-1}$
Velocity of products of combustion w.r.t jet plane $\text{v}_{\text{CJ}} = -1500\ \text{km h}^{-1}$
$\therefore$ Velocity of products of combustion w.r.t ground i s
$\text{v}_{\text{CG}} = \text{v}_{\text{CJ}} + \text{v}_{\text{JG}} = -1500\ \text{km h}^{-1} + 500\ \text{km h}^{-1} = -1000\ \text{km h}^{-1}$
−ve sign shows that the direction of products of combustion is opposite to that of the plane.
$\therefore$ Speed of the products of combustion w.r.t. ground $= 1000\ \text{km h}^{-1}$

Q8. Solution
Correct Answer: (C)

The field at the same point at the same distance from the mutually perpendicular wires carrying current will be having the same magnitude, but in perpendicular directions.

$\therefore \quad B = \sqrt{B_1^2 + B_2^2}$

$\therefore \quad B = \frac{\mu_0}{2\pi d}\left(I_1^2 + I_2^2\right)^{1/2}.$

Q9. Solution

Correct Answer: (B)

According to the law of conservation of angular momentum, the momentum of a moving body is always conserved. i.e. $L_1 = L_2$

$\because L = mvr$

$\therefore mv_1r_1 = mv_2r_2 \Rightarrow \frac{v_1}{v_2} = \frac{r_2}{r_1}$

Q10. Solution

Correct Answer: (C)

Initial temperature of ideal gas, $T_1 = 273 + 27 = 300\,K$

when temperature of gas is raised by 6^oC , the final temperature of gas $T_2 = 273 + 6 + 27$

$= 306\,K$

Let initial velocities are v_{rms_1}, and v_{rms_2}

$v_{rms} \propto \sqrt{T}$

$\frac{v_{rms_1}}{v_{rms_2}} = \sqrt{\frac{T_1}{T_2}}$

$v_{rms_2} = \sqrt{\frac{T_2}{T_1}} \times v_{rms_1}$

$= \sqrt{\frac{306}{300}} \times v_{rms_1}$

$= 1.00 \times v_{rms_1}$

So, it will increase by 1%.

Q11. Solution

Correct Answer: (D)

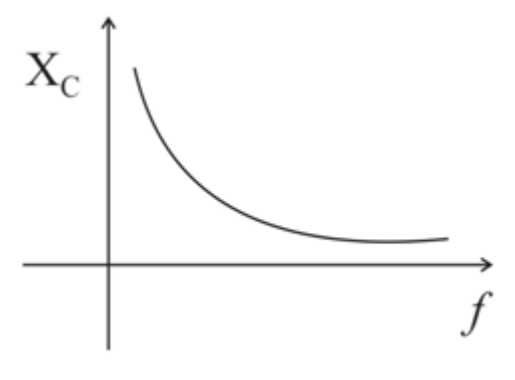
The formula of capacitance reactance in terms of angular frequency and capacity,

$X_{\mathrm{C}} = \frac{1}{\omega C}$

here the value of angular frequency, $\omega = 2\pi f$

$X_{\mathrm{C}} = \frac{1}{2\pi f C}$
$X_{\mathrm{C}} \propto \frac{1}{f}$

so the value of X_{C} is inversely proportional to frequency,



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Q12. Solution

Correct Answer: (C)

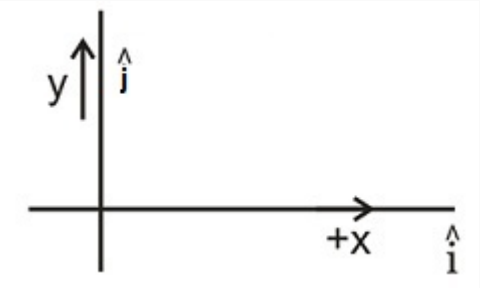
δ is the initial phase. When oscillations of pendulum are damped, δ doesn't change ,

Q13. Solution

Correct Answer: (D)

The initial momentum of system is $\overrightarrow{P_i} = m(2V)\hat{i} + (2m)V\,\hat{j}$

According to question as



On perfectly inelastic collision the particles stick to each other.

$\overrightarrow{P_f} = 3m\,\overrightarrow{V_f}$

By conservation of linear momentum

$\overrightarrow{P_f} = \overrightarrow{P_i} \Rightarrow 3m\,\overrightarrow{V_f} = m2V\,\hat{i} + 2mV\hat{j}$

$\Rightarrow \overrightarrow{V_f} = \frac{2V}{3}\left(\hat{i} + \hat{j}\right) \Rightarrow |V_f| = \frac{2\sqrt{2}}{3}V$

$\therefore$ loss in KE. of system $= K_{initial} - K_{final}$

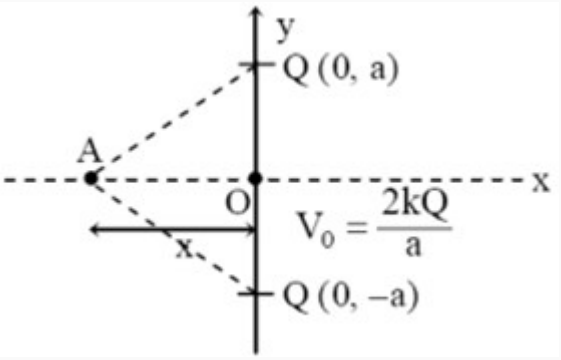
$= \frac{1}{2}m(2V)^2 + \frac{1}{2}(2m)V^2 - \frac{1}{2}(3m)\left(\frac{2\sqrt{2}V}{3}\right)^2$

$= 2mV^2 + mV^2 - \frac{4}{3}mV^2 = 3mV^2 - \frac{4mV^2}{3} = \frac{5}{3}mV^2$

% Loss in KE $= 100 \times \frac{\Delta K}{K_i} = \frac{\frac{5}{3}mv^2}{3mV^2} = \frac{5}{9} \times 100 = 56\% \sim$

Q14. Solution

Correct Answer: (A)



The potential at the centre is $\mathrm{V_0} = \frac{2\mathrm{kQ}}{\mathrm{a}}$

Potential on the x-axis is given by, $\mathrm{V_A} = \frac{2\mathrm{kQ}}{\sqrt{\mathrm{a^2}+\mathrm{x^2}}}$

At $\mathrm{x} = \infty, \mathrm{V}_\infty = 0$

$\therefore$ The graph will tend to 0 at $\mathrm{x} = \pm\infty$ and will be maximum at $\mathrm{x} = 0$,

Q15. Solution

Correct Answer: (A)

$f = 10^{14}\ \text{Hz}$

$E_0 = 4\ \text{V/m}$

$\in_0 = 8.8 \times 10^{-12} \frac{\text{C}^2}{\text{N}-\text{m}^2}$

Energy density of electric field

= $\frac{1}{2}$ (Total energy density)

$= \frac{1}{2} \cdot \frac{1}{2} \in_0 \text{E}^2$

$= \frac{1}{2} . \frac{1}{2} \left\{8.8 \times 10^{-12} \times 4^2\right\}$

$= \frac{1}{2} \cdot \frac{1}{2} \times 16 \times 8.8 \times 10^{-12}\ \text{J/m}^3$

$= 35.2 \times 10^{-12}\ \text{J/m}^3$ ∧

Q16. Solution

Correct Answer: (A)

$\text{F} = \text{I}\ell\text{B} = \lambda \text{vLB}$

$\text{F} = \text{qvB}$

$\text{F} = \text{qv} \frac{\mu_0}{4\pi} \frac{2\text{i}}{\text{a}} = \frac{\mu_0 \text{iqv}}{2\pi\text{a}}$.

Q17. Solution

Correct Answer: (A)

The given equation is written as,

$y = 3 \sin\left(100\ t + \frac{\pi}{6}\right)$ ...(i)

The general equation of simple harmonic motion is written as

$y = a \sin\left(\omega t + \emptyset\right)$ ...(ii)

Equating Eqs. (i) and (ii), we get

$a = 3,\ \omega = 100$

Maximum velocity, $v = a\omega\ = 3 \times 100 = 300\ \text{m s}^{-1}$ ∧

Q18. Solution

Correct Answer: (B)

The shunt of an ammeter,

$S = \frac{I_g \times G}{I - I_g}$

$= \frac{5 \times G}{100 - 5} = \frac{G}{19}$ ∧

Q19. Solution

Correct Answer: (C)

As stress is shown on x -axis and strain on y -axis.

So, we can say that $y=\cot \theta=\frac{1}{\tan \theta}=\frac{1}{slope}$

So, elasticity of wire P is minimum and R is maximum. !

Q20. Solution

Correct Answer: (A)

x = elongation in spring due to mass 10 kg

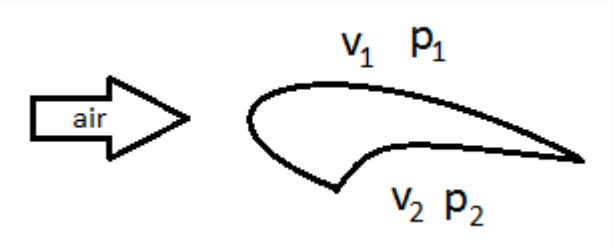
$=\frac{10 \times 10}{100}=1 \mathrm{~m}$

$\mathrm{W}_{\mathrm{F}}=\frac{1}{2} \times 100 \times\left[(3)^2-(1)^2\right]-10 \times 10 \times 2$

= 200 J

Q21. Solution

Correct Answer: (A)



Applying Bernoulli's equation at above (1) and below (2) the wings of aeroplane $p_1+\rho g h \frac{1}{+2} \rho v_1^2=p_2+\rho g h \frac{1}{+2} \rho v_2^2$. where, p and v represents pressure and velocity of air at corresponding positions. Here, if $v_1>v_2$ then $p_1<p_2$ Bernoulli's principle states that an increase in the speed of a fluid occurs simultaneously with a decrease in pressure. So a thrust acts upward due to pressure difference. ,

Q22. Solution

Correct Answer: (B)

According to Planck's hypothesis, the energy of a photon E is proportional to the frequency ν of photon where proportionality constant is Planck's constant h.

So,$\mathrm{E}=\mathrm{h} \nu \Rightarrow \nu=\frac{\mathrm{E}}{\mathrm{h}} \quad=\frac{2200 \times 1.6 \times 10^{-19}}{6.63 \times 10^{-34}} \quad=5 .3 \times 10^{17} \mathrm{~Hz}$

Q23. Solution

Correct Answer: (B)

Since initial phase is $\frac{\pi}{2}$ as per the given graph.

