Answer Key

Other (142 Questions)

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

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

Solutions

Q1. Solution

Correct Answer: (C)

As no torque is applied

$I_1\omega_1 = I_2\omega_2$ or $\left(MK_1^2\right)\omega_1 = \left(MK_2^2\right)\omega_2$

$\therefore \frac{K_1}{K_2} = \sqrt{\frac{\omega_2}{\omega_1}}$

Q2. Solution

Correct Answer: (A)

Initial volume, $\mathrm{V}_1 = 100.0\ \mathrm{l} = 100.0 \times 10^{-3} \mathrm{m}^3$
Final volume, $\mathrm{V}_2 = 100.5\ \mathrm{l} = 100.5 \times 10^{-3} \mathrm{m}^3$
Increase in volume, $\Delta \mathrm{V} = \mathrm{V}_2 - \mathrm{V}_1 = 0.5 \times 10^{-3} \mathrm{m}^3$
Increase in pressure, $\Delta \mathrm{p} = 100.0\ \mathrm{atm} = 100 \times 1.013 \times 10^5\ \mathrm{Pa}$

Bulk modulus $= \frac{\Delta p}{\frac{\Delta V}{V}} = \frac{\Delta p \times V_1}{\Delta V} = \frac{100 \times 1.013 \times 10^5 \times 100 \times 10^{-3}}{0.5 \times 10^{-3}}$
$= 2.026 \times 10^9\ \mathrm{Pa}$

Q3. Solution
Correct Answer: (A)

We have, angular velocity is differentiation of angular position and angular acceleration is derivative of angular velocity.

Torque (T) is cross product of force (F) and distance (r) which also equal to Moment of Inertia (I) product by angular acceleration (α).

Torque $= r \times F = I\alpha$

So, $2\left(20t - 5t^2\right) = 10\alpha$

$\alpha = 4t - t^2$

But $\alpha = \frac{d\omega}{dt}$, so

$\frac{d\omega}{dt} = 4t - t^2$

$d\omega = \left(4t - t^2\right)dt$

Integrating, $\omega = 2t^2 - \frac{t^3}{3}$

ω will be zero at $t = 6$ s.

So, $\omega = \frac{d\theta}{dt} = 2t^2 - \frac{t^3}{3}$

or $d\theta = \left(2t^2 - \frac{t^3}{3}\right)dt$

Again, integrating both sides, we get

$\theta = \frac{2t^3}{3} - \frac{t^4}{12}$

Since, $t = 6$ s

so, $\theta = \frac{2\times 6^3}{3} - \frac{6^4}{12} = 36$

Number of turns, $n = \frac{\theta}{2\pi} = \frac{36}{2\pi} = 5.73$

Q4. Solution
Correct Answer: (A)

It is a point near any magnet where the horizontal component of the earth's magnetic field will be equal and opposite to the field of the given magnet. So, the net magnetic field at that point will be zero. At the neutral point, the compass needle will not point in any particular direction.

Q5. Solution

Correct Answer: (A)

Magnetic flux

$\phi = LI \Rightarrow \frac{\Delta\phi}{\Delta t} = L\,\frac{\Delta I}{\Delta t}$

$\therefore\ (\varepsilon_{\text{ind}})_{\text{average}} = \frac{\Delta\phi}{\Delta t} = L\ \frac{\Delta I}{\Delta t}$

$\Rightarrow\ 50 = L\ \times\ \frac{5-2}{0.1}$

$\Rightarrow\ \frac{5}{3} = L$

$\Rightarrow\ L = 1.67\ \text{H}$

Q6. Solution

Correct Answer: (D)

$C_v = \frac{f}{2}R$

$C_p = R\left(1 + \frac{f}{2}\right)$

γ = ratio of specific heats at constant pressure and constant volume

$\gamma = \frac{C_P}{C_v}$

$\gamma = 1 + \frac{2}{f}$ or $\frac{2}{f} = \gamma - 1$ or $f = \frac{2}{\gamma - 1}$

Q7. Solution

Correct Answer: (A)

In a purely capacitive circuit, current lead voltage by $\frac{\pi}{2}$.

In a pure resistive circuit, current and voltage are in the same phase.

The given circuit is the combination of two pure parallel circuits with the applied voltage. In which I_2 is in phase with V and I_1 leads V by 90°.

Hence I_2 and V are in the same phase.

I_1 leads V by $\frac{\pi}{2}$.

Q8. Solution

Correct Answer: (D)

For a spherical lens

$\frac{1}{\mathrm{v}}-\frac{1}{\mathrm{u}}=\frac{1}{\mathrm{f}}$

For convex lens, $\mathrm{u}=-\frac{\mathrm{f}}{2}$ and f is +ve

$\therefore \quad \frac{1}{\mathrm{v}}=\frac{1}{\mathrm{f}}+\frac{1}{\mathrm{u}}=+\frac{1}{\mathrm{f}}-\frac{2}{\mathrm{f}}=-\frac{1}{\mathrm{f}}$

$\therefore \quad \mathrm{v}=-\mathrm{f}$

Q9. Solution

Correct Answer: (C)

We are measuring the depth from metallic strip of vernier calipers.

Given,

The least count of vernier calipers $\mathrm{LS}=0.1\ \mathrm{mm}=0.01\ \mathrm{cm}$

Main scale reading $\mathrm{MSR}=6.4\ \mathrm{cm}$

Vernier scale reading $\mathrm{VSR}=4$

So the reading of the depth,$D=\mathrm{MSR}+(\mathrm{VSR}\times\mathrm{LC})=6.4+(4\times0.01)=6.44\ \mathrm{cm}$

Because, there is no zero error, so depth will be same as above.

Q10. Solution

Correct Answer: (A)

Given that,
$\frac{dq}{dt}=1.8\times10^{-8}$
the displacement current is
$I_d=\frac{dq}{dt}$
$I_d=1\ .8\ \times10^{-8}\ \mathrm{C\ s^{-1}}$

Q11. Solution

Correct Answer: (A)

$\eta\%=\frac{80}{100}=\frac{\mathrm{V_sI_s}}{\mathrm{V_pI_p}}=\frac{120\times20}{1000\times\mathrm{I_p}}$

$\mathrm{I_p}=\frac{120\times20}{1000\times0.8}=3\ \mathrm{A}\sim$

Q12. Solution

Correct Answer: (C)

$u_{\mathrm{y}} = 0$ and $a_{\mathrm{y}} = g = 9\ .8\ \ \mathrm{m\ s^{-2}}$.

$s_{\mathrm{y}} = u_{\mathrm{y}}t + \frac{1}{2}a_{\mathrm{y}}t^2$

$= 0 \times 3 + \frac{1}{2} \times 9.8 \times (3)^2$

$= 44.1\ \mathrm{m}.$

Further, $v_{\mathrm{y}} = u_{\mathrm{y}} + a_{\mathrm{y}}t = 0 + (9\ .8)(3)$

$29.4\ \mathrm{m\ s^{-1}}$.

As the resultant velocity, v makes an angle of 45° with the horizontal,

$\tan 45^\circ = \frac{v_{\mathrm{y}}}{v_{\mathrm{x}}}$

$1 = \frac{29.4}{v_{\mathrm{x}}}$

$v_{\mathrm{x}} = 29.4\ \mathrm{m\ s^{-1}}$.

Therefore, the speed with which the body was projected (horizontally) is $29.4\ \mathrm{m\ s^{-1}}$.

~

Q13. Solution

Correct Answer: (C)

Angular displacement has unit (degree or radian) but it is dimensionless.

Note - vice - versa is not possible. ,

Q14. Solution

Correct Answer: (A)

Given, energy per unit area per second, $p = 1.388 \times 10^3 \text{ W m}^{-2}$

Let n be the number of photons incident on the earth per square metre. The wavelength of each photon = $550 \times 10^{-9} \text{ m}$

The energy of each photon, $E = \frac{hc}{\lambda}$

$$= \frac{6.63 \times 10^{-34} \times 3 \times 10^8}{550 \times 10^{-9}} = 3.616 \times 10^{-19} \text{ J}$$

Number of photons incident on the earth's surface

$$n = \frac{P}{E} = \frac{1.388 \times 10^3}{3.616 \times 10^{-19}} = 3.838 \times 10^{21}$$

$$= 3.838 \times 10^{21} \text{ photon m}^{-2} \text{ s}^{-1}$$

,

Q15. Solution

Correct Answer: (C)

For series L - C -R circuit

$$V = \sqrt{V_R^2 + (V_L - V_C)^2}$$

$$= \sqrt{(80)^2 + (40 - 100)^2}$$

$$= 100 \text{ V} .$$

Q16. Solution
Correct Answer: (C)

Electric dipole moment of a dipole is given by,

$p = qd$ (where, q is the charge and d is the distance between the charges)

Given that $q = \pm 3.2 \times 10^{-19}$ C and $d = 2.4\ \mathring{\text{A}} = 2.4 \times 10^{-10}$ m

On substituting the given values in the above formula, we get,

$p = \left(3.2 \times 10^{-19}\right)\left(2.4\ \times 10^{-10}\right)$

$p = 7.68 \times 10^{-29}$ C m

∧

Q17. Solution
Correct Answer: (C)

The arrangement shows a Wheatstone bridge.
As $\frac{C_1}{C_3} = \frac{C_4}{C_5} = 1$, therefore, the bridge is balanced.
$\frac{1}{C_{s_1}} = \frac{1}{4} + \frac{1}{4} = \frac{2}{4} = \frac{1}{2}$

$C_{s_1} = 2\ \mu\text{F}$.
Similarly, $C_{s2} = 2\ \mu\text{F}$.
∴ The effective capacitance
$= C_p = C_{s1} + C_{s2} = 2 + 2 = 4\ \mu\text{F}$.

∧

Q18. Solution
Correct Answer: (A)

It is given that the capacitor of capacitance $C = 2$ F is charged to a potential of 5 V. The decay of charge q in the $R - C$ circuit with resistance $R = 6\ \Omega$ is given by

$\mathrm{q} = \mathrm{q_0 e^{-t/\tau}}$ where the initial charge,$\mathrm{q_0} = CV = 2 \times 5 = 10$ coulomb

Characteristic time is
$\tau = CR = 2 \times 6 = 12$ s

At $t\ =\ 12$ s, the charge will be
$q = 10\ e^{-\frac{12}{12}} = \frac{10}{e}$ coulomb

!

Q19. Solution
Correct Answer: (C)

We know that the uniform electric field can be written as the ratio of potential difference and the length of the conductor. Hence,

$E = \frac{V}{d} = \frac{iR}{d} = \frac{i \times \rho d}{dA} = \frac{neAv_d\rho}{A} = nev_d\rho$

This shows that,
$v_d \propto E$

Now,
$P = \frac{V^2}{R} = \frac{E^2d^2}{R}$

This gives,
$P \propto E^2 \Rightarrow P \propto {v_d}^2 \Rightarrow$Parabola

Hence,

$P \propto I^2 \Rightarrow$Parabola

∧

Q20. Solution
Correct Answer: (A)

From Faraday's law of electromagnetic induction, magnitude of average induced emf is given by, $\varepsilon = -L\frac{\Delta i}{\Delta t}$, where $L,\ i$ & t represents coefficient of self inductance, current and time respectively.

