Answer Key

Other (142 Questions)

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

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

Solutions

Q1. Solution

Correct Answer: (B)

Current in primary coil $= \frac{P}{V} = \frac{3000}{200} = 15A$

$P_{\text{out}} = \eta\%$ of P_{in}

$V_2 i_2 = \frac{90}{100} \times (3000)$

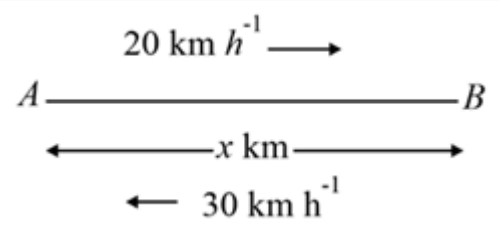
$(V_2)(6) = 2700$

$V_2 = 450$ volt

Q2. Solution

Correct Answer: (B)

Let the required distance from A to B be x km.



For motion from A to B:

Let the time taken be t_1.

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

$\Rightarrow t_1 = \frac{x}{20}$ h $\ldots$ (i)

For motion from B to A:

Let the time taken be t_2.

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

$\Rightarrow t_2 = \frac{x}{30}$ h $\ldots$ (ii)

$\therefore$ Average speed for whole journey.

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

$= \frac{x+x}{\frac{x}{20}+\frac{x}{30}}$

$= \frac{2x}{\frac{3x+2x}{60}}$

$= \frac{2x \times 60}{5x} = 24$ km h^{-1}

Q3. Solution

Correct Answer: (B)

The ideal gas law is the equation of state of an ideal gas. The state of an amount of gas is determined by its pressure, volume and temperature. The equation has the form

$pV = nRT$

where, p is pressure, V the volume, n the number of moles, R the gas constant and T the temperature.

$\therefore \quad \frac{p_1V_1}{T_1} = \frac{p_2V_2}{T_2}$

Given, $p_1 = 200\ \text{kPa},\ V_1 = V,\ T_1 = 273 + 22 = 295\ \text{K},\ V_2 = V + 0.02\ V$

$T_2 = 273 + 42 = 315\ \text{K}$

$\frac{200 \times V}{295} = \frac{p_2 \times 1.02V}{315}$

$\Rightarrow \quad p_2 = \frac{200 \times 315}{295 \times 1.02}$

$p_2 = 209\ \text{kPa}$

Q4. Solution

Correct Answer: (D)

Angle rotated in one rotation $= \pi\ \text{rad}$.

$\therefore$ Angle rotated in p rotations is $\theta = 2\pi p\ \text{rad}$.

$\therefore$ Angular velocity is given by,

$\omega = \frac{\theta}{t} = \frac{2\pi p}{t}\ \text{rad s}^{-1}$.

Tangential velocity is given by, $v = \omega r$

$\therefore\ v = \frac{2\pi p}{t} \times \pi = \frac{2\pi^2 p}{t}$.

Q5. Solution

Correct Answer: (A)

From Gauss's Law we know that,

$$\phi = \frac{q_{in}}{\varepsilon_0}$$

where, q_{in} is the net charge enclosed

So, for the given surface net charge enclosed can be calculated,

The total charge enclosed in the surface A is,

$$q_{in} = (q_1 + q_2 + q_3) = (-14 + 78.85 - 56)\ \text{nC}$$
$$\Rightarrow \mathrm{q_{in}} = 8.85 \times 10^{-9}\ \text{C}$$

Total flux through the surface A is,

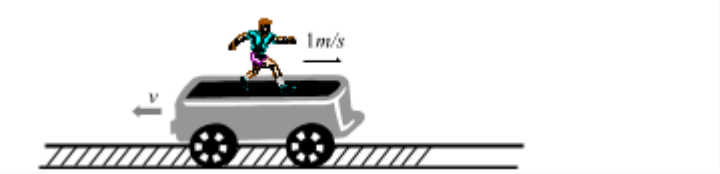
$$\phi = \frac{q_{in}}{\varepsilon_0} = \frac{8.85 \times 10^{-9}}{8.85 \times 10^{-12}} = 10^3\ \text{N m}^2\ \text{C}^{-1}$$

Therefore electric flux for the gaussian surface encloses the charged particle is free space is $10^3\ \text{N m}^2\ \text{C}^{-1}$.

Q6. Solution

Correct Answer: (C)

If the man starts walking on the trolley in the forward direction then whole system will move in backward direction with same momentum.