Using the equation of position of SHM $x = A\sin\left(\omega t + \frac{\pi}{2}\right)$

$\Rightarrow x = A\cos\omega t$

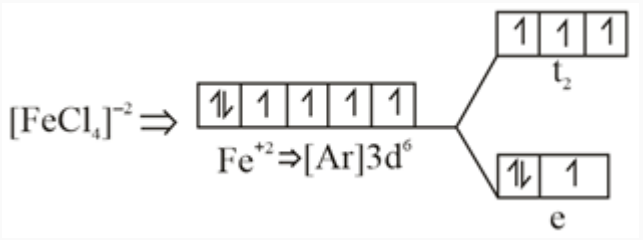
$\Rightarrow$ acceleration $f = \frac{d^2x}{dt^2} = -A\omega^2\cos\omega t$

Which is represented in option second.

Q24. Solution

Correct Answer: (A)

(i)

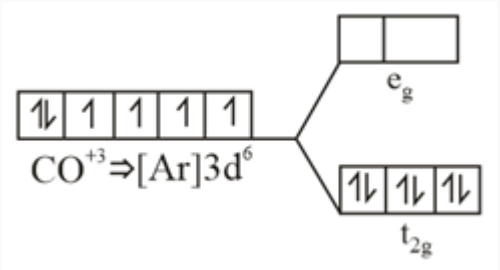


$\mu = \sqrt{n(n+2)}\,BM$

$= \sqrt{4(4+2)}\,BM$

$= \sqrt{24}\,BM \Rightarrow 4.90\ BM$

(ii) $[Co\,(C_2O_4)_3]^{-3}$



$\mu = 0$

(iii) MnO_4^{-2}

$Mn^{+6} \Rightarrow [Ar]3\,d^1\ \ \mu = \sqrt{n(n+2)}\,BM$

$= \sqrt{1(1+2)}\,BM$

$= \sqrt{3}BM \Rightarrow 1.73\ BM$

Q25. Solution

Correct Answer: (A)

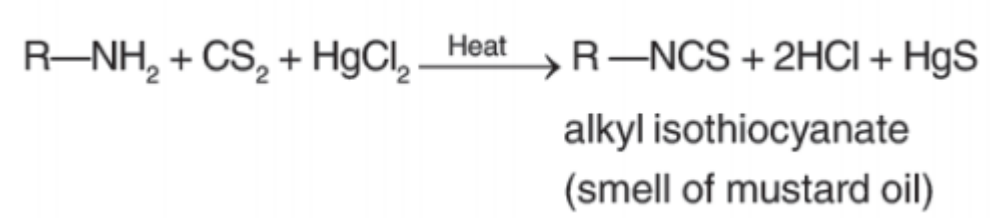
$y_{\text{incident}} = 5\sin(50t - 50x)$

$y_{\text{reflected}} = -5\sin(50t + 50x)$

Q26. Solution

Correct Answer: (B)

Primary amine and carbon disulphide on heating with mercuric chloride produce isothiocyanate. This reaction is known as mustard oil reaction.

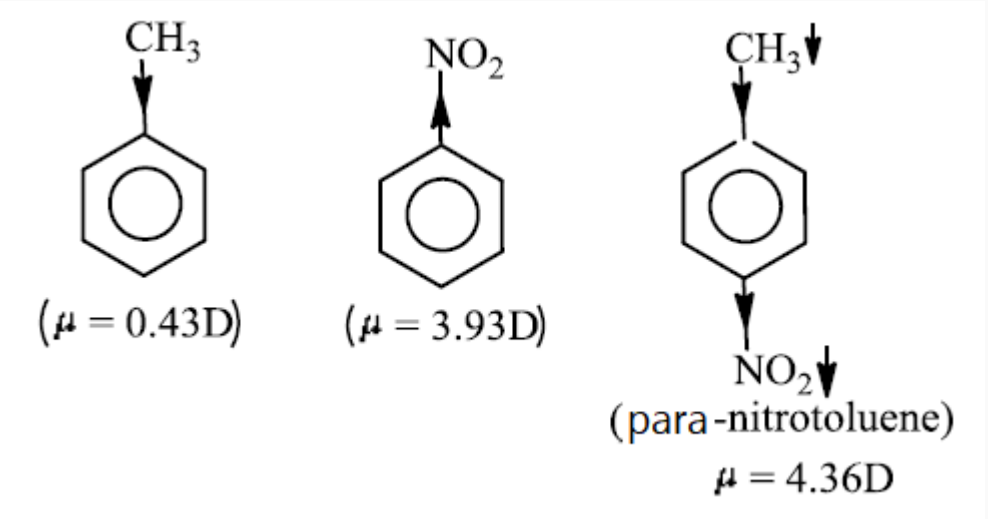


Q27. Solution

Correct Answer: (C)

Methyl group has $+\text{I}$ effect and $-\text{NO}_2$ group has $-\text{I}$ effect. Therefore, in p-nitro toluene the dipole moments of $-\text{CH}_3$ and $-\text{NO}_2$ groups act in the same direction. So, the resultant dipole moment is additive.

i.e., 3.93 + 0.43 = 4.36 debye



Q28. Solution

Correct Answer: (A)

On the basis of electrochemical theory of corrosion, in aqueous solution reaction occuring at the cathode is:

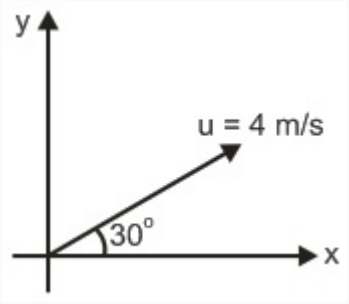
$\text{O}_2(\text{g}) + 4\text{H}^+(aq) + 4e^- \rightarrow 2\text{H}_2\text{O}(l)$

At cathode, always reduction takes place.

Q29. Solution

Correct Answer: (B)

Components of velocity of ball relative to lift are :



$u_x = 4 \cos 30^o = 2\sqrt{3}\ \text{m/s}$

and $u_y = 4 \sin 30^o = 2$ m/s

and acceleration of ball relative to lift is 12 m/s^2 in negative y-direction or vertically downwards. Hence time of flight

$T = \frac{2u_y}{12} = \frac{u_y}{6} = \frac{2}{6} = \frac{1}{3}s$

Q30. Solution

Correct Answer: (B)

It is given that NaOH is 20% w/w. Lets consider we have 100 g of the solution.

20% w/w means 100 g of solution has 20 g solute.

Thus, the mass of NaOH in solution will be 20 g and mass of water (solvent) will be 80 g.

Molality is a term used for concentration and is defined as the number of moles of solute per kilogram of solvent.

$$\text{Molality} = \frac{\text{no. of moles of solute}}{\text{mass of solution in kg}} = \frac{\frac{\text{mass of NaOH}}{\text{molar mass of NaOH}}}{\text{mass of solvent in kg}} = \frac{\frac{20}{40}}{80\times\frac{1}{1000}} = \frac{100}{16} = 6.25\ \text{m}$$

Q31. Solution

Correct Answer: (C)

For refraction at first surface,

$u = -7.5 \text{ cm},\ R_1 = 2.5 \text{ cm}$

$\mu_1 = 1,\ \mu_2 = \frac{4}{3}$

$\therefore \quad \frac{\mu_2}{v'} - \frac{\mu_1}{u} = \frac{\mu_2 - \mu_1}{R_1}$

$\therefore \quad \frac{4/3}{v\prime} - \frac{1}{(-7.5)} = \frac{4/3 - 1}{2.5}$

$\Rightarrow \quad \frac{4}{3v'} = \frac{1}{7.5} - \frac{1}{7.5} = 0$

$\Rightarrow \quad v' = \infty$

It means the ray is parallel within the sphere.

For refraction at second surface,

$u = -\infty,\ \mu_1 = \frac{4}{3}$

$\mu_2 = 1,\ R_2 = -2.5 \text{ cm}$

$\therefore \quad \frac{\mu_2}{v'} - \frac{\mu_1}{u} = \frac{\mu_2 - \mu_1}{R_2}$ gives

$\Rightarrow \quad \frac{1}{v'} - \frac{4/3}{(-\infty)} = \frac{1 - (4/3)}{(-2.5)}$

$\Rightarrow \quad v = +\ 7.5 \text{ cm}$

i.e. Image is formed at distance 7.5 cm to the right of P_2 . Hence, distance of final image P from centre $C = 7.5 + 2.5 = 10$ cm.

Q32. Solution
Correct Answer: (A)

Given that the hollow spherical ball is half-submerged in water.

To satisfy the condition of floatation of a hollow spherical ball, the weight of the ball must be balanced by the upward force i.e., the buoyant force or upthrust acting by the fluid on the ball. Thus, $W = \text{ Upthrust }$.

We know that upthrust is given as $F_{\mathrm{b}} = V_{\mathrm{i}} \times \rho_{\mathrm{l}} \times g$, here V_{i} is the volume of liquid displaced, ρ_l is the density of liquid and g is the acceleration due to gravity.

From the above relation, we get $V_{\mathrm{i}} = \frac{W}{\rho_{\mathrm{l}} g}$.

Now, if the density of liquid ρ_{l} is increased, then immersed volume V_{i} will decrease and the ball will go up.

Q33. Solution
Correct Answer: (D)

Option 4 is correct. There is direct bonding of the metal ion with carbon so it is an organometallic compound. All the other given compounds, have a metal-oxygen bond.

Q34. Solution
Correct Answer: (A)

A point charge moving in a circle with an angular speed ω is equivalent to the current-carrying loop with current,

$i = \frac{Q}{T} = \frac{Q\omega}{2\pi}$.