On substituting corresponding parameters in above relation, we have
$\Rightarrow 1 = -L\frac{(10-(-10))}{(0.5)}$
$\Rightarrow L = \frac{1 \times 0.5}{20} = \frac{1}{40} = 0.025\ \text{H} = 25\ \text{mH}$

,

Q21. Solution
Correct Answer: (C)

For an atom of atomic number Z, radius of the n^{th} orbit is given by
$r_n = \frac{kn^2}{Z} \ldots \left(\text{i}\right)$ where, k =constant
For the ground state of hydrogen, $Z = 1$ and $n = 1$, so that,
$r_1 = \frac{k1^2}{1} = k$
Let n be the energy state of Be^{+++} for which orbital radius is r_1. Put,
$Z = 4$ and $r_n = r_1 = k$ in equation (i)
$r_1 = \frac{r_1n^2}{4} \Rightarrow n^2 = 4 \Rightarrow n = 2$

Q22. Solution

Correct Answer: (C)

Tension at lowest point, $T_1 = 5g = 50$ N

Tension at highest point, $T_1 = 20g = 200$ N

Wave velocity, $v = \sqrt{\frac{T}{\mu}} \propto \sqrt{T}$

Frequency of the wave does not change during propagation. Then,
$f = \frac{v}{\lambda} = \text{constant} \Rightarrow \frac{\sqrt{T}}{\lambda} = \text{constant} \Rightarrow \frac{\sqrt{T_1}}{\lambda_1} = \frac{\sqrt{T_2}}{\lambda_2} \Rightarrow \frac{\sqrt{50}}{0.08} = \frac{\sqrt{200}}{\lambda_2} \Rightarrow \lambda_2 = 0.16 \text{ m}$

Q23. Solution

Correct Answer: (A)

$\eta = 1 - \frac{T_2}{T_1} = \frac{T_1 - T_2}{T_1}$
where T_1 and T_2 are the temperatures of a source and sink respectively.
When T_1 and T_2 both are decreased by 100 K each, (T_1 - T_2) stays constant. T_1 decreases.
$\therefore \quad \eta$ increases.

Q24. Solution

Correct Answer: (C)

We know that Q value of any reaction is given as, $Q = (\text{BE})_{\text{Product}} - (\text{BE})_{\text{reactants}}$
$\text{BE} = \frac{\text{BE}}{\text{nucleon}} \times \text{nucleon number}$ For reactants, there are total 4 nucleons. (mass of 2 deutron $= 2 \times 2 = 4$)
So, $(\text{BE})_{\text{Reactants}} = 4 \times (1.112)\ \text{MeV} = 4.448\ \text{MeV}$ For α-particle, there are total 4 nucleons. (mass of one alpha particle $= 4$) So, $(\text{BE})_{\text{Proudct}} = 4 \times (7.047)\ \text{MeV} = (28.188)\ \text{MeV}$
$Q_{\text{value}} = (28.188 - 4.448)\ \text{MeV} = 23.74\ \text{MeV}$ $Q_{\text{value}} \approx 23.8\ \text{Mev}$

Q25. Solution

Correct Answer: (B)

$x = (n)\lambda\frac{D}{d} = 3 \times 5000 \times 10^{-10} \times \frac{2}{0.2 \times 10^{-3}}$

$= 1.5 \times 10^{-2} m = 1.5\ cm$

Q26. Solution

Correct Answer: (D)

Thermodynamic equilibrium means all three types of equilibria.

Q27. Solution
Correct Answer: (B)

By definition of work, $W = \vec{F} \cdot \vec{S} = FS\cos(\theta)$.

Work done depends only on force, displacement and the angle between them and does not depend on time.

As height covered in both the case is equal hence work done will be same & hence ration will be $1:1$

Q28. Solution
Correct Answer: (C)

The force on the thread due to surface tension depends upon the material of the liquid and that of the thread, i.e., the force depends upon the adhesive and cohesive forces among molecules. This force acts radially outward on the loop, which keeps it circular. It does not depend upon the surface area of the liquid film.
So, on increasing the surface area of the film, the radius of the elastic loop does not change.

Q29. Solution
Correct Answer: (B)

$y(x,t) = 0.03\sin\pi(2t - 0.01x)$

Given, $x = 25, t = 0$

Phase difference$= \pi(2t - 0.01x)$

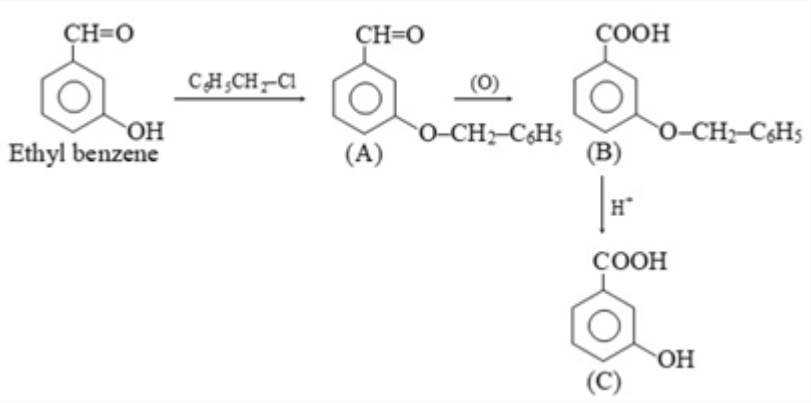
$= \pi((2 \times 0) - (0.01 \times 25))$
$= \pi 0.25$
$= \frac{25\pi}{100}$
$= \frac{\pi}{4}$

Q30. Solution
Correct Answer: (B)

When transistor is used as an amplifier base is
forward biased but collector is reverse biased.

Q31. Solution

Correct Answer: (B)



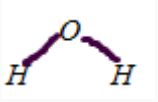
Q32. Solution

Correct Answer: (C)

We know that $\Delta E = Q + W$ If heat supplied from the surrounding, $Q = 0 \therefore \Delta E = W$ ie, work is done at the expense of only internal energy and $Q = 0$ for adiabatic process.

Q33. Solution

Correct Answer: (A)

Structure of CO_2 is linear $O = C = O$ while that of H_2O is 

i.e. bent structure so in CO_2 resultant dipole moment is zero while that of H_2O has some value.

Q34. Solution

Correct Answer: (C)

$\wedge_{eq} = \left[\frac{1}{n^+ \times Z^+}\right] \wedge_m$

Where, $\wedge_m$ = molar conductance

n^+ = number of cations

Z^+ = charge of cation

$\wedge_{eq} = \left(\frac{1}{1 \times 3}\right) \times 150 = 50$

Q35. Solution

Correct Answer: (C)

$$CH_3-CH_2-Br \xrightarrow{Na} NaBr + CH_3-\dot{C}H_2$$

Combination $\quad CH_3-\dot{C}H_2 + CH_3-\dot{C}H_2 \rightarrow CH_3-CH_2-CH_2-CH_3$ (n-butane)

Disproportionation $\quad CH_3-\dot{C}H_2 + CH_3-\dot{C}H_2 \rightarrow CH_3-CH_3 + CH_2=CH_2$

Q36. Solution

Correct Answer: (B)

The reaction is: $3\,Fe_{(s)} + 4H_2O\,(steam) \rightleftharpoons Fe_3O_{4\,(s)} + 4H_2\,(g)$

K_p represents equilibrium constant in terms of partial pressure of gases. It is defined as the ratio of partial pressure of gaseous products to the partial pressure of gaseous reactants, raised to the power of their respective stoichiometric coefficients.

$\Rightarrow K_p = \frac{(P_{H_2})^4}{(P_{H_2O})^4}$

Q37. Solution

Correct Answer: (A)

Vitamins are essential for body for normal growth and health. There are two types of vitamins fat soluble and water soluble. Fat soluble vitamins are stored in the body while water soluble can't stored. Therefore, water soluble vitamins like vitamin B-complex and vitamin C are required daily.

Q38. Solution

Correct Answer: (B)

$XY \longrightarrow X_{(g)} + Y_{(g)}; \Delta H = +akJ/$ mole $\quad \ldots\ldots\ldots$ (i) $X_2 \longrightarrow 2X; \Delta H = +a$ kJ/ mole $\quad \ldots\ldots\ldots$ (ii)
$Y_2 \longrightarrow 2Y; \Delta H = +0.5$akJ/ mole $\quad \ldots\ldots\ldots$ (iii) $\frac{1}{2} \times$ (ii) $+ \frac{1}{2} \times$ (iii) $-$ (i), gives
$\frac{1}{2}X_2 + \frac{1}{2}Y_2 \longrightarrow XY; \Delta H = \left(+\frac{a}{2} + \frac{0.5}{2}a - a\right)$kJ/ mole $+\frac{a}{2} + \frac{0.5a}{2} - a = -200$ $a = 800$

Q39. Solution

Correct Answer: (B)

$r = \frac{n^2h^2}{4\pi^2e^2mZ}$

Q40. Solution
Correct Answer: (C)

Froth Flotation: This process is especially suitable for the concentration of sulphide ores. The process is based on the difference in wetting characteristics of the ore and gangue particles with water and oil.

Magnetite $\mathrm{FeO \cdot Fe_2\,O_3}\ (\mathrm{oxide\ \ ore})$

Cassiterite $\mathrm{SnO_2}\ (\mathrm{oxide\ \ ore})$

Cinnabar $\mathrm{HgS}\ (\mathrm{sulphide\ \ ore})$

Malachite $\mathrm{Cu_2\,CO_3(OH)_2}\ (\mathrm{oxide\ \ carbonate\ \ ore})$

Sulphide ores are concentrated by Froth Flotation method. Therefore, cinnabar can be concentrated by this method.

Q41. Solution
Correct Answer: (D)

$\mathrm{4HNO_3 + P_4O_{10} \longrightarrow 4HPO_3 + 2\ N_2O_5}$ Hence, X is $\mathrm{N_2O_5}$.

Q42. Solution
Correct Answer: (B)

Here, $\mathrm{V_1 = 10}$ litres, $\mathrm{P_1 = 1\ atm.}$, $\mathrm{T_1 = 27^\circ C + 273^\circ = 300\ K}$ $V_2 = 5$ litres, $P_2 = 1$ atm., Now,

$\frac{\mathrm{P_1\,V_1}}{\mathrm{T_1}} = \frac{\mathrm{P_2\,V_2}}{\mathrm{T_2}} \therefore \quad \frac{1\times10}{300} = \frac{1 \times 5}{T_2}$ or $\quad \mathrm{T_2} = \frac{1\times5\times300}{10} = 150\ \mathrm{K}$

Q43. Solution
Correct Answer: (D)

$[\mathrm{SiCl_6}]^{-2}$ is unstable due to steric hinderance.

Q44. Solution
Correct Answer: (B)

Lanhanides have different oxidation state because there is only a small difference between the energies of the electrons in the n-s orbital and d orbital. The comon oxidation state is $+3$.

Q45. Solution

Correct Answer: (C)

$A_1e^{-Ea_1/RT} = A_2e^{-Ea_2/RT}$

$\frac{A_2}{A_1} = e^{(Ea_2-Ea_1)/RT}$

$10 = Exp\{\frac{600}{RT}\}$ $\quad\quad$ $R = 2\ cal/K - mol$

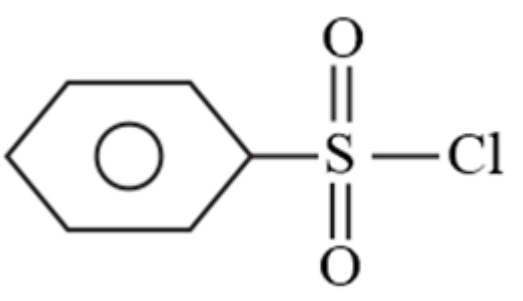
$ln10 = \frac{600}{2T}$

$T = \{\frac{300}{2\times 2.303}\}K$

Q46. Solution

Correct Answer: (A)

Hinsberg reagent is also known as benzene sulfonyl chloride and used for detection of primary, secondary and tertiary amines.