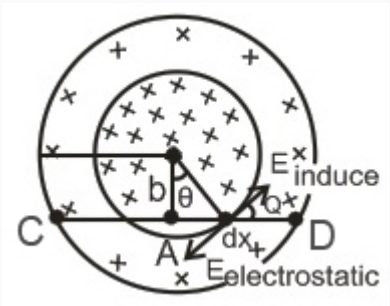
Momentum of man in forward direction = Momentum of system (man + trolley) in backward direction
$\Rightarrow 80 \times 1 = (80 + 320 \times V \Rightarrow V = 0.2\ \text{m/s}$
So the velocity of man w.r.t. ground $1.0 - 0.2 = 0.8\ \text{m/s}$
$\therefore$ Displacement of man w.r.t. ground $= 0.8 \times 4 = 3.2\ \text{m}$

Q7. Solution

Correct Answer: (A)

$E' = E_{electrostatic}$

$E = E_{induced}$



$$\oint \vec{E} \cdot d\ell = \frac{d}{dt}\vec{B} \cdot \vec{A}$$

$$E\ 2\pi r = \frac{dB}{dt}.\pi r^2 \quad \Rightarrow \quad E = \frac{r}{2}\frac{dB}{dt}$$

$$V_D - V_A = -\int \vec{E}.\vec{dx} = -\int E' dx \cos(\pi - \theta) = \int E dx \cos\theta$$

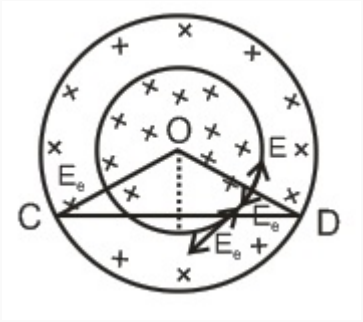
$$V_D - V_A = \frac{1}{2}\int r\frac{dB}{dt} dx \cos\theta = \frac{1}{2}\frac{dB}{dt}\int b\ dx = \frac{1}{2}\frac{dB}{dt}.b\int_0^{L/2} dx = \frac{1}{2}\frac{dB}{dt}\sqrt{R^2 - \frac{L^2}{4}} \times \frac{L}{2}$$

$$V_D - V_C = \frac{L}{2}\sqrt{R^2 - \frac{L^2}{4}}\frac{dB}{dt}$$

Alternative method

$$V_{induced} = A\frac{dB}{dt} = 2 \times \frac{1}{2} \times \frac{L}{2} \times \sqrt{R^2 - \frac{L^2}{4}}\frac{dB}{dt}$$

$$V_{induced} = \frac{L}{2}\sqrt{R^2 - \frac{L^2}{4}}\frac{dB}{dt}$$



$$V_{CO} + V_{DC} + V_{OC} = \frac{1}{2}\sqrt{R^2 - \frac{L^2}{4}}\frac{dB}{dt}$$

V_{CO} and V_{OC} are 0, because E and $d\ell$ are $\perp$

$$V_{CD} = \frac{L}{2}\sqrt{R^2 - \frac{L^2}{4}}\frac{dB}{dt}$$

Q8. Solution

Correct Answer: (B)

In the given question we have to calculate temperature at junction.Suppose the temperature at junction is θ. In steady state the heat current will be same in both rods

$\therefore H_1 = H_2$

Thermal conductivity of rods are K_1 and K_2 . The temperature at end of both rods are θ_1 and θ_2.Length of wire is l and area of cross-section is A.

So we can write

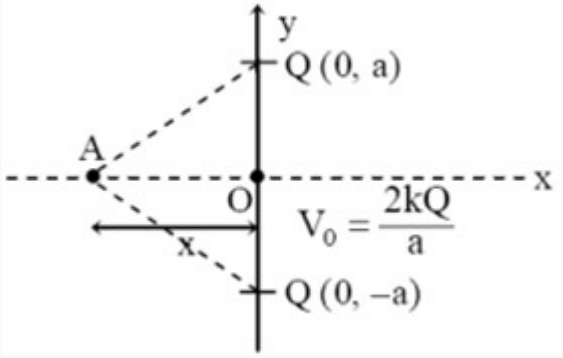
$\frac{\theta_1-\theta}{\left(\frac{l}{K_1 A}\right)} = \frac{\theta-\theta_2}{\left(\frac{l}{K_2 A}\right)}$ (θ =temperature of junction)

$K_1(\theta_1 - \theta) = K_2(\theta - \theta_2)$

$\theta = \frac{K_1\theta_1+K_2\theta_2}{K_1+K_2}$.

Q9. Solution

Correct Answer: (A)



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

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

At $x = \infty, V_\infty = 0$

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

Q10. Solution

Correct Answer: (D)

Amplitude, A = 0.06 m

Frequency, f = 15 Hz

Maximum velocity of the body,

$v_m = \omega A$

$= (2\pi f)A$

$= 2 \times 3.14 \times 15 \times 0.06$

$= 5.65 \text{ m s}^{-1}$

Maximum acceleration of the body,

$a_m = \omega^2 A$

$= (2\pi f)^2 A = 4\pi^2 f^2 A$

$= 4 \times (3.14)^2 \times 15^2 \times 0.06$

$= 5.32 \times 10^2 \text{ m s}^{-2}$

Q11. Solution

Correct Answer: (A)

Centre of mass is a point where the distribution of mass is equal around that point and it is not dependent on the gravitational field. On the other hand, the centre of gravity is a point at which distribution of weight of body is equal in all direction and this term is dependent on the gravitational field.