If the effective magnetic field at the centre of the circle to be reduced to zero, then the field produced by the charge should be directed opposite and equal in magnitude with the earth's magnetic field.

i.e.,

$F = 30 \ \times 10^{-6} \ \mathrm{T}$

$\Rightarrow \frac{\mu_0 i}{2r} = 30 \times 10^{-6} \ \mathrm{T}$

$\Rightarrow \frac{\mu_0}{2r} \frac{Q\omega}{2\pi} = 30 \times 10^{-6} \ \mathrm{T}$

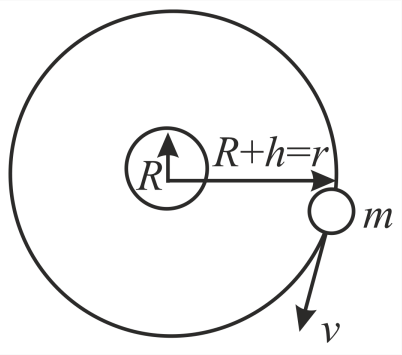
$\Rightarrow \omega = \frac{30 \times 10^{-6} \times 4\pi \mathrm{R}}{\mu_0 Q}$

$\Rightarrow \omega = \frac{30 \times 10^{-6} \times 4\pi \times 10^{-3}}{4\pi \times 10^{-7} \times 3 \times 10^{-12}}$

$\Rightarrow \omega = 10^{11} \ \mathrm{rad \ s^{-1}}$

Q35. Solution

Correct Answer: (A)



When the satellite is moving in circular orbit after launching the satellite, then centripetal force should be equal to the gravitational force,

$F_{\mathrm{c}} = F_{\mathrm{G}}$

$\frac{1}{2}\mathrm{m}(v_0)^2 = G\frac{Mm}{(r)^2}$

where $G,\ M,\ m,\ h$ are universal gravitational constant, the mass of the planet, the mass of satellite and height where the satellite is projected,

$\Rightarrow \frac{m(v_0)^2}{r} = G\frac{Mm}{(r)^2}$

$\Rightarrow (v_0)^2 = G\frac{M}{r}$

Now the time period of the satellite,

$T = \frac{2\pi r}{v_0} = \frac{2\pi r}{(G\frac{M}{r})^{1/2}}$

$\Rightarrow T^2 = \left(\frac{2\pi r}{(G\frac{M}{r})^{1/2}}\right)^2$

$\Rightarrow T^2 \propto r^3$

$\Rightarrow T \propto r^{3/2}$

$\therefore \frac{T_2}{T_1} = \left(\frac{r_2}{r_1}\right)^{3/2}$

or $T_2 = T_1(4)^{3/2} = 8T_1 = 8$ days

Q36. Solution

Correct Answer: (A)

We know,

$E = x \cdot l$ ...(i)

$E =$ Emf of the cell

$x =$ Potential gradient

$l =$ Balancing length

$E = \ 6 \ \mathrm{mV}$

$x = \frac{IR_{PQ}}{L}$ ...(ii)

Where, R_{PQ} is the resistance of potentiometer wire and $L$is the length of potentiometer wire.

$I = \frac{E_p}{(R+R_{PQ})}$ ...(iii)

where E_P is the emf of the cell in primary circuit.

So, from equations (i), (ii) and (iii),

$E = \left(\frac{E_p}{(R+R_{PQ})} \times \frac{R_{PQ}}{L}\right) \times l$

$6 \times 10^{-3} = \ \left(\frac{2}{(\mathrm{R}+5)} \times \frac{5}{1}\right) \times \left(0.6\right)$

$R = \ 995 \ \Omega$

Q37. Solution

Correct Answer: (B)

Lucas reagent (Conc. $\mathrm{HCl} + \mathrm{ZnCl_2}$). is used to distinguish between alcohols tertiary alcohol reacts immediately and gives white turbidity, secondary alcohol reacts in about 5 minutes and primary alcohol do not react.

Q38. Solution

Correct Answer: (B)

In this diagram, equal number of cations $\left(\mathrm{Na}^{+}\right)$and anions $\left(\mathrm{Cl}^{-}\right)$ are missing, so it, shows schottky defect.

Q39. Solution

Correct Answer: (A)

Insoluble calcium and magnesium salts formation can block radiators

Q40. Solution

Correct Answer: (C)

Rate of reaction$= \mathrm{k}[\mathrm{A}]^{\mathrm{m}}[\mathrm{B}]^{\mathrm{n}}$

$5 .07 \times 10^{-5}=\mathrm{k}[0 .2]^{\mathrm{m}}[0 .3]^{\mathrm{n}}$

$5 .07 \times 10^{-5}=\mathrm{k}[0 .2]^{\mathrm{m}}[0 .1]^{\mathrm{n}}$

$1 .43 \times 10^{-4}=\mathrm{k}[0 .4]^{\mathrm{m}}[0 .05]^{\mathrm{n}}$

On solving,

$\mathrm{m}=1 .5, \mathrm{n}=0$

Q41. Solution

Correct Answer: (D)

First Ionization Energy: The first ionization energy of an atom is the energy required to remove the first electron from the outermost shell of an atom. Once the first electron has been removed from the gaseous atom, it is possible to remove second and successive electrons from positive ions one after the other. Second Ionization Energy: Once the first ionization electron is removed from the gaseous atom, it is possible to remove second and successive electrons from positive ions one after the other. Removal of the second electron from an already ionized gaseous atom is called as second ionization energy. $\mathrm{A}(\mathrm{g})+\mathrm{IE}_1 \rightarrow \mathrm{A}^{+}(\mathrm{g})+\mathrm{e}^{-}$[First Ionization] $\mathrm{A}^{+}(g)+\mathrm{IE}_1 \mathrm{A}^{2+}(g)+\mathrm{e}^{-}$[Second ionization] The number of energies required to remove most loosely bound electron from unipositive, dipositive, tripositive ions of the element in the gaseous state are called second, third, fourth, etc ionization energies respectively. The second, third and fourth, etc ionization energies are collectively called as successive ionization energies. It is also seen that IE3 > IE2 > IE1. So options A & C are correct.

Q42. Solution

Correct Answer: (C)

Tin is oxidised to meta stannic acid when it is treated with nitric acid.

$\mathrm{Sn}+4 \mathrm{HNO}_3 \rightarrow \mathrm{H}_2 \mathrm{SnO}_3+4 \mathrm{NO}_2+\mathrm{H}_2 \mathrm{O}$

Q43. Solution

Correct Answer: (A)

Solubility of a gas in inversely proportional to Henry's constant. More the value of Henry's constant lesser will be the solubility of gas. This can be predicted through expression of Henry's law which is:

$\mathrm{P}_{\text{gas}}=\mathrm{K}_{\mathrm{H}} \times \mathrm{X}_{\text{gas}}$

where, X_{gas} is solubility

Order of Henry's law constant : $\mathrm{I}>\mathrm{II}>\mathrm{IV}>\mathrm{III}$

Order of solubility : $\mathrm{I}<\mathrm{II}<\mathrm{IV}<\mathrm{III}$

Q44. Solution

Correct Answer: (B)

$K_c = \frac{[PCl_3][Cl_2]}{[PCl_5]} = \frac{\left[\frac{20}{100}\right] \times \left[\frac{20}{100}\right]}{\left[\frac{80}{100}\right]} = \frac{0.2 \times 0.2}{0.8} = \frac{0.04}{0.8} = 0.05$

Q45. Solution

Correct Answer: (C)

"All their ions are colourless" this is incorrect because about 90% of ions are coloured and only few are colourless.

Q46. Solution

Correct Answer: (A)

If E_f and E_Γ are the activation energies of the forward and reverse reactions and the reaction is known to be exothermic then $E_f < E_r$

Q47. Solution

Correct Answer: (B)

Calcium hydroxide or slaked lime with the molecular formula $\mathrm{Ca(OH)_2}$ is a white amorphous powdery substance. At temperatures closing to the melting point, calcium hydroxide tends to lose water and hence decomposes.

Q48. Solution

Correct Answer: (C)

The second law of thermodynamics states that an isolated system’s entropy will never decrease over time. Thus, all spontaneous processes are thermodynamically irreversible.

Q49. Solution

Correct Answer: (B)

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

Q50. Solution
Correct Answer: (D)

The coded language from the given alternatives will be WXVMOI as when we add 4 in each alphabet of "BERNARD", we will get "FIVREVH".

Similarly, when we add 4 in each alphabet of "STRIKE", we will get WXVMOI written in that code language.

Q51. Solution
Correct Answer: (B)

Correct option is B)
$2HCl + \frac{1}{2}O_2 \rightarrow H_2O + Cl_2$

Q52. Solution
Correct Answer: (D)

$\Delta G^o = -nFE^o$
if $E^o =$ positive; then $\Delta G^o =$ negative,
For those conversions whose E^o values are more positive are more favourable.

Q53. Solution
Correct Answer: (C)

Every hour it is double fast of given minutes

In 8 minute fast = In 4th hour
× 2
16 minute fast = In 5th hour
× 2
32 minute fast = In 6th hour
× 2
64 minute fast = In 7th hour

Q54. Solution
Correct Answer: (D)

$SF_4 - sp^3$ d hybridised with 4 bond pairs 1 lone pair.
$CF_4 - sp^3$ hybridised with 4 bond pairs no lone pairs.
$XeF_4 - sp^3$ d^2 hybridised with 4 bond pairs 2 lone pairs.

Q55. Solution
Correct Answer: (D)

We have to find the correct mirror image for the word 'WATER' for which we need to find the mirror image for each letter separately and then arrange it, like the mirror image for the letters W is W, A is A, T is T, E is $\exists$ and R is ?. Since, the word ends with R, i.e., where the mirror is placed, therefore the mirror image will start from the mirror images of R, i.e.; ?.Thus the mirror image for water is

Thus option (4) is the correct answer.

Q56. Solution
Correct Answer: (B)

"Came to the conclusion" is an idiomatic expression which refers to the making of a determination about someone or something or reaching an end point. The other options do not fit contextually.
As option B represents its clear meaning, it will be the correct answer choice.

Q57. Solution
Correct Answer: (D)

'Tremble' means 'to shake involuntarily with quick, short movements, as from fear, excitement, weakness, or cold'. 'Trembling' is followed by fixed preposition 'with', which is again followed by some emotion or condition. E.g., The children trembled with fear as the bear approached them. Hence, this is the correct answer choice.

Q58. Solution
Correct Answer: (C)

Due to resonance benzyl carbonium ion is most stable.

Q59. Solution
Correct Answer: (B)

The Past Participle "swum" is to be used and not the past tense "swam". The Past Participle represents a completed action or state of the thing spoken of.
The past participle is often, but not always, formed by adding the suffix-ed to a verb. A participle also may function as an adjective or an adverb.

Q60. Solution
Correct Answer: (B)

The meaning of Delectation is enjoyment or entertainment. The correct answer will be entertainment.

Caution means care that you take in order to avoid danger or mistakes.
Reward means prize.
Compose means to combine together to form a whole.

Q61. Solution
Correct Answer: (C)

$K_b = \frac{\Delta T_b}{m} = \frac{0.1 \times 100}{\frac{1.8}{180} \times 1000} = 1\ \mathrm{K/m}.$

Q62. Solution
Correct Answer: (C)

Idiom 'to take to one’s heels' means. To escape from something/somebody.

Therefore, the option 'to run away' is correct.

Q63. Solution
Correct Answer: (A)

An adjective is the form of a word that describes the nature of a particular thing.
Adjectives are formed by using suffixes '-able' mainly with verbs.
Here, 'advice' is a verb. Adding '-able' with 'advice', we get the adjective form 'advisable'.