Q47. Solution

Correct Answer: (C)

Azeotropic mixture is a constant boiling mixture of two liquids, which boils at fixed temperature like a pure liquid and distils over in the same composition.

Q48. Solution

Correct Answer: (C)

In methane oxidation state of carbon is -4, which is minimum oxidation state of carbon. In behaving as oxidising agent, oxidation number of substance must get reduced. Since carbon is already present in minimum oxidation state, so it can't get decreased further hence, it can't act as an oxidising agent.

Q49. Solution

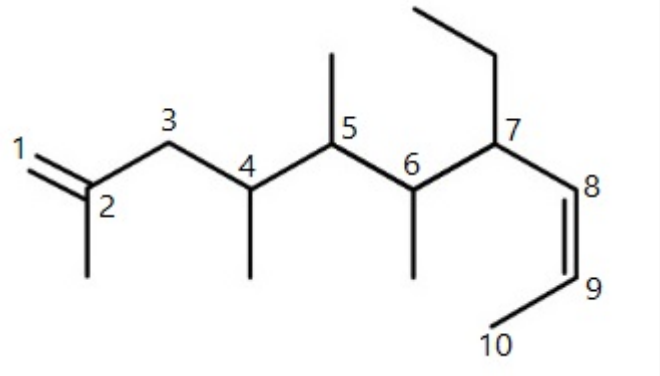
Correct Answer: (D)

$Na^+ > Mg^{2+} > Al^{3+} > Si^{4+}$. All are isoelectronic but nuclear charge per electron is greatest for Si^{4+}. So it has smallest size and nuclear charge per electron for $Na^+$is smallest. So it has largest size.

Q50. Solution

Correct Answer: (A)

Longest chain of $10-\mathrm{C}$ including both double bonds.



7-Ethyl-2, 4, 5, 6-tetramethyldeca-1, 8-diene

Q51. Solution

Correct Answer: (A)

$\mathrm{CF_2=CF_2}$ makes Teflon (polytetrafluoroethylene). So, $\mathrm{CF_2=CF_2}$ is the monomer of teflon

Q52. Solution

Correct Answer: (B)

$\mathrm{Ba(OH)_2 + CO_2 \rightarrow BaCO_3 + H_2O}$

Atomic wt. of $\mathrm{BaCO_3} = 137 + 12 + 16 \times 3 = 197$

No. of mole $= \frac{\text{wt.of substance}}{\text{mol wt.}}$

[1 mole of $\mathrm{Ba(OH)_2}$ gives 1 mole of $\mathrm{BaCO_3}$

$\therefore$ 0.205 mole of $\mathrm{Ba(OH)_2}$ will give 0.205 mole of $\mathrm{BaCO_3}$

$\therefore$ wt. of 0.205 mole of $\mathrm{BaCO_3}$ will be

$.205 \times 197 = 40.385\mathrm{gm} \approx 40.5\mathrm{gm}$

Q53. Solution

Correct Answer: (C)

$$3\mathrm{Ag} + \underset{\text{dilute}}{4\mathrm{HNO_3}} \xrightarrow{\text{heat}} 3\mathrm{AgNO_3} + \mathrm{NO} + 2\mathrm{H_2O}$$

Q54. Solution

Correct Answer: (A)

Plaster of Paris is $\mathrm{CaSO_4 \cdot \frac{1}{2}H_2O}$

Q55. Solution

Correct Answer: (A)

Ammonia reacts with water to form, ammonium hydroxide. $NH_3 + H_2O \longrightarrow NH_4OH$ NH_4OH exists in solution as NH_4^+ and OH^- ions therefore ionic bonding (or electrovalent bonding) is present in NH_4OH.

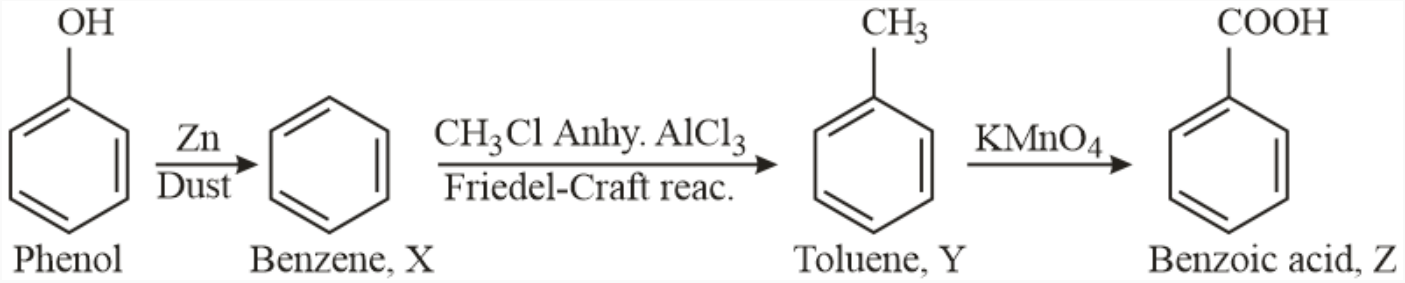
Q56. Solution

Correct Answer: (D)

1) In the first reaction, phenol undergoes reduction in the presence of zinc to form benzene.

2) Benzene when reacts with CH_3Cl gives toluene. It is a type of electrophilic substitution reaction in which H^+ is replaced by $CH_3{}^+$.

3) In this, toluene undergoes oxidation in the presence of strong oxidising agent, i.e., $KMnO_4$ to form benzoic acid.



Q57. Solution

Correct Answer: (D)

In electro-chemical series, Hg lies above Cu.
Hence, Cu electrode acts as the cathode and Mg electrode acts as an anode.
Given, E_{mf} of cell $= 2.7$ V
The standard reduction potential of $Cu = +0.34$ V
$E^0_{cell} = E^0_{Cu^+/Cu} - E^0_{Mg^+/Mg}$
$2.7 = 0.34 - E^0_{Mg^+Mg}$
$E^0_{Mg^+/Mg} = -2.36$ V
$\therefore$ Standard reduction potential of Mg electrode is -2.36 V.
Hence, option D is correct.

Q58. Solution

Correct Answer: (D)

Outermost electronic configuration of $[Ni(CO)_4]$ complex is $3\,d^8, 4\,s^2$ and CO is a strong ligand thus electrons get paired up and shows sp^3 hybridisation. Outermost electronic configuration of $[Ni(CN)_4]^{2-}$ complex is $3\,d^8$ and CN is a strong ligand thus electrons get paired up but one *d* orbital is empty and shows dsp^2 hybridisation. Outermost electronic configuration of $[Ni(Cl)_4]^{2-}$ complex is $3\,d^8, 4\,s^2$ and Cl is a weak ligand thus electrons does not paired up and shows sp^3 hybridisation.

Q59. Solution

Correct Answer: (A)

Tyndall effect can be observed in colloidal solutions.

Q60. Solution

Correct Answer: (D)

Le Chatelier's principle explains the effect of pressure, temperature and concentration of reactants and products on the system in equilibrium. So it is applicable to system in equilibrium.

Q61. Solution

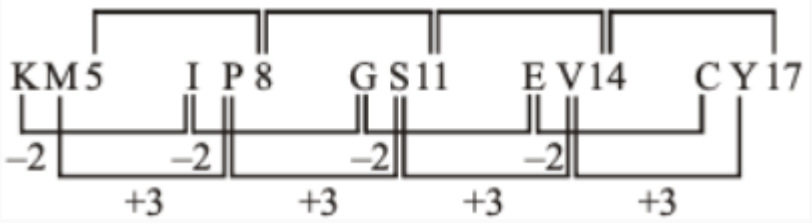
Correct Answer: (B)

1st letter : $\mathrm{U} \xrightarrow{-2} (\mathrm{S}) \xrightarrow{-4} \mathrm{O} \xrightarrow{-2} \mathrm{M} \xrightarrow{-4} \mathrm{I}$ 2nd letter : $\mathrm{P} \xrightarrow{-8} (\mathrm{H}) \xrightarrow{-4} \mathrm{D} \xrightarrow{-2} \mathrm{B} \xrightarrow{-1} \mathrm{A}$ 3rd letter : $\mathrm{I} \xrightarrow{+1} (\mathrm{J}) \xrightarrow{+6} \mathrm{P} \xrightarrow{+1} \mathrm{Q} \xrightarrow{+6} \mathrm{W}$

Q62. Solution

Correct Answer: (D)

Logic for the letters is $-2, +3$ steps, numbers added is 3 .



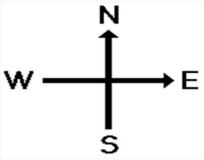
Q63. Solution

Correct Answer: (C)

$\mathrm{C}^{+3}\ \mathrm{F}^{-2}\mathrm{D}, \mathrm{G}^{+3}\ \mathrm{J} - 2\mathrm{H}, \mathrm{K}^{+3}\ \mathrm{N}^{-1}\mathrm{M}, \mathrm{J}^{+3}\mathrm{M}^{-2}\ \mathrm{K}, \mathrm{V}^{+3}\mathrm{Y}^{-2}\ \mathrm{W}$ Hence, KNM is the odd one.

Q64. Solution

Correct Answer: (D)



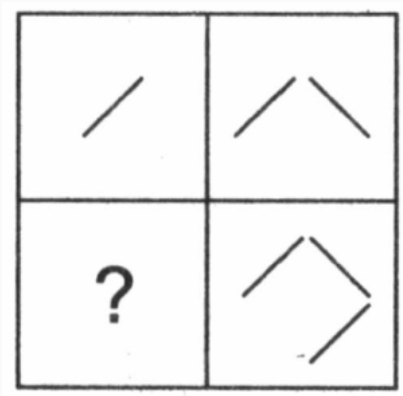
From the given information, it is given that Qadir travels towards the East and Mona travels towards the North. Now, Tina travels towards the right of Qadir means that Tina travels towards the South. Therefore, Sanjay travels towards the North because Sanjay and Tina travel in the opposite direction.

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

Q65. Solution

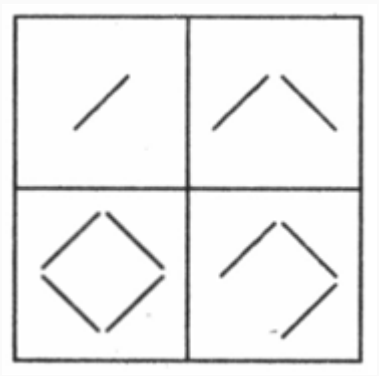
Correct Answer: (B)

Given question figure is:



In the above figure, if we move in clockwise direction, we can observe that number of lines or number of sides are increasing by 1.

The final figure is shown below:



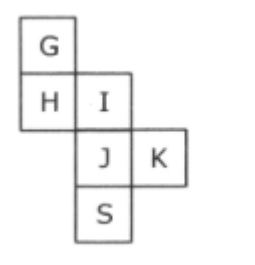
So, the correct answer is 

.

Q66. Solution

Correct Answer: (D)

As per the question,



If the figure is folded to make a cube, then H and I share's an edge and the one end of this edge is the face labelled G. So the faces G, H, I meet at a point, and at the other end of this edge is the face labelled J.

i.e., G is opposite to J.

H is opposite to K.

I is opposite to S.

Hence, the answer is J.