For a special case where gravitational field is uniform, the centre of mass and centre of gravity is coincides. For a regular shaped and small body, the gravitational field can be assumed to be uniform, hence, the centre of mass coincides with centre of gravity.

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Q12. Solution

Correct Answer: (B)

A positron is an antiparticle of the electron, so the electron has mass closest in value to that of the positron, but it has a positive charge which is equal in the magnitude of the charge of the electron.

The combination of an electron and a positron results in an annihilation process that transforms both particles into high-energy photons.

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Q13. Solution

Correct Answer: (B)

When the first positive wave enters input, the diode 1 is forward biased and diode 2 is reverse biased. So, the output is given by only diode 1. Similarly, when negative wave enters, diode 2 is forward biased and 1 is in reverse biased. So, diode 2 gives output. Therefore, B and D are contributed by diode 2.

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Q14. Solution

Correct Answer: (B)

$\text{Weight} = \mathrm{m}\left(\frac{\mathrm{GM}}{\mathrm{R}^2}\right)$
$\therefore \frac{9}{4} = \frac{\mathrm{GM_e}}{\mathrm{R_e^2}} \times \frac{\mathrm{R_p^2}}{\mathrm{GM_p}}$
Given that, $\mathrm{M_p} = \frac{\mathrm{M_e}}{9}$
$\therefore \frac{9}{4} = \frac{\mathrm{M_e}}{\left(\frac{\mathrm{M_e}}{9}\right)} \times \frac{\mathrm{R_p^2}}{\mathrm{R_e^2}}$
$\mathrm{R_p^2} = \mathrm{R_e^2} \times \frac{1}{4}$
$\mathrm{R_p} = \frac{\mathrm{R_e}}{2}$
As,
$\mathrm{R_e} = \mathrm{R}$

$\Rightarrow \mathrm{R_p} = \frac{\mathrm{R}}{2}$

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Q15. Solution

Correct Answer: (C)

$\mathrm{V_A} = 18\ \mathrm{km\ h^{-1}} = 5\ \mathrm{m\,s^{-1}}$; $\mathrm{V_B} = 27\ \mathrm{km\ h^{-1}} = 7.5\ \mathrm{m\,s^{-1}}$
Frequency received by A, $\mathrm{f_A} = \mathrm{f_0}\left(\frac{1500-5}{1500-7.5}\right)$
Frequency of reflected wave as heard by B.
$\mathrm{f'_B} = \mathrm{f_A}\left(\frac{1500+7.5}{1500+5}\right)$
$= \mathrm{f_0}\left(\frac{1500-5}{1500-7.5}\right)\left(\frac{1500+7.5}{1500+5}\right)$
$= 500\left(\frac{1495}{1492.5}\right)\left(\frac{1507.5}{1505}\right)$
$= 501.67\,\mathrm{Hz} \approx 502\ \mathrm{Hz}$.

Q16. Solution

Correct Answer: (A)

$c = f\lambda, \frac{1}{\lambda} = \frac{f}{c}$

$\frac{1}{\lambda} = R\left(\frac{1}{P^2} - \frac{1}{n^2}\right)$

$\Rightarrow f = Rc\left(\frac{1}{P^2} - \frac{1}{n^2}\right)$

$\Rightarrow f_2 = Rc\left(\frac{1}{2^2} - \frac{1}{3^2}\right) = Rc\left(\frac{1}{4} - \frac{1}{9}\right) = \frac{5Rc}{36}$

$f_1 = Rc\left(\frac{1}{2^2}\right) = \frac{Rc}{4}$

$f_3 = Rc\left(\frac{1}{3^2}\right) = \frac{Rc}{9}$

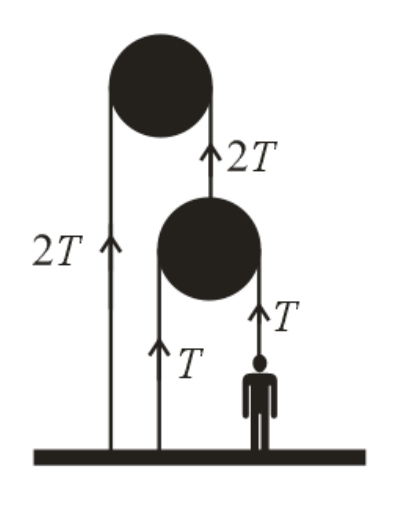
$\therefore \quad f_1 - f_3 = Rc\left(\frac{1}{4} - \frac{1}{9}\right)$