Q64. Solution
Correct Answer: (C)

$\mathrm{NaCl} + \mathrm{H_2SO_4} + \mathrm{K_2Cr_2O_7} \rightarrow$ Chromythloride $\mathrm{CrO_2Cl_2} + \mathrm{K_2SO_4} + \mathrm{Na_2SO_4}$

Q65. Solution

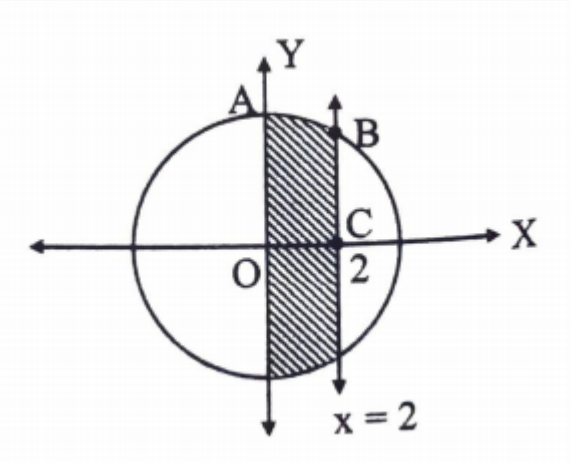
Correct Answer: (A)

Given equation of circle is $x^2+y^2=16 \therefore y^2=16-x^2 \therefore y=\sqrt{16-x^2}$ Required area is shaded.

$$\text{Area } = 2\int_0^2 \sqrt{16-x^2}\,dx$$

$$A = 2\ \text{A(OABCO)} \qquad = 2\left[\frac{x}{2}\sqrt{16-x^2}+\frac{16}{2}\sin^{-1}\frac{x}{4}\right]_0^2$$

$$= 2\left\{\frac{2}{2}\sqrt{12}+8\sin^{-1}\frac{1}{2}-0\right\} = 2\left[2\sqrt{3}+8\left(\frac{\pi}{6}\right)\right] = 4\sqrt{3}+\frac{8\pi}{3}$$



Q66. Solution

Correct Answer: (A)

$x^2+5|x|-6=0$

$|x|^2+5|x|-6=0$

$|x|^2+6|x|-|x|-6=0$

$|x|(|x|+6)-1(|x|+6)=0$

$(|x|-1)(|x|+6)=0$

$|x|=1$, nbsp;$|x|\neq -6$ (Since modulus can not be giving negative values)

$\therefore \ \ |x|=1$

$\therefore \ \ x=\pm 1$

$\alpha=1, \beta=-1$

$\therefore \quad \tan^{-1}\alpha-\tan^{-1}\beta \ = \ \tan^{-1}1-\tan^{-1}(-1)$

$= \ \frac{\pi}{4}-\left(-\frac{\pi}{4}\right)$

$= \ \frac{\pi}{2}=\frac{\pi}{2}$

Q67. Solution

Correct Answer: (D)

Here, $P\equiv \mathrm{F}, q\equiv \mathrm{T}, r\equiv \mathrm{T} \Rightarrow \sim p\vee(q\wedge r)$ is true

Q68. Solution

Correct Answer: (A)

Any plane passing through $(-2, 2, 2)$ is $A(x+2)+B(y-2)+C(z-2)=0 \because$ It passes through $(2,-2,-2) \Rightarrow \quad 4A-4B-4C=0$ It is parallel to $9x-13y-3z=0 \therefore \quad 9A-13B-3C=0 \quad \ldots$ (ii)

Solving Eqs. (i) and (ii), $\frac{A}{12-52}=\frac{B}{-36+12}=\frac{C}{-52+36} \therefore$ Required

$$\Rightarrow \quad \frac{A}{-40}=\frac{B}{-24}=\frac{C}{-16}$$

$$\Rightarrow \quad -40x-80-24y+48-16z+32=0$$

equation of plane is $-40(x+2)-24(y-2)-16(z-2)=0 \Rightarrow \quad 40x+24y+16z=0$

$$\Rightarrow \quad 5x+3y+2z=0$$

Q69. Solution

Correct Answer: (B)

$\int \frac{\sin 2x}{\sin^4 x+\cos^4 x} dx$

$= \int \frac{2 \sin x \cos x}{\sin^4 x+\cos^4 x} dx = \int \frac{2 \tan x \sec^2 x}{1+\tan^4 x} dx$ Put $\tan^2 x = t \Rightarrow 2 \tan x \sec^2 x dx = dt$, then it reduced to

$\int \frac{dt}{1+t^2} = \tan^{-1} t + c = \tan^{-1}\left(\tan^2 x\right) + c$. Trick : By inspection,

$\frac{d}{dx}\left\{\cot^{-1}\left(\tan^2 x\right)\right\} = -\frac{1\left(2 \tan x \cdot \sec^2 x\right)}{1+\tan^4 x} = -\frac{\sin 2x}{\cos^4 x+\sin^4 x}$

$\Rightarrow \frac{d}{dx}\left\{\tan^{-1}\left(\tan^2 x\right)\right\} = \frac{\sin 2x}{\sin^4 x+\cos^4 x}$

Q70. Solution

Correct Answer: (B)

$$\lim_{x\to\infty} x^3\left(\sqrt{x^2+\sqrt{1+x^4}}-x\sqrt{2}\right)$$

$$=\lim_{x\to\infty}\frac{x^3\left(x^2+\sqrt{1+x^4}-2x^2\right)}{\sqrt{x^2+\sqrt{1+x^4}}+x\sqrt{2}}$$

$$=\lim_{x\to\infty}\frac{x^3\left(\sqrt{1+x^4}-x^2\right)}{\sqrt{x^2+\sqrt{1+x^4}}+x\sqrt{2}}$$

$$=\lim_{x\to\infty}\frac{x^3\left(1+x^4-x^4\right)}{\left(\sqrt{x^2+\sqrt{1+x^4}}+x\sqrt{2}\right)\left(\sqrt{1+x^4}+x^2\right)}$$

$$=\lim_{x\to\infty}\frac{x^3}{x^3\left(\sqrt{1+\sqrt{\frac{1}{x^4}+1}+\sqrt{2}}\right)\left(\sqrt{\frac{1}{x^4}+1}+1\right)}$$

$$=\lim_{x\to\infty}\frac{1}{\left(\sqrt{1+\sqrt{\frac{1}{x^4}+1}+\sqrt{2}}\right)\left(\sqrt{\frac{1}{x^4}+1}+1\right)}$$

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

$$=\frac{1}{4\sqrt{2}}$$

Q71. Solution

Correct Answer: (B)

Given $A=\begin{bmatrix}1&-1&1\\2&-1&0\\3&3&-4\end{bmatrix}$ and $B=\begin{bmatrix}1\\1\\2\end{bmatrix}, X=\begin{bmatrix}x\\y\\z\end{bmatrix}$ and $AX=B$

$\therefore \mathrm{AA^{-1}X=A^{-1}\,B\Rightarrow IX=A^{-1}\,B\Rightarrow X=A^{-1}\,B}$ Now $|\mathrm{A}|=4+(-8)+9=5$

$$\therefore A^{-1}=\begin{bmatrix}4&-1&1\\8&-7&2\\9&-6&1\end{bmatrix}\times\frac{1}{5}$$

$$\therefore \begin{bmatrix}x\\y\\z\end{bmatrix}=\frac{1}{5}\begin{bmatrix}4&-1&1\\8&-7&2\\9&-6&1\end{bmatrix}\begin{bmatrix}1\\1\\2\end{bmatrix}$$

$$=\frac{1}{5}\begin{bmatrix}8-1+2\\8-7+4\\9-6+2\end{bmatrix}=\frac{1}{5}\begin{bmatrix}5\\5\\5\end{bmatrix}$$

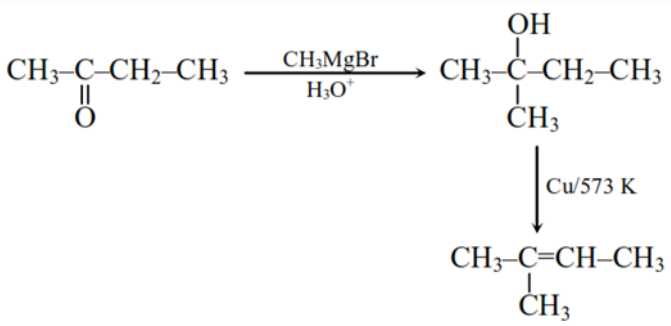
On comparing both side, we get

$$y=\begin{bmatrix}1\\1\\1\end{bmatrix}$$

$x=y=z=1\Rightarrow x+y+z=1+1+1=3$

Q72. Solution

Correct Answer: (D)



$\%\text{carbon} = \frac{\text{Atomicmass} \times \text{Atomicity}}{\text{Molarmass}} \times 100$

$= \frac{12 \times 4}{72} \times 100 = 66.66\%$

Q73. Solution

Correct Answer: (B)

Mean = np = 18

Variance = npq = 12

$\Rightarrow \frac{npq}{np} = \frac{12}{18}$

$\Rightarrow q = \frac{2}{3}$

$\Rightarrow p = 1 - q = 1 - \frac{2}{3}$

$\Rightarrow p = \frac{1}{3}$

Now $np = 18$

$\Rightarrow n\left(\frac{1}{3}\right) = 18$

$\Rightarrow n = 54$

$\Rightarrow \therefore$ Values of X are

0, 1, 2, ... 54

$\therefore$ 55 Values.

Q74. Solution

Correct Answer: (A)

Time taken for an electron to complete one revolution in Bohr orbit of hydrogen atom is $\mathrm{t} =$ distance/velocity

Distance of Bohr orbit = circumference of Bohr orbit $= 2\pi r$ $\mathrm{t} = 2\pi\mathrm{r}/\mathrm{v}$

Since $mvr = nh/2\pi$

$\mathrm{v} = \mathrm{nh}/2\pi\mathrm{mr}$

Thus, $\mathrm{t} = 2\pi\mathrm{r} \times (2\pi\mathrm{mr}/\mathrm{nh})$

$\mathrm{t} = 4\pi^2\mathrm{mr}^2/\mathrm{nh}$

Q75. Solution

Correct Answer: (B)

Pine oil is foaming agent. Now another substance collector such as potassium ethyl xanthate or amyl xanthate are added

Q76. Solution

Correct Answer: (C)

$$\ell_1 : \bar{r} = (1-t)\hat{i} + (t-2)\hat{j} + (3-2t)\hat{k}$$
$$= (\hat{i} - 2\hat{j} + 3\hat{k}) + t(-\hat{i} + \hat{j} - 2\hat{k})$$
$$\ell_2 : \bar{r} = (\hat{i} - \hat{j} + \hat{k}) + p(\hat{i} + 2\hat{j} + 2\hat{k})$$