Q67. Solution

Correct Answer: (B)

According to the question, we have the following codes:

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
k	m	t	h	u	w	n	c	q	p	x	v	j	d	l	s	f	b	o	r	z	a	y	e	g	i

So, the code for "ISWZHE" is given by:

I $\rightarrow$ q

S $\rightarrow$ o

W $\rightarrow$ y

Z $\rightarrow$ i

H $\rightarrow$ c

E $\rightarrow$ u

Hence, "ISWZHE" is coded as "qoyicu".

Hence, the correct answer is qoyicu.

Q68. Solution

Correct Answer: (C)

The letters of the word TRADE are composed of the letters that occur in the words BRACKET and DEAR.

The word BRACKET is coded as 9341285. So, the letter T is coded as 5.

The word DEAR is coded as 6843. So, the letters D, E, A and R are coded as 6, 8, 4 and 3 respectively.

T = 5

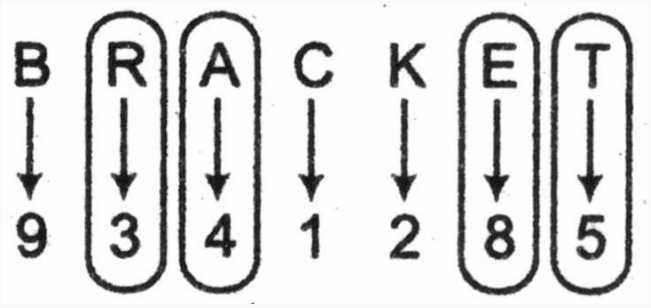
R = 3

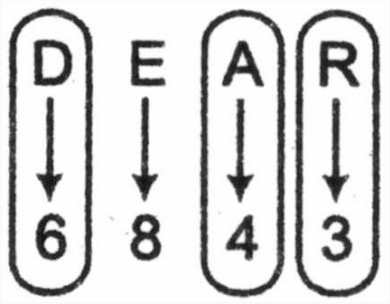
A = 4

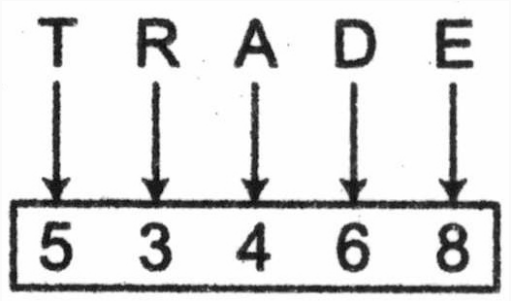
D = 6

E = 8

So, the word TRADE is coded as 53468.







So, the required code is 53468.

Q69. Solution
Correct Answer: (A)

In the given pair of words, a relation is analysed in the first pair and a similar relation is applied in the second pair to find the missing word. The relationship between swimming and river is that swimming is done in the river. Hiking is an activity (long, vigorous walk) done from the mountain. The other options sea, road, and pond do not fit the context.

Hence, this is the correct answer.

Q70. Solution
Correct Answer: (C)

According to the question,

An idiot means stupid or foolish which is deficient in intelligence. Similarly, a desert is a dry place which is deficient in water.

Erudite means having or showing great knowledge or a learning.

Wealthy is having a great deal of money, resources, or assets, rich.

Lackadaisical means lacking an enthusiasm and a determination.

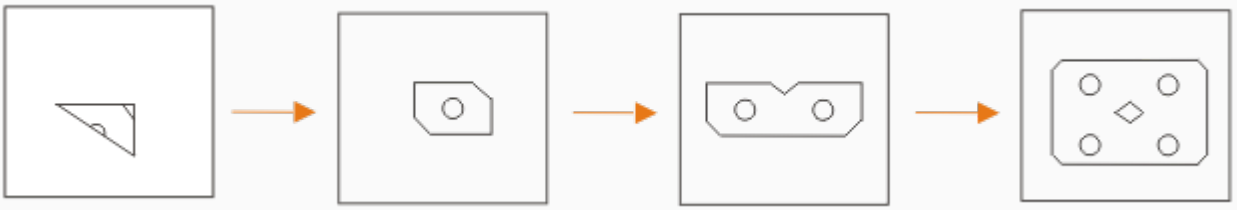
Hence, the correct answer is Desert.

Q71. Solution
Correct Answer: (D)

After observing the above pair of letters, we can conclude that there is a gap of $13,\ 17,\ 19$, letters between the first letter, second letter, and third letter respectively of the words 'ACFJ' and 'OUZJ'. The last letter remains the same. Similarly, skip $13,\ 17,\ 19$ letters from S, U, X, and we will get G, M, R, and the last letter will be the same as B only. Thus, we get GMRB as an answer.

Q72. Solution

Correct Answer: (B)



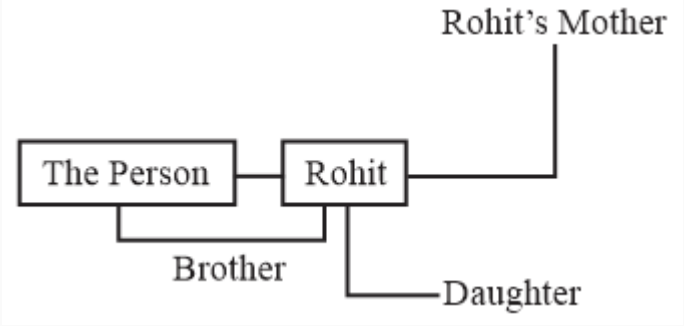
Hence, option B is correct.

Q73. Solution

Correct Answer: (B)

Pointing to a man, Rohit recalled, 'He is the son of the mother of the father of my daughter'.

This can be drawn into the family tree:



Rohit said, that the man is the son of my daughter's father's mother which means they both are brothers.

Hence, this is the correct answer.

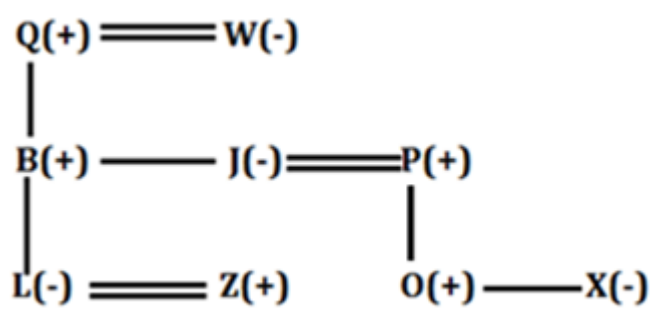
Q74. Solution

Correct Answer: (D)

According to the question,

X is sister of O. L is daughter of B and wife of Z. B and J are children of Q and W, who has only one son and one daughter. J is married to P who is father of O and has only one daughter. W is the mother-in-law of P.

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



Now, if the age of B is 28, years, then the possible age of W could be 48.

Hence, 48, is the correct answer.

Q75. Solution

Correct Answer: (D)

Following the final solution to the puzzle set we can say that T won the least number of matches after the first round.

Hence the correct answer is option (D.)

Rank	1st	2nd	3rd	4th
Group A	V	U	P	T
Number of matches won	5	4	3	0
Group B	Q	W	S	R
Number of matches won	6	3	2	1

Common Explanation:

References:

V won both the matches against U.

Inference:

Studying the information carefully we can say that V and U were in same group let's says that Group A. And we also know that Q, U, W, V were the four players who qualifed for the semifinal so we can also say that Q and W were in second group let's say that Group B.

Rank	1st	2nd	3rd	4th
Group A	V/U	U/V		
Number of matches won				
Group B	Q/W	W/Q		
Number of matches won				

References:

Each player of each group had a different number of wins.
P and W won the same number of matches.
R lost all of his matches against all the other players except S, who atleast lost one match against each of the other players except one.

Inference:

Using the given information we can say that R and S belongs to Group B and P and T belongs to Group A its

because P and w can't be in the same group and R and S must go together. As it is given that R won only against S so he has only one point.

Rank	1st	2nd	3rd	4th
Group A	V/U	U/V	P/T	T/P
Number of matches won				
Group B	Q/W	W/Q	S	R
Number of matches won				1

Now, In a group each player had to play twice against each of the other players. So the total number of matches that can be played in each group are equal to 12. And the winning combinations given that Each player of group had a different number of wins can only be

A - (6 4 2 0)
B- (6 3 2 1)
C- (5 4 2 1)
D- (5 4 3 0)

In all of the combinations only B and C can fit in Group B. But we know that W and P have same number of wins so only combination B and D fits into our requirements.

Rank	1st	2nd	3rd	4th
Group A	V/U	U/V	P	T
Number of matches won	5	4	3	0
Group B	Q	W	S	R
Number of matches won	6	3	2	1

But U cannot have 5 wins in Group A because he lost both of his matches to V.
Therefore the final scorecard is as follows

Rank	1st	2nd	3rd	4th
Group A	V	U	P	T
Number of matches won	5	4	3	0
Group B	Q	W	S	R
Number of matches won	6	3	2	1

Q76. Solution

Correct Answer: (C)

Following the final solution to the puzzle set we can say that P has 3 wins after the first round.

Hence the correct answer is option (C.)

Rank	1st	2nd	3rd	4th
Group A	V	U	P	T
Number of matches won	5	4	3	0
Group B	Q	W	S	R
Number of matches won	6	3	2	1

Common Explanation:

References:

V won both the matches against U.

Inference:

Studying the information carefully we can say that V and U were in same group let's says that Group A. And we also know that Q, U, W, V were the four players who qualifed for the semifinal so we can also say that Q and W were in second group let's say that Group B.

Rank	1st	2nd	3rd	4th
Group A	V/U	U/V		
Number of matches won				
Group B	Q/W	W/Q		
Number of matches won				

References:

Each player of each group had a different number of wins.
P and W won the same number of matches.
R lost all of his matches against all the other players except S, who atleast lost one match against each of the other players except one.

Inference:

Using the given information we can say that R and S belongs to Group B and P and T belongs to Group A its because P and w can't be in the same group and R and S must go together. As it is given that R won only against

S so he has only one point.

Rank	1st	2nd	3rd	4th
Group A	V/U	U/V	P/T	T/P
Number of matches won				
Group B	Q/W	W/Q	S	R
Number of matches won				1

Now, In a group each player had to play twice against each of the other players. So the total number of matches that can be played in each group are equal to 12. And the winning combinations given that Each player of group had a different number of wins can only be

A - (6 4 2 0)
B- (6 3 2 1)
C- (5 4 2 1)
D- (5 4 3 0)

In all of the combinations only B and C can fit in Group B. But we know that W and P have same number of wins so only combination B and D fits into our requirements.