$\therefore \quad f_1 - f_3 = f_2$

$\therefore \quad f_1 - f_2 = f_3$ ∧

Q17. Solution

Correct Answer: (D)



Since the system is in equilibrium, $4\,T = mg = 60 \times 10 = 600$

$T = 150$ N

∧

Q18. Solution

Correct Answer: (C)

$\mathrm{K.E.} = \frac{1}{2}\mathrm{I}\,\omega^2$

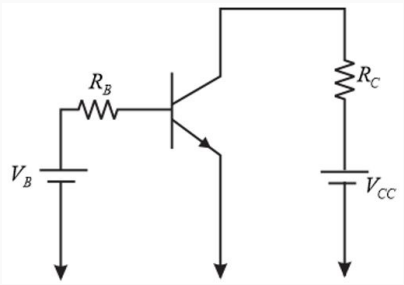
I is min. about the centre of mass

So, $(\mathrm{m_1})(\mathrm{x}) = (\mathrm{m_2})(\mathrm{L} - \mathrm{x})$

$\mathrm{x} = \frac{\mathrm{m_2 L}}{\mathrm{m_1 + m_2}}$ ∧

Q19. Solution

Correct Answer: (B)



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

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

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Q20. Solution

Correct Answer: (A)

Given,

$T_1 = 30\ \text{dyne}\ \ \text{cm}^{-1}, T_2 = 60\ \text{dyne}\ \ \text{cm}^{-1},\ r_1 = r_2$

Now recall the formula of surface tension with respect to force applied or weight applied,

$T = F/l = W/l,$

it means,

$\frac{T_1}{T_2} = \frac{W_1}{W_2}$
$\Rightarrow \frac{30}{60} = \frac{W_1}{W_2}$
$\Rightarrow \frac{W_1}{W_2} = \frac{1}{2}$

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Q21. Solution

Correct Answer: (C)

The ideal gas equation is given by, $PV = nRT$, where P is pressure, V is volume, n is number of moles, R is gas constant and T is temperature. Gas constant is given by, $R = \frac{PV}{nT}$. After putting the units of all physical quantities. We get, $\Rightarrow R = \frac{\mathrm{N\,m^{-2} \times m^3}}{\mathrm{mol \times K}}$

$\Rightarrow R = \frac{\mathrm{N\,m}}{\mathrm{mol \times K}}$ $(\mathrm{N\ m = J})$, so the unit of gas constant,

$R = \mathrm{J\ mol^{-1}\ K^{-1}}$.

Q22. Solution

Correct Answer: (B)

Change in length of brass rod

$\Delta l_B = \alpha_B l_B (T_2 - T_1)$

= $2.5 \times 10^{-5} \times 500 \times \left(200 - 50\right)$

= 1.875 mm

Similarly change in length of the steel rod

$\Delta l_s = \alpha_s l_S (T_2 - T_1)$

= $1.25 \times 10^{-5} \times 500 \times \left(200 - 50\right)$

= 0.9375 mm

Therefore, change in length of the combined rod

= $\Delta l_B + \Delta l_S = 1.875 + 0.9375$

= 2.8175 mm =2.8 mm

Q23. Solution

Correct Answer: (A)

Atomic energy reactor

Q24. Solution

Correct Answer: (D)

Speed of light v in a medium of refractive index μ is given by using the formula, $\mu = \frac{c}{v} \Rightarrow v = \frac{c}{\mu}$ $\quad \ldots . (1)$

Time taken to cover a distance t in glass slab,$= \frac{t}{v} = \frac{t\mu}{c}$ $\left[\text{using } \left(1\right)\right]$

Q25. Solution
Correct Answer: (A)

For rotational motion

$\tau = I\alpha$
$\Rightarrow F(2R) = \frac{3}{2}MR^2\left(\frac{a}{R}\right)$
$\Rightarrow a = \frac{4F}{3M} = \frac{4(20)}{3(4)} = 6\ .7\ \text{m s}^{-2}$

Q26. Solution
Correct Answer: (D)

Factors affecting internal resistance of a cell:

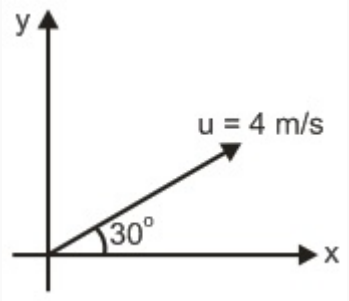
(i) Larger the separation between the electrodes of the cell, more the length of the electrolyte through which current has to flow.

(ii) Greater the conductivity of electrolyte, lesser is the resistance.

(iii) The internal resistance is inversely proportional to the common area of electrodes dipped in electrolyte.