Here $\bar{a}_2 - \bar{a}_1 = (\hat{i} - \hat{j} + \hat{k}) - (\hat{i} - 2\hat{j} + 3\hat{k}) = \hat{j} - 2\hat{k}$ $\quad \therefore \ \bar{b}_1 \times \bar{b}_2 = \sqrt{36+9} = 3\sqrt{5}$

$$\bar{b}_1 \times \bar{b}_2 = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ -1 & 1 & -2 \\ 1 & 2 & 2 \end{vmatrix} = \hat{i}(2+4) - \hat{j}(0) - 3\hat{k} = 6\hat{i} - 3\hat{k}$$

shortest distance $= \dfrac{\left(\bar{b}_1 \times \bar{b}_2\right) \cdot (\bar{a}_2 - \bar{a}_1)}{\left(\bar{b}_1 \times \bar{b}_2\right)} = \dfrac{(6\hat{i} - 3\hat{k}) \cdot (\hat{j} - 2\hat{k})}{3\sqrt{5}} = \dfrac{6}{3\sqrt{5}} = \dfrac{2}{\sqrt{5}}$

Q77. Solution

Correct Answer: (A)

In a given mixture, the ionization of two acids can be written at

Let α, β be degree of ionization at same concentration.

$$\underset{1-\alpha}{CH_3COOH} \rightleftharpoons \underset{\alpha}{CH_3COO^-} + \underset{\alpha+\beta}{H^+}$$

$$\underset{1-\beta}{C_2H_5COOH} \rightleftharpoons \underset{\beta}{C_2H_5COO^-} + \underset{\alpha+\beta}{H^+}$$

So $K_{\text{Acetic acid}} = \dfrac{[\alpha][\alpha+\beta]\cdot c}{[1-\alpha]}$

$K_{\text{Prepionic acid}} = \dfrac{[\beta][\alpha+\beta]\cdot c}{[1-\beta]}$

So $\dfrac{K_{\text{acetic acid}}}{K_{\text{propinoic acid}}} = \dfrac{\alpha}{1-\alpha} \times \dfrac{(1-\beta)}{\beta}$

or $\dfrac{\alpha}{1-\alpha} = \dfrac{1.75}{1.3} \times \left[\dfrac{\beta}{1-\beta}\right]$.

Q78. Solution

Correct Answer: (B)

The correct option is $B\frac{d^2y}{dx^2} + a^2y = 0$ $y = c_1 \cos ax + c_2 \sin ax$ Differentitate it w.r.t.x, we get $\frac{dy}{dx} = -c_1 a \sin ax + c_2 a \cos ax$ Again $\frac{d^2y}{dx^2} = -c_1 a^2 \cos ax - c_2 a^2 \sin ax$ $\frac{d^2y}{dx^2} = -a^2 (c_1 \cos ax + c_2 \sin ax)$ $\Rightarrow \frac{d^2y}{dx^2} = -a^2 y$ or $\frac{d^2y}{dx^2} + a^2 y = 0$

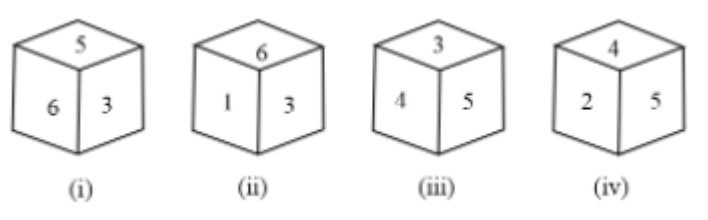
Q79. Solution

Correct Answer: (B)

$$FeSO_4 + NO \rightarrow \underset{\text{(Brown)}}{FeSO_4 \cdot NO}$$

Q80. Solution
Correct Answer: (C)

In the figure (i) and (iv) the common number is 5, and if we unwind the dices in clockwise direction.



Then the numbers on dice (i) will be $5,\ 3,\ 6$, and the numbers on the dice (iv) will be $5,\ 2,\ 4$.

Hence, on comparing the numbers side by side, number is on the face opposite to 6 is 4.

Q81. Solution
Correct Answer: (D)

We have, $\frac{(1-3x)^2}{(1-2x)} = \left(1+9x^2-6x\right)(1-2x)^{-1} = \left(1+9x^3-6x\right)\left(1+(2x)+(2x)^2+(2x)^3+\ldots\right)$
Coefficient of $x^4 = 16+36-48 = 52-58 = 4$

Q82. Solution
Correct Answer: (C)

Given series:
BKS, DJT, FIU, HHV, ?

By observing closely, we find that the letters are following the pattern below:
There are three patterns following in the given letters in each set, i.e., $+2, -1, +1$ to the given letters of each set to get the next set of letters.

$\mathrm{B}+2=\mathrm{D},\ \mathrm{D}+2=\mathrm{F},\ \mathrm{F}+2=\mathrm{H},\ \mathrm{H}+2=\mathrm{JK}-1=\mathrm{J},\ \mathrm{J}-1=\mathrm{I},\ \mathrm{I}-1=\mathrm{H},\ \mathrm{H}-1=\mathrm{GS}+1=\mathrm{T},\ \mathrm{T}+$

So, the next term in the series is JGW.
Hence, this is the correct answer.

Q83. Solution

Correct Answer: (B)

As given, $2\tan^{-1}(\cos\ x) = \tan^{-1}(2\,\text{cosec}\ x)$

$\tan^{-1}(\cos\ x) + \tan^{-1}(\cos\ x) = \tan^{-1}(2\,\text{cosec}\ x)$

Since $|\cos x| \leq 1$

$= \tan^{-1}\left[\frac{2\cos\ x}{1-\cos^2 x}\right] = \tan^{-1}(2\,\text{cosec}\ x)$

$\Rightarrow\ \frac{2\cos\ x}{\sin^2 x} = 2\,\text{cosec}\ x$

$\Rightarrow\ 2\cot\ x = 2$

$\Rightarrow\ \cot\ x = 1$

$\Rightarrow\ x = \frac{\pi}{4}$

Hence,

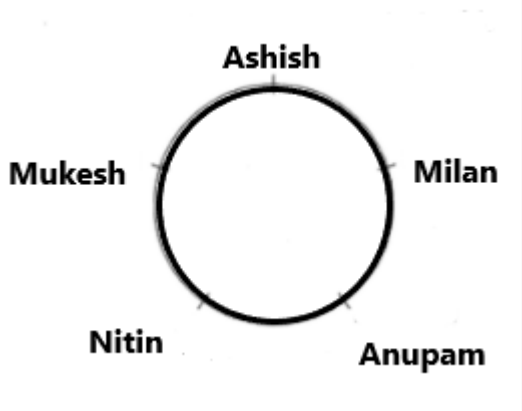
$\sin\ x + \cos\ x = \sin\frac{\pi}{4} + \cos\frac{\pi}{4}$

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

$= \sqrt{2}$

Q84. Solution

Correct Answer: (D)



As per the given information, Ashish was to the left of Milan, Nitish was to the right of Anupam and between Anupam and Mukesh we can conclude that Ashish was to the right of Mukesh.

Hence, the correct answer is Ashish.

Q85. Solution

Correct Answer: (C)

Let $\mathrm{d(AP)} = \mathrm{x} \Rightarrow \mathrm{d(BP)} = 12 - \mathrm{x}$

$\mathrm{f(x)} = \mathrm{AP}^2 + \mathrm{BP}^2$

$= \mathrm{x}^2 + (12 - \mathrm{x})^2$

$\therefore \mathrm{f'(x)} = 4\mathrm{x} - 24$ and when $\mathrm{f'(x)} = 0,$ we get $\mathrm{x} = 6.$

$\mathrm{f''(x)} = 4 > 0$

Hence $f(x)$ is minimum at $x = 6$

Q86. Solution

Correct Answer: (B)

Given $\overline{AB} = 3\hat{i} + 5\hat{j} + 4\hat{k}$

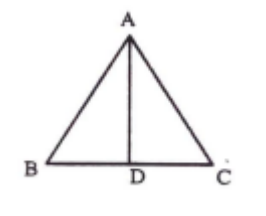
$\overline{AC} = 5\hat{i} - 5\hat{j} + 2\hat{k}$

Let $\overline{AD}$ is median position vector of

$$\overline{AD} = \frac{(3\hat{i} + 5\hat{j} + 4\hat{k}) + (5\hat{i} - 5\hat{j} + 2\hat{k})}{2}$$

$$\overline{AD} = 4\hat{i} + 3\hat{k}$$

$$\therefore |\overline{AD}| = \sqrt{16 + 9} = \sqrt{25} = 5$$



Q87. Solution

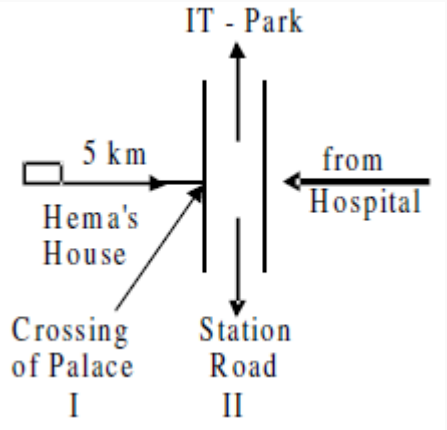
Correct Answer: (C)

$D_{30} = \{1, 2, 3, 5, 6, 10, 15, 30\}$

$$\begin{aligned} f(2, 5, 15) &= (2 + 5) \cdot (5' + 15) \\ &= 10 \cdot \left(\frac{30}{5} + 15\right) \\ &= 10(6 + 15) \\ &= 10 \cdot 30 \\ &= 10 \end{aligned}$$

Q88. Solution

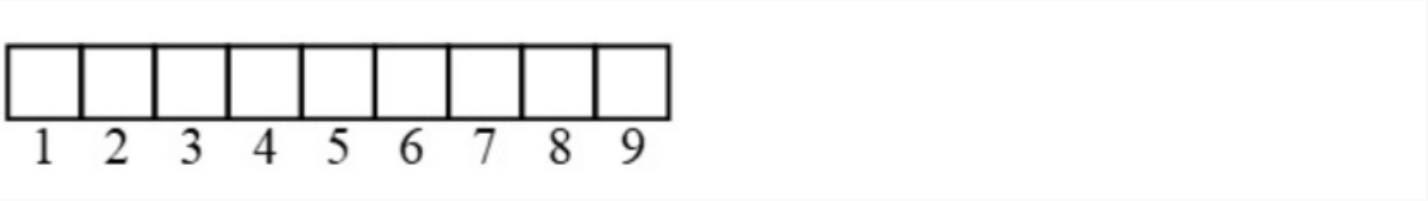
Correct Answer: (B)



From II it is clear that the road which goes to IT-Park is to the left to Hema.

Q89. Solution

Correct Answer: (B)



ways and remaing five even digits $4, 4, 8, 8, 8$ can be arranged in 5 places in $\frac{5}{\underline{23}}$ Hence total no of ways $= \frac{\lfloor 4}{\lfloor 2 L 2} \times \frac{5}{2\underline{23}} = 6 \times 10 = 60$

Q90. Solution

Correct Answer: (D)

As per the given information in the question, we need to find the odd one out of all the options given.