Rank	1st	2nd	3rd	4th
Group A	V/U	U/V	P	T
Number of matches won	5	4	3	0
Group B	Q	W	S	R
Number of matches won	6	3	2	1

But U cannot have 5 wins in Group A because he lost both of his matches to V.
Therefore the final scorecard is as follows

Rank	1st	2nd	3rd	4th
Group A	V	U	P	T
Number of matches won	5	4	3	0
Group B	Q	W	S	R
Number of matches won	6	3	2	1

Q77. Solution
Correct Answer: (D)

Given,

Shrikant is shorter than Nilima.
Nilima > Shrikant

Pratima is taller than Shrikant
Pratima > Shrikant

Subhash is taller than Nilima
Subhash > Nilima

Subhash but shorter than Heramb.
Heramb > Subhash

Nilima is taller than Pratima.
Nilima > Pratima

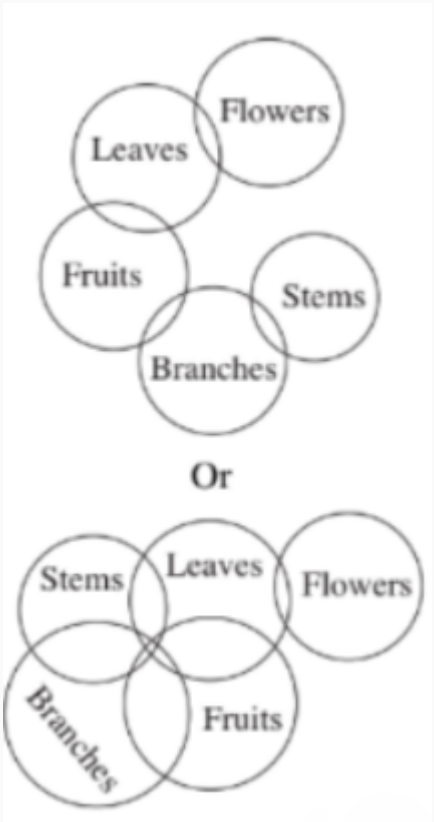
The above relation shows that,
Heramb > Subhash > Nilima > Pratima > Shrikant

According to the question,
If they are standing in a row in descending order of height.
i.e.
Heramb > Subhash > Nilima > Pratima > Shrikant.

Hence, Nilima is in the middle of the row.

Q78. Solution

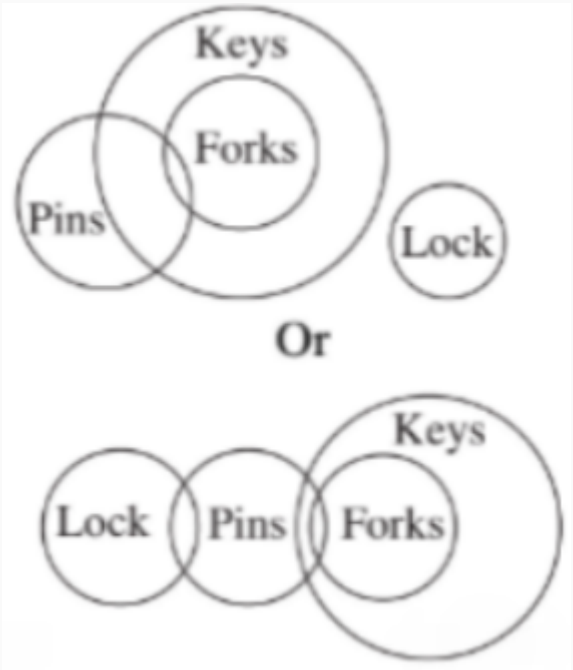
Correct Answer: (D)



None follows

Q79. Solution

Correct Answer: (C)



Q80. Solution
Correct Answer: (B)

An adjective is often defined as a word which describes or gives more information about a noun or pronoun. Here, 'my' shows possession of coffee. Hence, it is an adjective.

Q81. Solution
Correct Answer: (B)

A	C	D	F;	B	E	H	I
$+2$	$+4$	$+6$	$+8$ Similarly,	$+2$	$+4$	$+6$	$+8$
C	G	J	N	D	I	N	Q

Q82. Solution
Correct Answer: (A)

Kindly refer to the video to get to know the context the word is generally used in.

Exonerate (Verb) :

1. (of an official body) absolve (someone) from blame for a fault or wrongdoing.

Ex. "an inquiry exonerated those involved"
Ex. It's another matter that in the equally sensational TANSI land-deal case, the Supreme Court finally exonerated Jayalalithaa of any wrong-doing.

Synonyms: absolve, clear, acquit, declare innocent, find innocent, pronounce not guilty, discharge.

2. release someone from (a duty or obligation).

Ex. "Pope Clement V exonerated the king from his oath to the barons"

Synonyms: release, discharge, relieve, free, liberate.

Q83. Solution
Correct Answer: (D)

Poignant: Evoking a keen sense of sadness or regret.

All of the words are synonyms and thus, are incorrect.

Hence, option E is correct.

Q84. Solution
Correct Answer: (D)

Blank 1: Options B and C do not fit in here and can be eliminated.

Blank 2: Finding a company is incorrect and hence option A can be eliminated. Out of making and founding, founding is a better fit. Hence, Option E may be correct.

This is confirmed by putting the last word in the last blank. All three blanks are a perfect match.

Hence Option E is correct.

Q85. Solution
Correct Answer: (C)

Option A: All the blanks are absurd here.

Option B: Blanks 1 and 2 are incorrect and do not fit in.

Option D: Blanks 1 and 2 are opposite of what is needed.

Option E: Blanks 1 and 2 are incorrect.

Option C is perfect here.

Hence, Option C is correct.

Q86. Solution
Correct Answer: (C)

The passage states that The Sugar Mill is famous for its delicious cookies, cakes, and pastries.

Q87. Solution
Correct Answer: (B)

The passage describes the "Glenhill Special" as a unique combination of flavors that has become a local favorite.

Q88. Solution
Correct Answer: (A)

The two world wars are the price that man paid due to the absence of wisdom and sagacity.

Q89. Solution
Correct Answer: (C)

'Lost in the clouds' is an idiom which means confused.
Example (a) — My friend seems to be lost in clouds as she is unable to respond.
Example (b) — My psychology teacher is often lost in the clouds as she is sometimes unable to explain the questions clearly.
Hence, this is the correct answer.

Q90. Solution
Correct Answer: (B)

$$\begin{aligned}\overrightarrow{OA}+\overrightarrow{OB}+\overrightarrow{OC} &= (\overrightarrow{OG}+\overrightarrow{GA})+(\overrightarrow{OG}+\overrightarrow{GA})+(\overrightarrow{OG}+\overrightarrow{GC}) \\ &= 3\overrightarrow{OG}+(\overrightarrow{GA}+\overrightarrow{GB}+\overrightarrow{GC}) \\ &= 3\overrightarrow{OG}(\because \overrightarrow{GA}+\overrightarrow{GB}+\overrightarrow{GC}=\overrightarrow{0})\end{aligned}$$

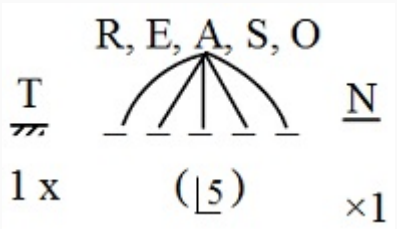
Q91. Solution
Correct Answer: (A)

The idiom "A sacred cow" is used when someone who is often unreasonably immune from criticism or opposition. Hence, the first option is the correct answer.

For example:
Students did not dare to challenge the sacred cow of administration decision.

Therefore, the correct answer is option (1).

Q92. Solution
Correct Answer: (C)



Fixing T at the first place and N at the last place, other letters $R,\ E,\ A,\ S,\ O$ can arrange themselves in $5!$ ways. Hence,

Number of words starting with T and ending with N is $5! = 120$.

Q93. Solution

Correct Answer: (D)

Coefficient of $x^{k_1}y^{k_2}z^{k_3}$, in the expansion of $(x+y+z)^n$ is $\frac{n!}{k_1!k_2!k_3!}$, where $k_1+k_2+k_3=n$

Hence, coefficient of $a^8bc = \frac{10!}{8!1!1!} = 90$.

Q94. Solution

Correct Answer: (B)

Let $Z = \frac{\alpha+\beta}{\alpha-\beta}$ $\text{cis}(\theta) = \cos\theta + i\sin\theta$ Let, $|\alpha| = |\beta| = r \quad \& \quad \alpha = \text{rcis}(A), \quad \beta = \text{rcis}(B)$ $Z = \frac{\text{cis}(A)+\text{cis}(B)}{\text{cis}(A)-\text{cis}(B)}$ $= \frac{\cos A+\cos B+i(\sin A+\sin B)}{\cos A+\cos B-i(\sin A+\sin B)} = \frac{\cos\left(\frac{A-B}{2}\right)\left[\cos\left(\frac{A+B}{2}\right)+i\sin\left(\frac{A+B}{2}\right)\right]}{-\sin\left(\frac{A-B}{2}\right)\left[\sin\left(\frac{A+B}{2}\right)-i\cos\left(\frac{A+B}{2}\right)\right]}$ $Z = \frac{-i\cos\left(\frac{A-B}{2}\right)}{\sin\left(\frac{A-B}{2}\right)}$

Q95. Solution

Correct Answer: (C)

$$D = \begin{vmatrix} 1 & -2 & 0 \\ 1 & -1 & k \\ 0 & k & 4 \end{vmatrix} = 4 - k^2$$

so, A is correct and B, C, E are incorrect. If $k = 2$

$$D_1 = \begin{vmatrix} 1 & -2 & 0 \\ -2 & -1 & 2 \\ 6 & 2 & 4 \end{vmatrix} = -48 \neq 0$$

So no solution

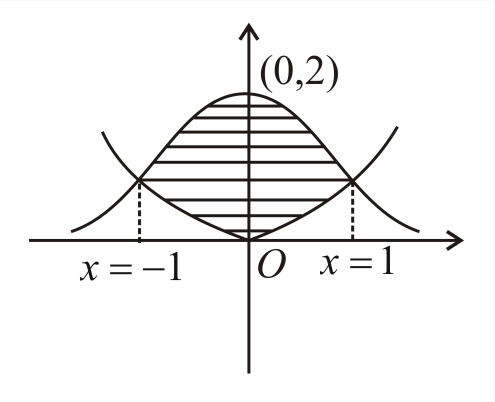
Q96. Solution

Correct Answer: (B)

Since, two parabolas meet in the points $(0,0)$ and $(1,1)$, hence, length of the common chord $= \sqrt{(1-0)^2+(1-0)^2} = \sqrt{2}$.

Q97. Solution

Correct Answer: (B)



For point of intersection $x^2 = \frac{2}{1+x^2}$

$\Rightarrow\ x^4 + x^2 - 2 = 0$

$\Rightarrow\ \left(x^2 - 1\right)\left(x^2 + 2\right) = 0$

$\Rightarrow\ x = 1, -1,\ \Rightarrow y = 1, -1$

$\therefore\quad \text{area} = 2\int_0^1 \left(\frac{2}{1+x^2} - x^2\right) dx$

$= 4\left[\tan^{-1} x\right]_0^1 - \frac{2}{3}\left[x^3\right]_0^1$

$= 4\left(\frac{\pi}{4}\right) - \frac{2}{3}$

$= \pi - \frac{2}{3}\ \text{sq. units}$

Q98. Solution

Correct Answer: (C)

L.H.L. $= \lim_{x\to 0^-} \frac{\sqrt{1+kx}-\sqrt{1-kx}}{x} = k$ R.H.L $= \lim_{x\to 0^+} \left(2x^2 + 3x - 2\right) = -2$ Since it is continuous, Hence, L.H.L = R. H. L $\Rightarrow$ k $= -2$

Q99. Solution

Correct Answer: (C)

Let four observations are be $x_1,\ x_2,\ x_3$ and x_4

Given, mean $\left(\overline{x}\right) = 3$

and $\sum x_i^2 = 48$

$\therefore SD = \sqrt{\frac{\sum x_i^2}{n} - \left(\overline{x}\right)^2}$

$= \sqrt{\frac{48}{4} - (3)^2} = \sqrt{12 - 9} = \sqrt{3}$

Q100. Solution

Correct Answer: (B)