Q27. 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
$T = \frac{2u_y}{12} = \frac{u_y}{6} = \frac{2}{6} = \frac{1}{3}s$

Q28. Solution
Correct Answer: (B)

Radio waves are in the lowest frequency range of the electromagnetic spectrum. Above that, we have infrared, visible, ultraviolet, X-rays and gamma rays. Like all other electromagnetic waves, radio waves also travel with the speed of light. The wavelength of radio waves is in the range of $1\ \text{mm}\ \text{to}\ 100\ \text{km}$. Naturally occurring radio waves are produced by lightning or by astronomical objects. Artificially generated radio waves are used for communication.

Q29. Solution
Correct Answer: (A)

Given,

The number of molecules (n) striking the wall per second is 10^{23}.

Force experienced by the wall is the rate of change in momentum of the striking molecule, i.e.,

$F = \frac{\Delta p}{\Delta t} = (nm)(2v\cos\theta)$

Pressure, $p = \frac{F}{A} = \frac{(nm)(2v\cos\theta)}{A}$

$p = \frac{10^{23} \times 3.32 \times 10^{-27} \times 2 \times 1000 \times \cos 45^{\circ}}{2 \times 10^{-4}}$

$p = 2.34 \times 10^{3}\ \text{N m}^{-2}$

Q30. Solution
Correct Answer: (C)

The deviation will be minimum for some particular value of angle of incidence. The graph is shifted towards origin and is distorted parabola.

Q31. Solution
Correct Answer: (A)

(i) More be the ionic nature, more be the attractive force between the species.
(ii) More be the attractive force, More be the thermal stability.
(iii) Ionic character for the same anionic species, increases down the group.
Thus, correct order for thermal-stability is
$\text{BaCO}_3 > \text{CaCO}_3 > \text{MgCO}_3$

Q32. Solution

Correct Answer: (B)

Reactivity of benzene ring towards towards electrophile depends upon electron density in benzene rings. If electron donating group is attached to benzene ring it will increase the electron density and enhances the reactivity. But if an electron-withdrawing group is attached to benzene ring it will reduce the electron and lowers the reactivity. So correct option is B.

Q33. Solution

Correct Answer: (B)

$\mathrm{CO(g) + 0.5O_2(g) \rightarrow CO_2(g)}$

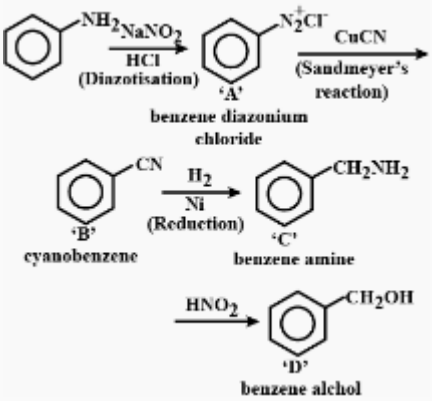
$\Delta n_g = n_p - n_r = 1 - 1.5 = -0.5$

$K_p = K_c(RT)^{\Delta n} = K_c(RT)^{-0.5}$

$\frac{K_p}{K_c} = \frac{1}{\sqrt{RT}}$

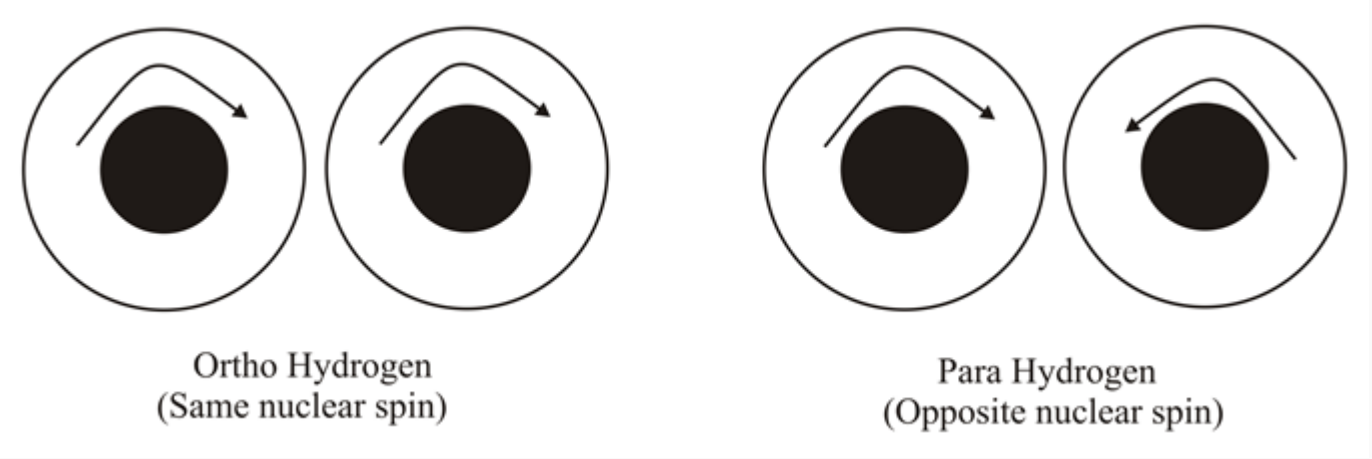
Q34. Solution

Correct Answer: (D)



Q35. Solution

Correct Answer: (B)



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

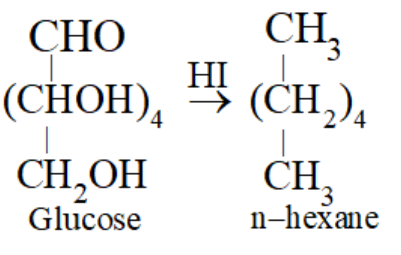
Q36. Solution

Correct Answer: (D)

All of these are facts.