Feeling, idea, thought and Emotion all are process of thinking. Whereas, Expression is a way to show or tell these feelings, idea, thought and Emotion to outside world. Hence, Expression is an odd one out.

Therefore, the correct answer is Expression.

Q91. Solution

Correct Answer: (A)

According to the venn diagram given in the question we can see that X comes under the triangle, square and circle whose values are given to us. The value of triangle, square and circle are 7, 5 and 4 respectively.

Value of X $= 7 \times 5 \times 4 = 140$

Thus, this is the correct answer.

Q92. Solution

Correct Answer: (C)

Given $\sum x = 12, \sum x^2 = 16.9$ and $n = 10$

$$\because \text{ S.D. } = \sqrt{\frac{\sum x^2}{n} - \left(\frac{\sum x}{n}\right)^2} = \sqrt{\frac{16.9}{10} - \left(\frac{12}{10}\right)^2}$$

$$= \sqrt{\frac{169 - 144}{100}} = \frac{5}{10} = 0.5$$

Q93. Solution

Correct Answer: (B)

We have, $7^n = (1+6)^n$

$$
\begin{aligned}
&= {}^nC_0 + {}^nC_1 6^1 + {}^nC_2 6^2 + {}^nC_3 6^3 + \ldots + {}^nC_n 6^n \\
&= 1 + 6n + 66^2\left[{}^nC_2 + {}^nC_3 6 + \ldots + {}^nC_n 66^{n-2}\right] \\
&= 1 + 6n + 36\lambda \quad \left[\text{ where, } {}^nC_2 + \ldots + {}^nC_n 6^{n-2} = \lambda\right] \\
\Rightarrow \quad & 7^n - 6n = 36\lambda + 1 \\
\Rightarrow \quad & 7^n - 6n - 50 = 36\lambda - 49 \\
\Rightarrow \quad & 7^n - 6n - 50 = 36\lambda - 72 + 23 \\
\Rightarrow \quad & 7^n - 6n - 50 = 36(\lambda - 2) + 23
\end{aligned}
$$

$$\Rightarrow \quad 7^n - 6n - 50 = 36\mu + 23[\text{ where } \lambda - 2 = \mu]$$

$\therefore$ When $7^n - 6n - 50$ is divided by 36 , then remainder will be equal to 23 .

Q94. Solution

Correct Answer: (D)

$|z| + z = 3 + i$

$\Rightarrow \sqrt{x^2 + y^2} + x + iy = 3 + i[\text{ let } z = x + iy]$

$\Rightarrow \sqrt{x^2 + y^2} + x = 3 \text{ and } y = 1$

$\Rightarrow \sqrt{x^2 + 1^2} + x = 3$

$\Rightarrow x^2 + 1 = (3 - x)^2$

$\Rightarrow x = \dfrac{4}{3}$

$\Rightarrow |z| = \sqrt{x^2 + y^2} = \sqrt{\left(\dfrac{4}{3}\right)^2 + 1^2} = \dfrac{5}{3}$

Q95. Solution

Correct Answer: (B)

$\lim_{n\to\infty}\left(\frac{1^4}{1^5+n^5} + \frac{2^4}{2^5+n^5} + \frac{3^4}{3^5+n^5} + \ldots + \frac{n^4}{n^5+n^5}\right)$

$\sum_{r=0}^{r=n} \frac{r^4}{r^5+n^5} = \int_0^1 \frac{x^4}{1+x^5}dx$

Put $1 + x^5 = t \Rightarrow 5x^4dx = dt$

$= \int_1^2 \frac{1}{5t}dt = \frac{1}{5}[\log t]_1^2$

$= \frac{1}{5}[\log 2 - \log 1] = \frac{\log 2}{5}$

Q96. Solution

Correct Answer: (C)

$P(A)=1-P\left(A'\right)=1-\frac{2}{3}=\frac{1}{3}$

and $P(B)=1-P\left(B'\right)=1-\frac{2}{7}=\frac{5}{7}$

Now if A and B are independent event then,

$\mathrm{P(A \cap B)=P(A)P(B)}=\frac{1}{3} \cdot \frac{5}{7}=\frac{5}{21}$

Q97. Solution

Correct Answer: (B)

Impulse = Change is momentum p_i-p_f direction of p_f and p_i apposite to each other.

$$\begin{aligned}\therefore \quad \text{Impulse } &= mu-(-mv) \\ &= mu+mv=m(u+v)=0.1(30+20) \\ &= 0.1 \times 50=5 \text{ N}-\text{s}\end{aligned}$$

Q98. Solution

Correct Answer: (B)

According to the given condition, one is added to the place values of the vowels and, one is subtracted from the place values of the consonants.
For example, E will be coded as F and C will be coded as B.
Given word, ENIGMATIC

After rearranging it becomes, FMJFLBSJB.
So, the sixth letter from left is B.
Hence, the correct answer is B.

Q99. Solution

Correct Answer: (D)

In all the given letter groups except (D), we move one place in the forward direction to get the next letter, i.e. the letters in a group are related in the following manner -

$Z + 1 = A$ and $A + 1 = B$

Similarly,

$Y + 1 = Z$ and $Z + 1 = A$

$P + 1 = Q$ and $Q + 1 = R$

But, in the fourth option,

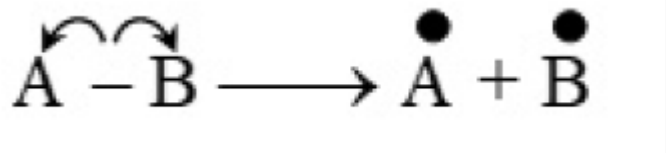
$Y + 1 = Z$ and $Z + 2 = B$

Option D is not following the same pattern and therefore, it is the odd one out.

Q100. Solution

Correct Answer: (A)

Homolytic fission (sometimes referred to as hemolysis) is a type of bond fission that involves the dissociation of a given molecule wherein one electron is retained by each of the original fragments of the molecule. Therefore, when a neutrally charged molecule is subjected to homolytic fission, two free radicals are obtained as the product (since each of the chemical species retains one electron from the bond pair).



Q101. Solution
Correct Answer: (D)

Savings

$= 26000 \text{ of } 22\%$

$=₹ \left(\frac{26000 \times 22}{100}\right) =₹ 5720$

Amount spend on purchasing gold:

$₹ \left(\frac{5720 \times 65}{100}\right)$

$=₹ 3718$

So, Mahesh spends ₹ 3718 on purchasing gold.

Hence, the correct answer is ₹ 3718.

Q102. Solution
Correct Answer: (B)

Given that,

A is the brother of B, C is the brother of A.

Is it clear that C is the Brother of B but how B is related to C depends on the sex of B.

Q103. Solution
Correct Answer: (D)

The numbers of the series given in the options have similar or repeated digits. Whereas in $35 - 51$ series, the numbers 1 and 3 do not get repeated, thus making it the odd one out.

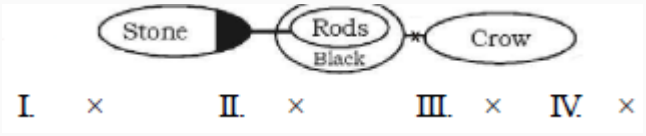
Hence, our answer is $35 - 51$.

Q104. Solution
Correct Answer: (D)

(I) $\Rightarrow N = 64 (\because$ only 64 is both the square of an integer and the cube of an integer) $\therefore$ Statement (I) alone is sufficient to answer the question. (II) $\Rightarrow N = 64. \therefore$ Statement (II) alone is sufficient to answer the question.

Q105. Solution

Correct Answer: (B)



Q106. Solution

Correct Answer: (C)

The following four series are combined to get the given series.
M L K J I
A B C D
Z Y X W
N O P Q

Q107. Solution

Correct Answer: (D)

In the given letter sequence $\underset{1\ 2}{\text{cpeajebcsmajammfdadhco}\underline{\text{au}}\text{idpakseadfaje afdc}}\underset{3}{\underline{\text{aaae}}}\underset{4\ 5}{\text{k}}\underset{6}{\underline{\text{aaakaea}}}$ There are 6 vowels which are immediately preceded by a vowel and immediately followed by a vowel

Q108. Solution

Correct Answer: (D)

Note the direction of arrow which changes alternately. The dots are also changing alternately. Hence we are looking for a figure in which the arrow points down and the dots and positioned as in figure (B).

Q109. Solution

Correct Answer: (B)

Assertion states that India is a democratic country. It is true, and it was declared when the Constitution was adopted on January 26, 1950. Democratic is the country in which the people are free to elect their Government.

Reason states that India has a constitution of its own It is also true as the Constitution of India was adopted on January 26, 1950, declaring India, a sovereign, democratic, and republic state.
Both assertion and reason are true, but R is not the correct explanation of A, as India is democratic because the government is elected by its citizens and not because of the Indian Constitution.
Hence, option B is the correct answer.

Q110. Solution
Correct Answer: (B)

Mirror image for
'd' is 'ɓ', 'e' is 'ɘ', 'a' is 'ɐ' and 'r'
is 'ɿ'

Thus, option (2) is the correct answer.

Q111. Solution
Correct Answer: (D)

Consider pair of numbers
$(1, 1) = (1, 1^3)$
$(2, 4) = (2, 2^2)$
$(3, 27) = (3, 3^3)$
$(4, 16) = (4, 4^2)$
Next number will be 5.

Q112. Solution
Correct Answer: (D)

The word PURPOSED consists of all the alphabets which are required for the words ROPE, PURE, and ROSE.

But, the word DARE has the alphabet A, which is not present in the given word. Hence, the word DARE can not be formed using the alphabets of the word given in the question.

Q113. Solution
Correct Answer: (C)

'Damp squib' is an idiom that means a situation or event much less impressive than expected.
For example:
a) The party turned out to be a bit of a damp squib. Half the people who'd been invited didn't turn up.
b) The film has garnered a lot of hype, but I thought it was a bit of a damp squib.
Hence, this is the correct answer.

Q114. Solution
Correct Answer: (B)

The adjective 'obscure' means not discovered or known about; uncertain. 'Hidden' and 'concealed' are synonyms of 'obscure.'

Among the options, the adjective 'obvious' means easily perceived or understood; clear, self-evident or apparent. It is an antonym of 'obscure.' Therefore, option B is the correct answer.