$\cot 70^\circ + 4\cos 70^\circ$

$= \frac{\cos 70^\circ + 4\sin 70^\circ \cdot \cos 70^\circ}{\sin 70^\circ}$

Using $2\sin A \cos A = \sin 2A$, we get

$= \frac{\cos 70^\circ + 2\sin 140^\circ}{\sin 70^\circ}$

$= \frac{\cos(90^\circ - 70^\circ) + 2\sin(180^\circ - 40^\circ)}{\sin 70^\circ}$

Using, $\cos(90^\circ - \theta) = \sin\theta,\ \ \sin(180^\circ - \theta) = \sin\theta$, we get

$= \frac{\sin 20^\circ + 2\sin 40^\circ}{\sin 70^\circ}$

$= \frac{\sin 20^\circ + \sin 40^\circ + \sin 40^\circ}{\sin 70^\circ}$

Now, using $\sin C + \sin D = 2\sin\left(\frac{C+D}{2}\right)\cos\left(\frac{C-D}{2}\right)$, we get

$= \frac{2\sin 30^\circ \cos 10^\circ + \sin 40^\circ}{\sin 70^\circ}$

$= \frac{2 \times \left(\frac{1}{2}\right) \times \cos(90^\circ - 10^\circ) + \sin 40^\circ}{\sin 70^\circ}$

Again, using $\cos(90^\circ - \theta) = \sin\theta$, we get

$= \frac{\sin 80^\circ + \sin 40^\circ}{\sin 70^\circ}$

Again, using $\sin C + \sin D = 2\sin\left(\frac{C+D}{2}\right)\cos\left(\frac{C-D}{2}\right)$, we get

$= \frac{2\sin 60^\circ \cos 20^\circ}{\sin 70^\circ}$

$= \frac{2 \times \left(\frac{\sqrt{3}}{2}\right) \times \cos(90 - 70^\circ)}{\sin 70^\circ}$

$= \frac{\sqrt{3} \cdot \sin 70^\circ}{\sin 70^\circ} = \sqrt{3}.$

Q101. Solution

Correct Answer: (A)

Given $f(x) = \ell n\ (\ell n(\ell nx)))$

For the domain of $f(x)$:

$\ell n\ (\ell nx) > 0$

$\Rightarrow \ell nx > e^0$

$\Rightarrow \ell nx > 1$

$\Rightarrow x > e^1$

$\Rightarrow x > e$

So, the Domain of given function is $x \in (e, \infty)$

Now, for the range of $f(x)$:

$x > e$

Taking log both side with the base e, we get:

$\Rightarrow \ell nx > 1$

$\Rightarrow \ell n\ (\ell nx) > 0$

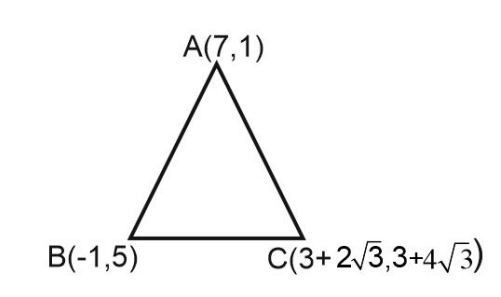
Logarithmic function (When the base is >1) is strictly increasing and its range will be set of all real numbers, so:

$\Rightarrow \ell n\ (\ell n(\ell nx)) \in R$

Hence, the given function is one - one onto.

Q102. Solution

Correct Answer: (A)



Using distance formula, we get

$AB = \sqrt{(8)^2 + 4^2} = 4\sqrt{5}$

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

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

$AB = BC = CA = 4\sqrt{5}$

So, the given triangle is equilateral.

For an equilateral triangle, centroid, circumcenter, incenter and orthocenter coincide.

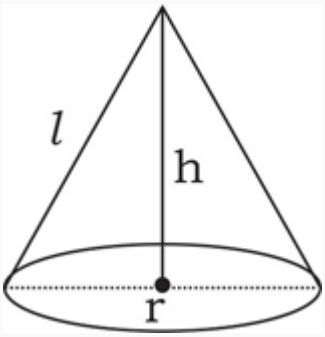
Hence, incenter (using centroid formula) $= \left(\frac{7-1+3+2\sqrt{3}}{3}, \frac{1+5+3+4\sqrt{3}}{3}\right)$

$= \left(3 + \frac{2}{\sqrt{3}}, 3 + \frac{4}{\sqrt{3}}\right)$

Q103. Solution

Correct Answer: (A)

Given $l = 3$



$\Rightarrow r^2 + h^2 = l^2 = 9$

Volume, $V = \frac{1}{3}\pi r^2 h$

$\Rightarrow V = \frac{1}{3}\pi\left(9 - h^2\right)h = \frac{1}{3}\pi\left(9h - h^3\right)$

$\frac{dv}{dh} = \frac{1}{3}\pi\left(9 - 3h^2\right)$

$\frac{dv}{dh} = 0 \Rightarrow h = \sqrt{3}$

$\frac{d^2V}{dh^2} = \frac{1}{3}\pi(-6h) < 0$

$\therefore$ at $h = \sqrt{3}$, cone has maximum volume

$\therefore V_{\max} = \frac{1}{3}\pi\left(9\sqrt{3} - 3\sqrt{3}\right) = 2\sqrt{3}\pi cm^3$

Q104. Solution

Correct Answer: (B)

$y_1 = a\cos mx \cdot m + b(-\sin mx)m \Rightarrow \quad y_2 = ma(2\sin mx)m - mb\cos mx.\, m \therefore \quad \frac{d^2y}{dx^2} = -m^2y.$

Q105. Solution

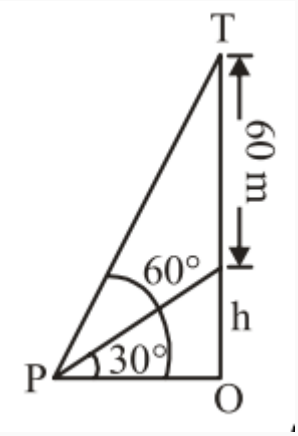
Correct Answer: (D)

$^{n-1}C_6 + {}^{n-1}C_7 > {}^{n}C_6 \Rightarrow \quad {}^{n}\mathrm{C}_7 > {}^{n}\mathrm{C}_6 \Rightarrow \quad \frac{n!}{(n-7)!7!} > \frac{n!}{(n-6)!6!} \Rightarrow \quad \mathrm{n} - 6 > 7 \Rightarrow \quad \mathrm{n} > 13$

Q106. Solution

Correct Answer: (A)

$(60 + h)\cot 60^\circ = h\cot 30^\circ \Rightarrow h = 30m$



Q107. Solution

Correct Answer: (D)

$3^{2n} = 9^n = (1 + 8)^n$

$\Rightarrow 3^{2n} = {}^nC_0 + {}^nC_1 \cdot 8 + {}^nC_2 \cdot 8^2 + \ldots\ldots + {}^nC_n \cdot 8^n$

$\Rightarrow \frac{3^{2n}}{8} = \frac{{}^nC_0 + {}^nC_1 \cdot 8 + {}^nC_2 \cdot 8^2 + \ldots\ldots + {}^nC_n \cdot 8^n}{8}$

$\Rightarrow \frac{3^{2n}}{8} = \frac{1}{8} + ({}^nC_1 + {}^nC_2 \cdot 8 + \ldots\ldots + {}^nC_n \cdot 8^{n-1})$

$\Rightarrow \frac{3^{2n}}{8} = \frac{1}{8} +$ integer quantity

$\{x\} \in [0, 1)$ & $\{I\} = 0$

$\Rightarrow \left\{\frac{3^{2n}}{8}\right\} = \frac{1}{8} + 0$

Q108. Solution

Correct Answer: (B)

$I = \int e^x \left(\frac{1+x}{(2+x)^2}\right) dx$

$= \int e^x \left(\frac{2+x-1}{(2+x)^2}\right) dx$

$= \int e^x \left(\frac{2+x}{(2+x)^2}\right) dx - \int e^x \left(\frac{dx}{(2+x)^2}\right)$ Integrating by parts, we get Let $\mathrm{u} = \frac{1}{2+\mathrm{x}} \Rightarrow \mathrm{du} = \frac{-1}{(\mathrm{x}+2)^2}\mathrm{dx}$

$= \int e^x \left(\frac{dx}{(2+x)}\right) - \int e^x \left(\frac{dx}{(2+x)^2}\right)$

Consider $\int e^x \left(\frac{dx}{(2+x)}\right)$

$dv = e^x dx \Rightarrow v = e^x$ $\int u.vdx = u\int vdx - \int \left[\int vdx \cdot \frac{du}{dx} \cdot dx\right]$ . . . . . by parts formula.

$\Rightarrow \int \mathrm{e}^{\mathrm{x}} \left(\frac{\mathrm{dx}}{(2+\mathrm{x})}\right)$

$= \frac{\mathrm{e}^{\mathrm{x}}}{2+\mathrm{x}} - \int \mathrm{e}^{\mathrm{x}} \left(\frac{-\mathrm{dx}}{(2+\mathrm{x})^2}\right)$ Now, $\mathrm{I} = \int \mathrm{e}^{\mathrm{x}} \left(\frac{\mathrm{dx}}{(2+\mathrm{x})}\right) - \int \mathrm{e}^{\mathrm{x}} \left(\frac{\mathrm{dx}}{(2+\mathrm{x})^2}\right) + \mathrm{c}$

$= \frac{\mathrm{e}^{\mathrm{x}}}{2+\mathrm{x}} + \int \mathrm{e}^{\mathrm{x}} \left(\frac{\mathrm{dx}}{(2+\mathrm{x})^2}\right)$

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

Q109. Solution

Correct Answer: (B)

Since $\sqrt{2^2+1^2} = \sqrt{5} < 3$, hence the equation has no solution.

Q110. Solution

Correct Answer: (D)

We know, $(1+x)^n = {}^nC_0 + {}^nC_1 x + {}^nC_1 x^2 + \ldots\ldots + {}^nC_n x^n$. Substituting $\quad x = -1$.

Q111. Solution

Correct Answer: (A)

Let plane be $\frac{x}{a} + \frac{y}{b} + \frac{z}{c} = 1$

It passes through $(3,\ 2,\ 1)$.

$\therefore \frac{3}{a} + \frac{2}{b} + \frac{1}{c} = 1$

Now, $A(a,\ 0,\ 0),\ B(0,\ b,\ 0),\ C(0,\ 0,\ c)$

$\therefore$ Locus of point of intersection of planes $x = a,\ y = b$ & $z = c$ is $\frac{3}{x} + \frac{2}{y} + \frac{1}{z} = 1$

Q112. Solution
Correct Answer: (D)

Given$\vec{a} \times \left(\vec{a} \times \vec{b}\right) = \vec{c}$,

Since vectors on both sides are equal, hence magnitude of both sides are equal.

So,

$\vec{a} \times \left(\vec{a} \times \vec{b}\right) = \vec{c}$

$\Rightarrow \vec{a}\ \vec{a} \times \vec{b} \sin\frac{\pi}{2} = \vec{c}$

$\left(\because \vec{a} \times \vec{b} = \vec{a}\ \vec{b} \sin\theta \& \vec{a} \times \vec{b} \perp \vec{a}\right)$

$\Rightarrow \vec{a}^{\,2} \vec{b} \sin\theta = \vec{c}$

Here we have $\vec{a} = 1,\ \vec{b} = 5,\ \vec{c} = 3$

$\sin\theta = \frac{3}{5} \Rightarrow \tan\theta = \frac{3}{4}$

Q113. Solution
Correct Answer: (C)

$y^2 = 4(1)x$

$x^2 = 4(-8)y$

The equation of the tangent to $y^2 = 4x$ is $y = mx + \frac{a}{m}$
The equation of the tangent to $x^2 = 4by$ is $y = mx - bm^2$

Since, they have a common tangent,

$\frac{a}{m} = -bm^2$

$\therefore \frac{1}{m} = 8m^2$

$\therefore m^3 = \frac{1}{8}$

$\therefore m = \frac{1}{2}$

$\therefore$ The slope of the common tangent is $\frac{1}{2}$.