Q37. Solution

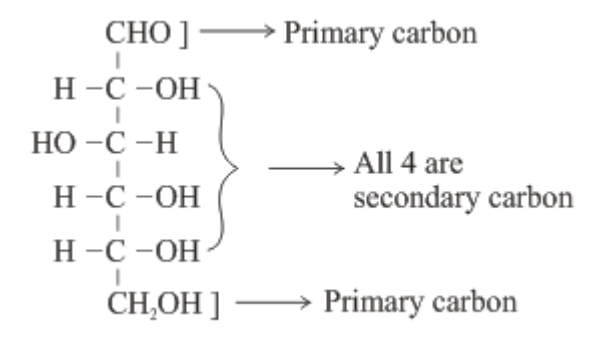
Correct Answer: (B)



Q38. Solution

Correct Answer: (B)

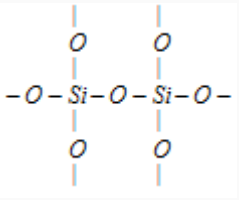
There are 4 secondary alcohols present in glucose. The structure of glucose depicts:



Also, the structure of glucose shows that it has an aldehyde group the secondary alcoholic groups and primary alcoholic group.

Q39. Solution

Correct Answer: (A)



Q40. Solution

Correct Answer: (A)

As Both ΔH and ΔS are positive so to keep $\Delta G = -$ve High Temp is favourable so that process become spontaneous.

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

$T = \frac{\Delta H}{\Delta S} = \frac{35.5 \times 1000}{83.6} = 424.6K$

$T > 425K$

Q41. Solution

Correct Answer: (D)

$K_3\left[Fe(CN)_6\right]$ is most effective in coagulating a ferric hydroxide sol.

Q42. Solution

Correct Answer: (B)

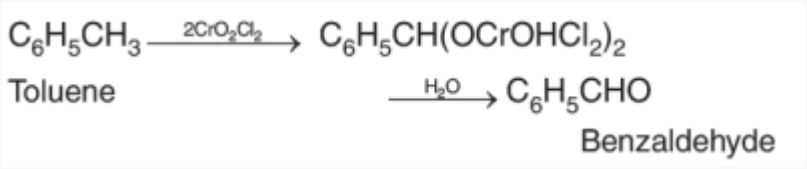
Leaching is often used if the ore is soluble in some suitable solvent. In the metallurgy of silver and that of gold, the respective metal is leached with a dilute solution of NaCN or KCN in the presence of air (for $\mathrm{O_2}$) from which the metal is obtained later by replacement.

$4 \mathrm{M}(\mathrm{s})+8 \mathrm{CN}^{-}(\mathrm{aq})+2 \mathrm{H}_2 \mathrm{O}(\mathrm{aq})+\mathrm{O}_2(\mathrm{~g}) \rightarrow 4\left[\mathrm{M}(\mathrm{CN})_2\right]^{-}(\mathrm{aq})+4 \mathrm{OH}^{-}(\mathrm{aq})$ ($\mathrm{M}=\mathrm{Ag}$ or Au)

$2\left[\mathrm{M}(\mathrm{CN})_2\right]^{-}(\mathrm{aq})+\mathrm{Zn}(\mathrm{s}) \rightarrow\left[\mathrm{Zn}(\mathrm{CN})_4\right]^{2-}(\mathrm{aq})+2 \mathrm{M}(\mathrm{s})$

Q43. Solution

Correct Answer: (C)



This reaction is known as Etard reaction.

Q44. Solution

Correct Answer: (A)

Sodium reacts rapidly with water but copper is least reactive with water. Therefore, the reactivity of metals with water is $\mathrm{Na}>\mathrm{Mg}>\mathrm{Zn}>\mathrm{Fe}>\mathrm{Cu}$ Most reactive $\overset{\text{decreasing reactivity}}{\Rightarrow}$ Least reactive

Q45. Solution

Correct Answer: (D)

Alkali metals, lower the no. of valence electrons, lower is the value of ionization potential.