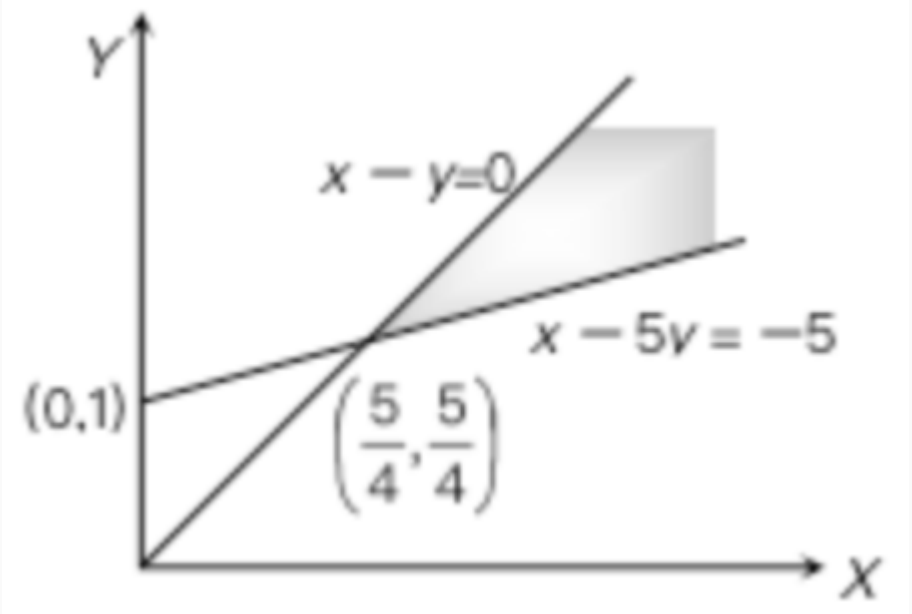
Q115. Solution
Correct Answer: (D)

The meanings of the given words are:
Converge: (of lines) tend to meet at a point
Savoury: (of food) belonging to the category that is salty or spicy rather than sweet
Brief: of short duration; not lasting for long
Obvious: easily perceived or understood; clear, self-evident, or apparent
Diverge: (of a road, route, or line) separate from another route and go in a different direction

Hence, we can say that 'converge' and 'diverge' are opposite in meaning.

Q116. Solution
Correct Answer: (B)

Required region is unbounded whose vertex is $\left(\frac{5}{4}, \frac{5}{4}\right)$.



Hence the minimum value of objective function is $= 2 \times \frac{5}{4} + 10 \times \frac{5}{4} = 15$.

Q117. Solution

Correct Answer: (A)

Given $\frac{dr}{dt} = 2$ cm/sec$r = 10$ cm We have $A = \pi r^2$ Diff. w.r.t. t

$$\frac{dA}{dt} = 2\pi r\frac{dr}{dt}$$
$$= 2\pi \times 10 \times 2$$
$$= 40\pi$$

Q118. Solution

Correct Answer: (C)

Since, p, q, r non-zero, non-coplanar vectors then, $[\overline{p} + \overline{q} - \overline{r}, \overline{p} - \overline{q}, \overline{q} - \overline{r}] = \begin{matrix} 11-1 \\ 1-10 \\ 01-1 \end{matrix} [p \quad q \quad r]$

$= (1 + 1 - 1)[p \quad q \quad r]$
$= [p \quad q \quad r]$

Q119. Solution

Correct Answer: (D)

Section-I	Section-II	No. of ways
2	4	${}^6C_2 \times {}^5C_4 = 15 \times 5 = 75$
3	3	${}^6C_3 \times {}^5C_3 = 20 \times 10 = 200$
4	2	${}^6C_4 \times {}^5C_2 = 15 \times 10 = 150$
		Total $= 425$

Q120. Solution

Correct Answer: (B)

Circumcentre divides orthocentre $A(-3, 0)$ and centroid $B(3, 3)$ externally in the ratio 3:1 Hence, $C \equiv \left(\frac{3\times3-1\times(-3)}{3-1}, \frac{3\times3-1\times5}{3-1}\right) \equiv (6, 2)$ Now required radius $= \frac{1}{2}AC = \frac{1}{2}\sqrt{(6+3)^2 + (2-5)^2} = 3\sqrt{\frac{5}{2}}$

Q121. Solution

Correct Answer: (A)

We have $\left(y + x\frac{dy}{dx}\right)\sin xy = \cos x$ Put $xy = u \Rightarrow x\frac{dy}{dx} + y = \frac{du}{dx} \therefore \left(\frac{\mathrm{du}}{\mathrm{dx}}\right)\sin \mathrm{u} = \cos \mathrm{x}$
$\therefore \int \sin u du = \int \cos x dx \Rightarrow -\cos u = \sin x + c \Rightarrow -\cos xy = \sin x + c$ When $x = 0$, we get
$-\cos 0 = 0 + c \Rightarrow c = -1 \therefore -\cos xy = \sin x - 1 \Rightarrow \sin x + \cos xy = 1$

Q122. Solution
Correct Answer: (A)

Let AB be the chord Let the mid point of chord be $\mathrm{M(h,k)}$ Here centre is $\mathrm{O}=(3-1)$ Here $OM \perp AB \therefore$ (slope of OM)(slope of AB) $=-1\left(\frac{\mathrm{k}+1}{\mathrm{h}-3}\right)\left(\frac{2}{5}\right)=-1 \therefore 5\ \mathrm{h}+2\mathrm{k}=13$ Point $M(h,k)$ lies on the $2x-5y+18=0$...(1) $\therefore 2\ \mathrm{h}-5\mathrm{k}=-18$...(2) Solving equation (1) \& (2) we get $\mathrm{h}=1, \mathrm{k}=4 \Rightarrow (1,4)$ is required point.

Q123. Solution
Correct Answer: (D)

Given: A is non-singular matrix then $|\mathrm{A}| \neq 0$ Also $(\mathrm{A}-2\mathrm{I})(\mathrm{A}-4\mathrm{I})=0\ \mathrm{A}^2-6\mathrm{A}+8\mathrm{I}=0$ multiply by A^{-1} both the side We have $\mathrm{A}+8\mathrm{A}^{-1}=6\mathrm{I}$

Q124. Solution
Correct Answer: (D)

(a) $\sin 120^{\circ}=\sin\left(90^{\circ}+30^{\circ}\right)=\cos 30^{\circ}=\frac{\sqrt{3}}{2}$ (b)
$\cos 930^{\circ}=\cos\left[\left(2\times 360^{\circ}\right)+210^{\circ}\right]=\cos 210^{\circ}=\cos(180+30)=-\cos 30^{\circ}=-\frac{\sqrt{3}}{2}$ (c)
$\tan 840^{\circ}=\tan\left[\left(2\times 360^{\circ}\right)+120^{\circ}\right]=-\tan 120^{\circ}=-\cot 30^{\circ}=-\sqrt{3}$ (d)
$\cot\left(-1110^{\circ}\right)=-\cot 1110^{\circ}=-\cot\left[\left(3\times 360^{\circ}\right)+30^{\circ}\right]=-\cot 30^{\circ}=-\sqrt{3}$

Q125. Solution
Correct Answer: (A)

The eccentricity of the ellipse $y^2+4x^2-12x+6y+14=0$ is $\frac{\sqrt{3}}{2}$. Given ellipse,
$y^2+4x^2-12x+6y+14=0$
$4x^2-12x+y^2+6y+14=0$
$4\left(x^2-3x+\frac{9}{4}\right)+y^2+6y+9=-14+9+9$
$4\left(x-\frac{3}{2}\right)^2+(y+3)^2=4$
$\frac{\left(x-\frac{3}{2}\right)^2}{1}+\frac{(y+3)^2}{4}=1$
Here, $a^2=1, b^2=4$
$\therefore e=\sqrt{1-\frac{a^2}{b^2}}$
$e=\sqrt{1-\frac{1}{4}}$

Q126. Solution
Correct Answer: (B)

$\frac{1^2}{2}+\frac{1^2+2^2}{3}+\frac{1^2+2^2+3^2}{4}+\underset{\text{term}}{\text{general}}\ \sum_{t=1}^{8}\frac{\sum\varepsilon^2}{\varepsilon}==\sum_{\varepsilon=1}^{8}\frac{\varepsilon(\varepsilon+1)(2q+1)}{6\varepsilon}=\frac{1}{6}\sum_{\varepsilon=1}^{8}\frac{(2+1)(2\varepsilon+1)}{(8)}$
$=\frac{1}{6}\sum_{\varepsilon=1}^{8}\left[2\varepsilon^2+3r+1\right]=\frac{1}{6}\left[\frac{2\times 8\times 9\times 17}{6}+\frac{3\times 8\times 9}{2}+8\right]=74$

Q127. Solution

Correct Answer: (A)

Let $A = \begin{bmatrix} 1 & a & b \\ \omega & 1 & c \\ \omega^2 & \omega & 1 \end{bmatrix}$ For non-singular matrix $|A| \neq 0$

$$\Rightarrow \begin{vmatrix} 1 & a & b \\ \omega & 1 & c \\ \omega^2 & \omega & 1 \end{vmatrix} \neq 0$$

$\Rightarrow 1(1-\omega c) - a\left(\omega - \omega^2 c\right) + b(0) \neq 0$

$\Rightarrow 1(1-\omega c) - a\omega(1-\omega c) \neq 0$

$\Rightarrow (1-\omega c)(1-a\omega) \neq 0$

$\Rightarrow c \neq \dfrac{1}{\omega}$ and $a \neq \dfrac{1}{\omega}$

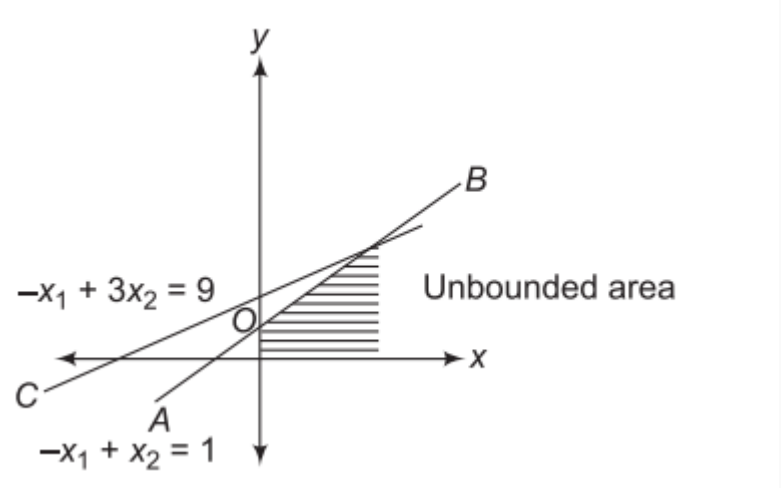
$\Rightarrow c \neq \omega^2$ and $a \neq \omega^2 \quad \ldots \left[\because \omega^3 = 1\right]$

So possible value of a and c is ω only and b can take values ω or ω^2.