Q114. Solution
Correct Answer: (D)

Here, $\mathrm{S}=\{x \mid x$ is a positive multiple of 3 less than $100\}$ So, $\mathrm{n}(\mathrm{s})=33$ Now, $\mathrm{P}=\{x \mid x$ is a prime number less than $20\}$ Therefore, $n(\mathrm{P})=8$ Hence, $n(\mathrm{~S})+n(\mathrm{P})=33+8=41$

Q115. Solution
Correct Answer: (C)

$y-x-\frac{x^2}{2}, \frac{x^3}{3} \quad \frac{x^4}{4}+\ldots \Rightarrow \quad y=\log_e(1+x) \Rightarrow \quad 1+x=e^y \Rightarrow \quad x=e^y-1$

Q116. Solution
Correct Answer: (C)

$\mathrm{z}=\log_2(1+\mathrm{i})=\log_2\left(\sqrt{2}\mathrm{e}^{\mathrm{i}\pi/4}\right)=\frac{1}{2}+\mathrm{i}\frac{\pi}{4}\log_2\mathrm{e} \therefore \mathrm{z}+\overline{\mathrm{z}}=1$ and $\mathrm{z}-\overline{\mathrm{z}}=\mathrm{i}\frac{\pi}{2}\log_2\mathrm{e}$ Hence,
$(z+\bar{z})+i(z-\bar{z})=1-\frac{\pi}{2}\log_2\mathrm{e}=1-\frac{\pi}{2\ln 2}=\frac{\ln 4-\pi}{\ln 4}$

Q117. Solution
Correct Answer: (A)

Let $6x+7=\lambda\frac{d}{dx}(x-5)(x-4)+\mu$ i.e. $6x+7=\lambda(2x-9)+\mu$ which gives $\lambda=3$ and $\mu=34$
$\therefore \int \frac{6x+7}{\sqrt{(x-5)(x-4)}}dx=\int \frac{3(2x-9)+34}{x^2-9x+20}dx=3\int(2x-9)\left(x^2-9x+20\right)^{-\frac{1}{2}}dx+34\int\frac{dx}{\sqrt{x^2-9x+20}}$
$=6\sqrt{x^2-9x+20}+34\int\frac{dx}{\sqrt{\left(x-\frac{9}{2}\right)^2-\left(\frac{1}{2}\right)^2}}=6\sqrt{\mathrm{x}^2-9\mathrm{x}+20}$
$+34\log\left\{x-\frac{9}{2}+\sqrt{\left(x-\frac{9}{2}\right)^2-\left(\frac{1}{2}\right)^2}\right\}+C=6\sqrt{\mathrm{x}^2-9\mathrm{x}+20}$
$+34\log\ x+\sqrt{x^2-9x+20}-\frac{9}{2}\ +C \therefore \mathrm{A}=6,\ \mathrm{B}=34.$

Q118. Solution
Correct Answer: (D)

$\underset{x\to 0}{Lt}\left\{\frac{\int_0^{x^2}\sec^2\ t\ dt}{x\ \sin\ x}\right\} \quad \left(\frac{0}{0}\ \text{form}\right)$

Apply L'Hospital's Rule, we get

$=\underset{x\to 0}{Lt}\frac{\left(\sec^2 x^2\right)2x}{x\cos x+\sin x} \quad \left(\frac{0}{0}\ \text{form}\right)$

$=\underset{x\to 0}{Lt}\frac{2\sec^2 x^2}{\cos x+\frac{\sin x}{x}}=\frac{2}{1+1}=1$

Q119. Solution

Correct Answer: (B)

$$\sec^2\left(\tan^{-1}2\right)+\operatorname{cosec}^2\left(\cot^{-1}3\right)=\left\{1+\tan^2\left(\tan^{-1}2\right)\right\}+\left\{1+\cot^2\left(\cot^{-1}3\right)\right\}$$
$$=1+\left\{\tan\left(\tan^{-1}2\right)\right\}^2+1+\left\{\cot\left(\cot^{-1}3\right)\right\}^2=1+2^2+1+3=15$$

Q120. Solution

Correct Answer: (C)

$u=\phi(x)=\frac{1}{x-1}$ is discontinuous at $x=1,\ y=f(u)=\frac{1}{u^2+u-2}=\frac{1}{(u+2)(u-1)}$ is discontinuous at $u=-2,\ u=1$. If $u=-2$ then $-2=\frac{1}{x-1}\ \Rightarrow x=\frac{1}{2}$. If $u=1$ then $1=\frac{1}{x-1}\ \Rightarrow x=2$. Hence the composite function is discontinuous only at $x=1,\ \frac{1}{2},\ 2$.

Q121. Solution

Correct Answer: (B)

As, $n^3+(n+1)^3+(n+2)^3$ is always a multiple of 9 (can be proved by induction), therefore $\mathrm{P}\subset\mathrm{Q}$.

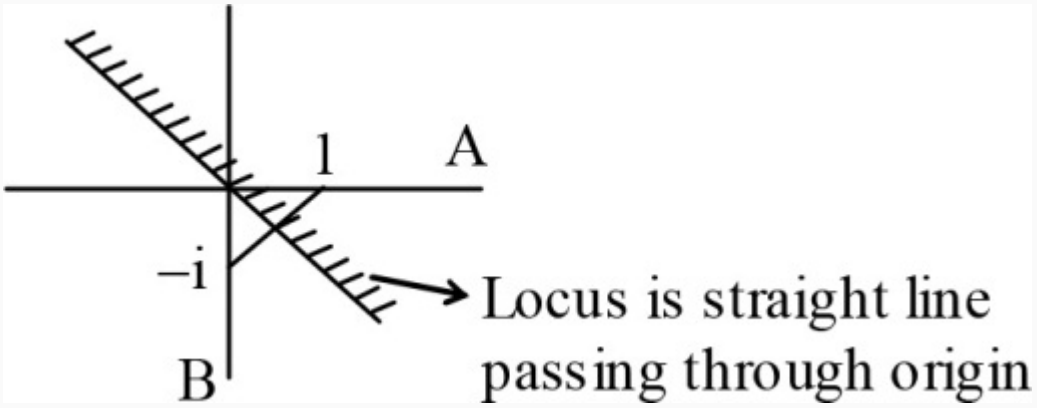
Q122. Solution

Correct Answer: (B)

Each stall can be occupied in 3 ways ; a cow or a horse or a calf may be put in it. So all the 15 stalls can be filled in 3^{15} ways.

Q123. Solution

Correct Answer: (C)



Let P be point satisfying complex number

$\Rightarrow \ |z-1| = |z+i|$

$\Rightarrow \ |z-1| = |z-(-i)|$

from given figure it is clear that distance of point P from points on co-ordinate axes are same.

$\Rightarrow \boxed{PA = PB}$

so it is possible only when point P lies on line passes through origin .

Q124. Solution

Correct Answer: (A)

For unique solution, $\Delta \neq 0$.

$$\Rightarrow \begin{vmatrix} 1 & 1 & 1 \\ 2 & 1 & -1 \\ 3 & 2 & k \end{vmatrix} \neq 0$$

$\Rightarrow 1(k+2) - 1(2k+3) + 1(4-3) \neq 0$

$\Rightarrow -k \neq 0 \Rightarrow k \neq 0$

Thus, $S = R - \{0\}$.

Q125. Solution

Correct Answer: (A)

We have, $f(x) = \begin{cases} x^2 - a\,, & x > 2 \\ b - x\,, & x \leq 2 \end{cases}$

As $f(x)$ is continuous at $x = 2$

$\Rightarrow \lim\limits_{x \to 2^-} f(x) = \lim\limits_{x \to 2^+} f(x)$

$\Rightarrow b - 2 = 4 - a$

$\Rightarrow a + b = 6$

$\Rightarrow (a + b)^2 = 36$

$\Rightarrow a^2 + b^2 + 2ab + 4 = 36 + 4 = 40.$

Q126. Solution

Correct Answer: (C)

The slope of a line $ax + by + c = 0$ is $m = -\frac{a}{b}$.

Thus, the slope of the line $x - y = 2$ is $m = -\frac{1}{(-1)} = 1$ and we know that if two lines are parallel then their slopes are equal, hence the slope of the tangent is also $m = 1$.

The given hyperbola is $\frac{x^2}{5} - \frac{y^2}{4} = 1$

The equation of the tangent to the hyperbola $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$ having slope m is $y = mx \pm \sqrt{a^2m^2 - b^2}$.

Hence, the equation of its tangent having slope 1 is $y = x \pm \sqrt{5 \times 1^2 - 4}$

$\Rightarrow y = x \pm 1$

Thus, the tangents are $x - y + 1 = 0$ & $x - y - 1 = 0$.

Q127. Solution

Correct Answer: (A)

Here, $\alpha = \omega, \omega^2$ where ω is complex cube root of unity.

$$A^2 = \frac{1}{3}\begin{bmatrix}1 & 1 & 1\\ 1 & \omega & \omega^2\\ 1 & \omega^2 & \omega\end{bmatrix}\begin{bmatrix}1 & 1 & 1\\ 1 & \omega & \omega^2\\ 1 & \omega^2 & \omega\end{bmatrix} = \begin{bmatrix}1 & 0 & 0\\ 0 & 0 & 1\\ 0 & 1 & 0\end{bmatrix}$$

$$\Rightarrow A^4 = \begin{bmatrix}1 & 0 & 0\\ 0 & 0 & 1\\ 0 & 1 & 0\end{bmatrix}\begin{bmatrix}1 & 0 & 0\\ 0 & 0 & 1\\ 0 & 1 & 0\end{bmatrix} = \begin{bmatrix}1 & 0 & 0\\ 0 & 1 & 0\\ 0 & 0 & 1\end{bmatrix}$$

$$\Rightarrow A^{31} = A^{28} \times A^3 = I \times A^3 = A^3$$

Q128. Solution

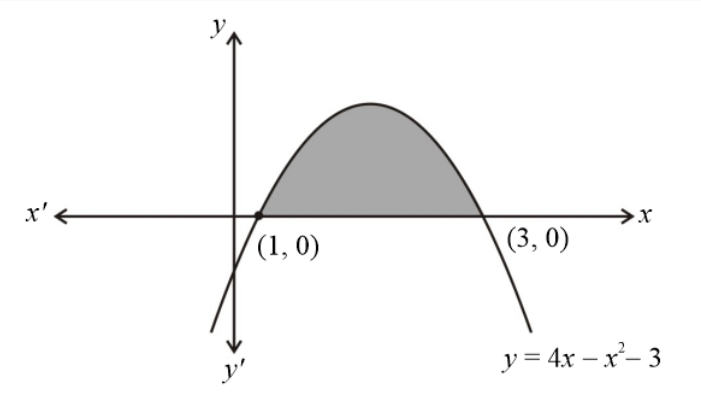
Correct Answer: (D)

Let the centre be (h, k), then radius $= h$ Also $CC_1 = R_1 + R_2$
or $\sqrt{(h-3)^2 + (k-3)^2} = h + \sqrt{9 + 9 - 14}$
$\Rightarrow (h-3)^2 + (k-3)^2 = h^2 + 4 + 4h$
$\Rightarrow k^2 - 10h - 6k + 14 = 0$ or $y^2 - 10x - 6y + 14 = 0$