Q46. Solution

Correct Answer: (A)

The most probable complex which gives three moles ions in aqueous solution may be $\left[\mathrm{Co}\left(\mathrm{NH}_3\right)_5 \mathrm{NO}_2\right] \mathrm{Cl}_2$ because it gives two chlorine atoms on ionisation. $\left[\mathrm{Co}\left(\mathrm{NH}_3\right)_5 \mathrm{NO}_2\right] \mathrm{Cl}_2 \rightarrow\left[\mathrm{Co}\left(\mathrm{NH}_3\right)_5 \mathrm{NO}_2\right]^{2+}+2 \mathrm{Cl}^{-}$

Q47. Solution

Correct Answer: (C)

$\mathrm{CrCl}_3 \cdot 6 \mathrm{H}_2 \mathrm{O}$ has $3-\mathrm{Cl}$ atoms but $\frac{1}{3}$ Cl atoms precipitated so one 1 Cl atom get precipitated.

According to Werner's theory, only those ions are precipitated which are attached to the metal atoms with ionic bonds and are present outside the co-ordination sphere.

$\left[\mathrm{Cr}\left(\mathrm{H}_2 \mathrm{O}\right)_4 \mathrm{Cl}_2\right] \mathrm{Cl}\,(\mathrm{aq}) \rightleftharpoons \quad\left[\mathrm{Cr}\left(\mathrm{H}_2 \mathrm{O}\right)_4 \mathrm{Cl}_2\right]^{+}(\mathrm{aq})+\mathrm{Cl}^{-}(\mathrm{aq})$

$\mathrm{Ag}^{+}+\mathrm{Cl}^{-} \longrightarrow \mathrm{AgCl} \downarrow(\text{white})$

Q48. Solution

Correct Answer: (D)

$\frac{U_{MP}}{U_{rms}}=\sqrt{\frac{\frac{2RT_1}{M}}{\frac{3RT_2}{M}}}=\sqrt{\frac{2}{3}\frac{T_1}{T_2}}\Rightarrow\frac{2}{3}\frac{T_1}{T_2}=1$

$T_1=\frac{3}{2}\times 300=450K$

Q49. Solution

Correct Answer: (D)

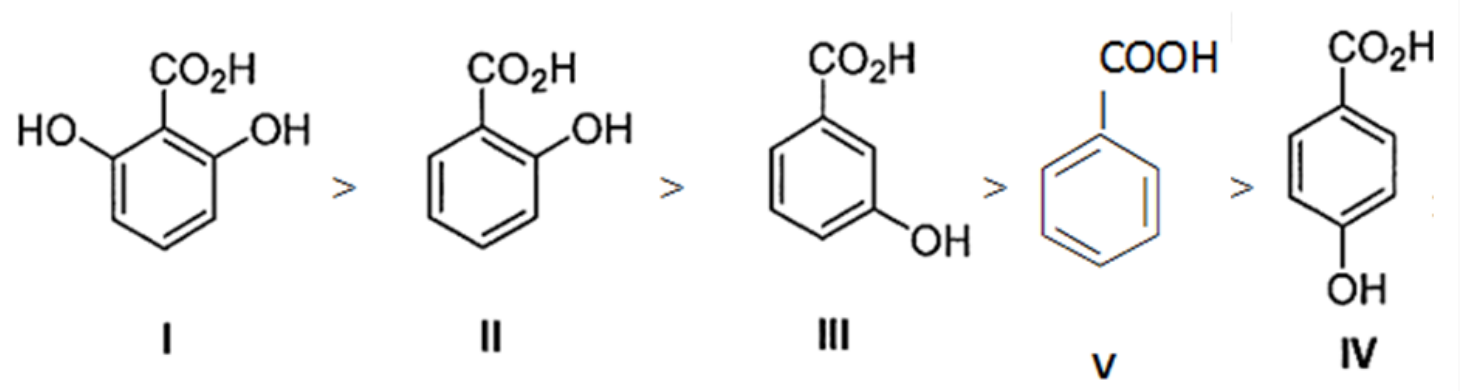
$Na^+ > Mg^{2+} > Al^{3+} > Si^{4+}$. All are isoelectronic but nuclear charge per electron is greatest for si^{4+}. So it has smallest size and nuclear charge per electron for $Na^+$is smallest. So it has largest size.

Q50. Solution

Correct Answer: (D)

Acidic nature $\propto$ electron withdrawing group (-I, -R) $\propto$ ortho effect

Ortho substituted benzoic acid is always more acidic than its other substituted isomers as here steric inhibition of resonance occurs



Q51. Solution

Correct Answer: (C)

BCl_3 has zero dipole moment because of its trigonal planar geometry.

Q52. Solution

Correct Answer: (B)

In ZnS structure, sulphides occupy all the lattice points while Zn^{2+} ions are present in alternative tetrahedral voids.

NaCl has FCC structure and Na^+ atom occupied all octahedral hole.

CaF_2 has FCC structure and all T-holes will occupied by guest.