$\therefore$ The possible number of distinct matrices $= 2$.

Q128. Solution

Correct Answer: (B)



So, constraints defines unbounded feasible space.

Q129. Solution

Correct Answer: (C)

$\tan[f(x)] = \tan\left[\frac{x}{2} - 1\right] = \begin{cases} \tan(-1), & \text{if} \quad 0 \leq x < 2 \\ \tan(0) = 0, & \text{if} \quad 2 \leq x \leq \pi \end{cases}$ which is discontinuous at $x = 2$ $\frac{1}{f(x)} = \frac{1}{\frac{x}{2}-1}$

which is discontinuous at $x = 2$

Q130. Solution

Correct Answer: (A)

$$\int_1^2 |2x-[3x]|dx = \int_1^{\frac{4}{3}} |2x-3|dx + \int_{\frac{4}{3}}^{\frac{5}{3}} |2x-4|dx + \int_{\frac{5}{3}}^{2} |2x-5|dx$$

$$= \int_1^{\frac{4}{3}} (3-2x)dx + \int_{\frac{4}{3}}^{\frac{5}{3}} (4-2x)dx + \int_{\frac{5}{3}}^{2} (5-2x)dx$$

$$= \left[3x-x^2\right]_1^{4/3} + \left[4x-x^2\right]_{4/3}^{5/3} + \left[5x-x^2\right]_{5/3}^{2}$$

$$= 3[x]_1^{4/3} + [4x]_{4/3}^{5/3} + 5\left[x^2\right]_{5/3}^{2} - \left[x^2\right]_1^{2}$$

$$= (3+4+5)\times\frac{1}{3} - \left(2^2-1^2\right)$$

$$= 4-3 = 1$$

Q131. Solution

Correct Answer: (D)

$g(x) = 1+\sqrt{x}$ and $\mathrm{f}(\mathrm{g}(x)) = 3+2\sqrt{x}+x$

$\therefore \quad \mathrm{f}(\mathrm{g}(x)) = \left[(\sqrt{x})^2 + 2\sqrt{x} + 1\right] + 2$

$= (\sqrt{x}+1)^2 + 2$

$= [\mathrm{g}(x)]^2 + 2$

$\Rightarrow \mathrm{f}(x) = x^2 + 2$

$\Rightarrow \mathrm{f}(\mathrm{f}(x)) = \left(x^2+2\right)^2 + 2 = x^4 + 4x^2 + 6$

Q132. Solution

Correct Answer: (B)

$xy = 1$

$\therefore \quad y = \dfrac{1}{x} \quad \therefore \quad$ Slope of the normal $= x^2$ Slope of the line $ax+by+c=0$ is $\frac{-a}{b}$. Since the line

$\therefore y' = \dfrac{-1}{x^2}$

$ax+by+c=0$ is a normal to the curve $xy=1$, $x^2 = -\frac{\mathrm{a}}{\mathrm{b}}$ For this condition to hold true, either $\mathrm{a}<0,\ \mathrm{b}>0$ or $\mathrm{b}<0, \mathrm{a}>0$

Q133. Solution

Correct Answer: (D)

$$A = \begin{matrix} 1 & -1 & 1 \\ 0 & 2 & -3 \\ 2 & 1 & 0 \end{matrix}$$

$\Rightarrow |A| = 1 \times (0+3) + 1 \times (0+6) + 1 \times (0-4) = 5$

$\because B = \text{adj } A$

$\Rightarrow |B| = |\text{adj } A| = |A|^2 = 25$

$\Rightarrow |\text{adj } B| = |B|^2 = 625$

$\because C = 5A$

$\Rightarrow |C| = |5A| = 5^3|A| = 125 \times 5 = 625$

now $\dfrac{|\text{adj } B|}{|C|} = \dfrac{625}{625} = 1$

Q134. Solution

Correct Answer: (C)

Let (x_1, y_1) be the required point $\therefore \quad 2x_1 - y_1 = 5$ Also, (x_1, y_1) is at the distance of 1 unit from line $3x + 4y = 5$

$$\therefore \quad 1 = \frac{3x_1 + 4y_1 - 5}{\sqrt{9+16}}$$

$$\therefore \quad \pm 5 = 3x_1 + 4y_1 - 5$$

$$\therefore \quad 3x_1 + 4y_1 - 5 = 5 \quad \text{or } 3x_1 + 4y_1 - 5 = -5$$

$$\therefore \quad 3x_1 + 4y_1 = 10$$

or

$$3x_1 + 4y_1 = 0$$

Solving equations (i) and (ii), we get $x_1 = \frac{30}{11}$ and $y_1 = \frac{5}{11}$ Solving equation (i) and (iii), we get $x_1 = \frac{20}{11}$ and $y_1 = \frac{-15}{11} \therefore \quad \left(\frac{30}{11}, \frac{5}{11}\right)$ and $\left(\frac{20}{11}, \frac{-15}{11}\right)$ are the required points.

Q135. Solution

Correct Answer: (A)

Given,

initial angular speed, $\omega_0 = 0$,

final angular speed, $\omega = 350 \text{ rps}$

and time, $t = 220$ s.

Let the angular acceleration be α.

Use, $\omega = \omega_0 + \alpha t$

$\therefore 350 = 0 + \alpha \times 220$

$\Rightarrow \alpha = \frac{350}{220}$

$\Rightarrow \alpha = \frac{35}{22} \text{ rps}^2$

$\because$ 1 revolution$= 2\pi$ rad

$\therefore \alpha = \frac{35}{22} \times 2\pi \text{ rad s}^{-2}$

$\Rightarrow \alpha = \frac{35}{22} \times 2 \times \frac{22}{7} = 10 \text{ rad s}^{-2}$.

Q136. Solution

Correct Answer: (D)

$\because \frac{dT}{T} = \frac{1}{2} \bullet (\alpha \propto \mathrm{d}T)$
$dT = \left(\frac{1}{2}\right)\left(\frac{1}{2}\right)\left(9 \times 10^{-7}\right)(10)$
$dT = 2.25 \times 10^{-6}$

Q137. Solution

Correct Answer: (C)

Atomic size decreases across the series from left to right. $\mathrm{Ce} > \mathrm{Pr} > \mathrm{Pm} > \mathrm{Sm}$

Q138. Solution

Correct Answer: (C)

$V_1 = 3.4 \text{ L}, \quad T_1 = 25^\circ\text{C} = 25 + 273 = 298 \text{ K}$
$V_2 = 10.2 \text{ L}, \quad T_2 = ?$
According to Charle's Law,
$\frac{\mathrm{V_1}}{\mathrm{T_1}} = \frac{\mathrm{V_2}}{\mathrm{T_2}}$ (at constant P and n)
$\therefore \mathrm{T_2} = \frac{\mathrm{V_2} \times \mathrm{T_1}}{\mathrm{V_1}} = \frac{10.2 \text{ L} \times 298 \text{ K}}{3.4 \text{ L}} \quad \therefore \mathrm{T_2} = 894 \text{ K}$

Q139. Solution

Correct Answer: (B)

According to the question,

Given information is, $11,\ 14,\ 23,\ 50,\ 131,\ ?$

Now we find the next number of given series,

So the pattern is used in this series, $+3^1,\ +3^2,\ +3^3,\ +3^4,\ +3^5$

$14\ =\ 11\ +\ 3^1,\ 23\ =\ 14\ +\ 3^2, 50\ =\ 23\ +\ 3^3,\ 131\ =\ 50 +\ 3^4,\ ?\ =\ 131\ +\ 3^5\ =\ 374$

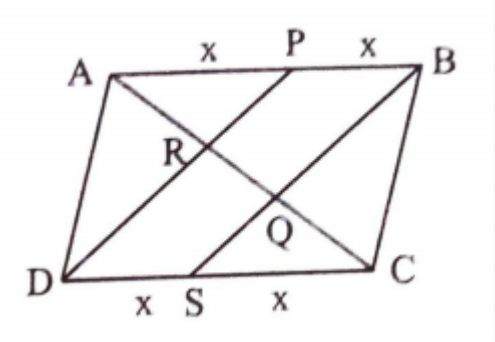
So, the next number of this series is, 374.

Hence, the answer is 374.

Q140. Solution

Correct Answer: (C)

Draw BS parallel to DP as shown Let $AP = PB = x \Rightarrow DS = x \Rightarrow SC = x\ \triangle BAQ \sim \triangle PAR$
$\therefore \frac{\mathrm{AB}}{\mathrm{AP}} = \frac{\mathrm{AQ}}{\mathrm{AR}} \Rightarrow \frac{2\mathrm{x}}{\mathrm{x}} = \frac{\mathrm{AQ}}{\mathrm{AR}} \Rightarrow \mathrm{AQ} = 2\mathrm{AR}$ Thus R is mid point of AQ. i.e. $\mathrm{AR} = \mathrm{RQ}$ Similarly Δ CQS Δ CRD $\therefore \mathrm{CQ} = \mathrm{RQ}$ Thus we get $\mathrm{AR} = \mathrm{RQ} = \mathrm{CQ}$ Hence point R divides AC in the ratio $1 : 2$



Q141. Solution

Correct Answer: (B)

$$I = \int_0^{\frac{\pi}{2}} \left(e^{\sin x} - e^{\cos x}\right) dx \ldots . (1)$$

$$\text{Let} \quad = \int_0^{\pi/2} e^{\sin\left(\frac{\pi}{2} - x\right)} - e^{\cos\left(\frac{\pi}{2} - x\right)} \mathrm{dx}$$

$$= \int_0^{\pi/2} e^{\cos x} - e^{\sin x} dx \ldots . (2)$$

Adding equation (1) \& (2) we get

$$2I = \int_0^{\pi/2} \left(e^{\sin x} - e^{\cos x} - e^{\cos x} - e^{\sin x}\right) dx$$
$$2I = 0 \Rightarrow I = 0$$

Q142. Solution

Correct Answer: (B)

Circle $x^2 + y^2 - 4x + 10y + 20 = 0$ has centre $C_1 = (2, -5)$ and radius

$$r_1 = \sqrt{4 + 25 - 20} = 3$$

Circle $x^2 + y^2 + 8x - 6y - 24 = 0$ has centre $C_2 = (2, -5)$ and radius

$$r_2 = \sqrt{16 + 9 + 24} = 7$$

Distance between centres

$$= \sqrt{(2+4)^2 + (5-2)^2} = 10$$

Thus circle touch each other externally at one point only. $\therefore$ Equation of common tangent is

$$\left(x^2 + y^2 - 4x + 10y + 20\right) - \left(x^2 + y^2 + 8x - 6y - 24\right) = 0 \text{ i.e.}$$
$$12x - 16y - 44 = 0 \quad \Rightarrow \quad 3x - 4y - 11 = 0$$