Q129. Solution

Correct Answer: (A)

Curve: $y = 4x - x^2 - 3,\ x$-axis



Required area$= \int_1^3 y dx = \int_1^3 \left(4x - x^2 - 3\right) dx$

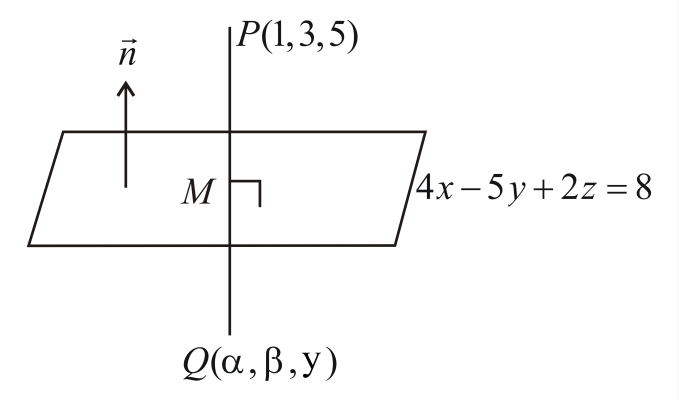
$= \left(2x^2 - \frac{x^3}{3} - 3x\right)_1^3$

$= (18 - 9 - 9) - \left(2 - \frac{1}{3} - 3\right)$

$= \frac{4}{3}.$

Q130. Solution

Correct Answer: (B)



Point Q is image of point P w.r.to plane, M is mid point of P and Q, lies in plane

$M\left(\frac{1+\alpha}{2}, \frac{3+\beta}{2}, \frac{5+\gamma}{2}\right)$

$4x - 5y + 2z = 8$

$4\left(\frac{1+\alpha}{2}\right) - 5\left(\frac{3+\beta}{2}\right) + 2\left(\frac{5+\gamma}{2}\right) = 8 \ \ldots(1)$

Also PQ perpendicualr to the plane

$\Rightarrow \overrightarrow{PQ} \ \vec{n}$

$\frac{\alpha-1}{4} = \frac{\beta-3}{-5} = \frac{\gamma-5}{2} = k$ (let)

$$\left.\begin{aligned}\alpha &= 1 + 4k \\ \beta &= 3 - 5k \\ \gamma &= 5 + 2k\end{aligned}\right\} \ \ldots(2)$$

use (2) in (1)

$2(1 + 4k) - 5\left(\frac{6-5k}{2}\right) + (10 + 2k) = 8$

$k = \frac{2}{5}$

from (2) $\alpha = \frac{13}{5}, \beta = 1, \gamma = \frac{29}{5}$

$5(\alpha + \beta + \gamma) = 13 + 5 + 29 = 47$

Q131. Solution
Correct Answer: (C)

Energy of a photon,
$E = \frac{hc}{\lambda} = \frac{6.63 \times 10^{-34} \times 3 \times 10^{8}}{590 \times 10^{-9}} = \frac{6.63 \times 3}{59} \times 10^{-18}\ \mathrm{W}$
Light energy produced per second $= \frac{90}{100} \times 10 = 9\ \mathrm{W}$
The required number of photons emitted per second will be the energy of one photon divided by the total light energy produced per second. This is given by,
$\frac{9 \times 59}{6.63 \times 3 \times 10^{-18}} = 2.67 \times 10^{19} = 0.267 \times 10^{20}$

Q132. Solution
Correct Answer: (D)

Let $x = l - 1.4$

Then, $1.4 + x + 5v = 1.4 + 5s$, where s denotes the length of one main scale division, and v denotes the length of one vernier scale division.
Hence, $x = 5s - 5v = 5(1s - 1v) = 5\ \mathrm{C}$.

Q133. Solution
Correct Answer: (C)

Donor impurities are those which have five electrons in their valence shell. Among the given options Bismuth, Antimony and Arsenic are pentavalent atoms while Iridium has only three electrons in its valence shell. Therefore, it cannot act as a donor impurity.

Q134. Solution
Correct Answer: (C)

$\mathrm{pH} = 9$
So $\left[\mathrm{H}^{+}\right] = 10^{-9}\mathrm{molL}^{-1}$
or $\left[\mathrm{OH}^{-}\right] = 10^{-5}\mathrm{molL}^{-1}$
$\mathrm{K}_{\mathrm{sp}}\left[\mathrm{Mg(OH)}_{2}\right] = \left[\mathrm{Mg}^{2+}\right]\left[\mathrm{OH}^{-}\right]^{2}$
So $\left[\mathrm{Mg}^{2+}\right] = \frac{1 \times 10^{-11}}{\left(10^{-5}\right)^{2}} = 10^{-1} = 0.1\,\mathrm{M}$

Q135. Solution
Correct Answer: (C)

Anti-addition of $\overset{\ominus}{\mathrm{O}}\mathrm{H}$ (nucleophile) and $\overset{\oplus}{\mathrm{B}}\mathrm{r}$ (electrophilic) takes place as per Markovnikov's rule in Halohydrin formation reaction.

Q136. Solution

Correct Answer: (A)

Ethanol is C_2H_5OH

Molecular mass $= 12 \times 2 + 6 \times 1 + 16 \times 1$

$= 24 + 6 + 16 = 46$

Mass of carbon in ethanol $= 12 \times 2 = 24$

$\text{Mass \% of carbon} = \frac{\text{Mass of carbon}}{\text{Molar mass of compound}} \times 100$

$= \frac{24}{46} \times 100 = 52\%$

Q137. Solution

Correct Answer: (C)

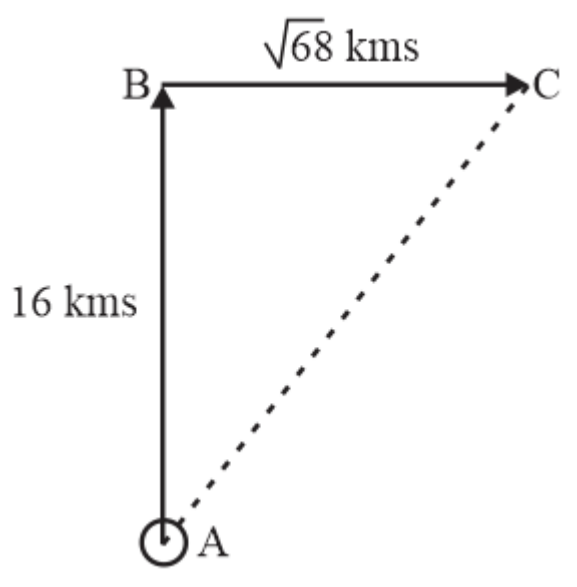
Word :	R	E	C	T	A	N	G	L	E
Logic :	$+2$	$+2$	$+2$	$+2$	$+2$	$+2$	$+2$	$+2$	$+2$ Similarly, the code for RHOMBUS is
Code :	T	G	E	V	C	P	I	N	G
Word :	R	H	O	M	B	U	S		
Logic :	$+2$	$+2$	$+2$	$+2$	$+2$	$+2$	$+2$		
Code :	T	J	Q	O	D	W	U		

Q138. Solution

Correct Answer: (A)

According to the given information, Shivani started running from her office. She first ran for $16\ \text{kms}$ towards the north, then she turned towards the east and ran $\sqrt{68}\ \text{kms}$ in that direction.

So, the following direction diagram can be drawn,



From the above figure, we can see that Shivani is in the north-east direction from her office and the distance will be,

As per the Pythagoras theorem,

$$\text{AC} = \sqrt{\text{AB}^2 + \text{BC}^2}$$

$$\text{AC} = \sqrt{16^2 + \left(\sqrt{68}\right)^2}$$

$$\text{AC} = \sqrt{256 + 68}$$

$$\text{AC} = \sqrt{324}$$

$$= 18\ \text{kms}$$

So, Shivani is $18\ \text{kms}$ north-east of her office.

Hence, this is the correct answer.

Q139. Solution

Correct Answer: (A)

The paper upon being opened can be visualized as shown below:

The middle lines represent the fold lines. The punch holes will be symmetric about the fold lines.

Hence, this is the answer.

Q140. Solution

Correct Answer: (D)

$$\Delta = \begin{matrix} x+1 & \omega & \omega^2 \\ \omega & x+\omega^2 & 1 \\ \omega^2 & 1 & x+\omega \end{matrix}$$

$R_1 \to R_1 + R_2 + R_3$

$$\Delta = \begin{matrix} x & x & x \\ \omega & x+\omega^2 & 1 \\ \omega^2 & 1 & x+\omega \end{matrix} \qquad \left(\because\ 1+\omega+\omega^2 = 0\right)$$

$$\Delta = x \begin{matrix} 1 & 1 & 1 \\ \omega & x+\omega^2 & 1 \\ \omega^2 & 1 & x+\omega \end{matrix}$$

Again we apply $C_3 \to C_3 - C_2,\ C_2 \to C_2 - C_1$

$$\Delta = x \begin{matrix} 1 & 0 & 0 \\ \omega & x+\omega^2-\omega & 1-x-\omega^2 \\ \omega^2 & 1-\omega^2 & x+\omega-1 \end{matrix}$$

$$\Delta = x\left[\left(x+\omega^2-\omega\right)(x+\omega-1) - \left(1-\omega^2\right)\left(1-x-\omega^2\right)\right]$$

$$\Delta = x\left\{x^2+x\omega-x+\omega^2 x+\omega^3-\omega^2-\omega x-\omega^2+\omega-1+x+\omega^2-\omega^2-\omega^2 x-\omega\right\}$$

$$\Delta = x\left(x^2\right) = x^3$$

Q141. Solution

Correct Answer: (D)

Value of determinant $= \Delta = \alpha\left(\beta \cdot \gamma - \alpha^2\right) - \beta\left(\alpha \cdot \gamma - \beta^2\right) + \gamma\left(\alpha\beta - \gamma^2\right)$
$\rightarrow \Delta = 3 \cdot \alpha \cdot \beta \cdot \gamma - \left(\alpha^3 + \beta^3 + \gamma^3\right) \rightarrow \alpha \cdot \beta \cdot \gamma = -b \rightarrow \alpha + \beta + \gamma = -\mathrm{a} \rightarrow \alpha\beta + \beta\gamma + \gamma\alpha = 0$ And
$\alpha^3 + \beta^3 + \gamma^3 - 3\alpha\beta\gamma = (\alpha + \beta + \gamma)\left(\alpha^2 + \beta^2 + \gamma^2 - \alpha\beta - \beta\gamma - \gamma\alpha\right)$ Also
$\alpha^2 + \beta^2 + \gamma^2 = (\alpha + \beta + \gamma)^2 - 2(\alpha\beta + \beta\gamma + \gamma\alpha)$ Substituting we get; $\alpha^3 + \beta^3 + \gamma^3 = 3(-b) + (-a)\left(a^2\right)$
$\therefore \Delta = \mathrm{a}^3 + 3\ \mathrm{b} - 3\ \mathrm{b} \Rightarrow \Delta = \mathrm{a}^3$

Q142. Solution

Correct Answer: (C)

mid point $(1, -1, 2)$ and $\overrightarrow{n} = 0\hat{\mathrm{i}} + 6\hat{\mathrm{j}} + 2\widehat{\mathrm{k}}$

equation is $6(y + 1) + 2(z - 2) = 0$

$\Rightarrow 3y + z + 1 = 0.$