Na_2O has FCC sturcture and all T-holes wll occupied by guest.

Q53. Solution

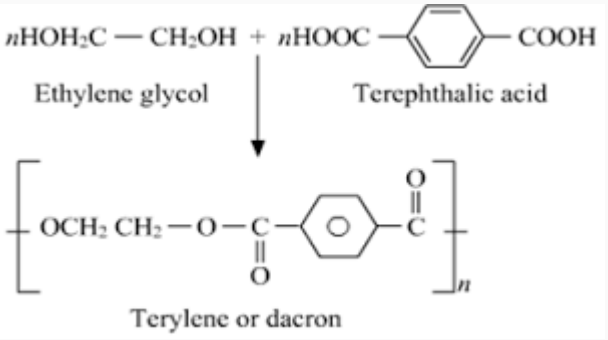
Correct Answer: (C)

In between dilute H_2SO_4 and platinum electrode O_2 gas evolve at anode.

Q54. Solution

Correct Answer: (D)

Condensation polymerization: This type of polymerization generally involves a repetitive condensation reactions between two bi-functional monomers. These poly-condensation reactions may result in the loss of simple molecule as water, alcohol etc. Example: Terylene (as shown in the figure).



Q55. Solution

Correct Answer: (D)

1) 10 mM HCl + 10 mM NaOH $\Rightarrow$ pH = 7

2)5.5 mM HCl + 4.5 mM NaOH $\Rightarrow$1mM HCl in 100mL. [HCl] = 10^{-2} M pH = 2

3) 1 mM HCl + 9 mM NaOH $\equiv$ 8mM NaOH in 100mL
= 8×10^{-2} M NaOH
pOH = 2 - log 8 = 1.1
pH = 12.9

4) 7.5 m M HCl + 2.5 m M NaOH = 5 mM HCl in 100mL
[HCl] = 5×10^{-2} M
pH = 2 - log 5 = 2 - 0.7 = 1.3 close to 1

Q56. Solution

Correct Answer: (A)

$SO_3^{2-} + H_2SO_4 \rightarrow SO_2 + H_2O + SO_4^{2-}$

Since SO_2 has a burning sulphur smell which is irritating, Hence, X is SO_3^{2-} , and Y is SO_2 which turns acidified $K_2Cr_2O_7$ solution green due to its reduction to Cr^{3+} ions.

$3SO_2 + K_2Cr_2O_7 + H_2SO_4 \rightarrow K_2SO_4 + Cr_2(SO_4)_3 + H_2O$

Q57. Solution

Correct Answer: (D)

$\%$ of $\mathrm{C} = \frac{12}{44} \times \frac{0.15}{0.2} \times 100 = 20\%$

$\%$ of $\mathrm{H} = \frac{2}{18} \times \frac{0.12}{0.2} \times 100 = 6.66\%$

$\%$ of $\mathrm{O} = 100 - (20 + 6.66) = 73.34\%$

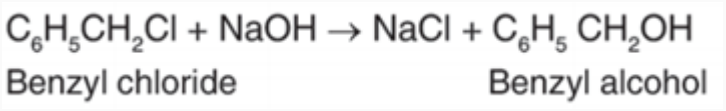
Q58. Solution

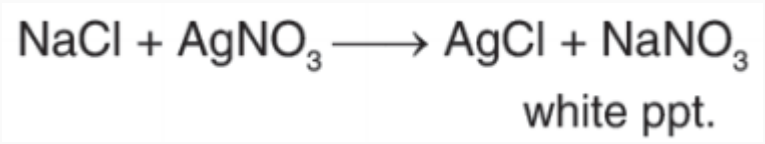
Correct Answer: (C)

Oxidation state of Mn changes from $+7$ to $+2$ in acidic medium i.e. one mole of it accepts 5 mole of electrons.

Q59. Solution

Correct Answer: (B)





Therefore, compound A is identified as benzyl chloride.

Q60. Solution

Correct Answer: (B)

According to MOT bond order for $\mathrm{O_2}$ is 2 and $\mathrm{O_2^+}$ is 2.5 and both are paramagnetic

Q61. Solution

Correct Answer: (A)

In this question, both the terms in the given pair are related to each other in the following way;

The second number denotes the number which is twice the first.

$\mathrm{XXIV}\ (24) : 48$

Similarly,

$\mathrm{XIV}(14) : 28$

Hence, the answer is 28.

Therefore, the correct option is 'A'.

Q62. Solution

Correct Answer: (A)

According to the question,

Given information is, $52,\ 45,\ 66,\ 31,\ 80,\ ?$

Now we find the next term of this series,

So, the pattern used in this series is, $-7\times 1,\ +7\times 3,\ -7\times 5,\ +7\times 7\ldots$

$45\ =\ 52\ -7\times\ 1, 66\ =\ 45\ +\ 7\ \times\ 3, 31\ =\ 66\ -\ 7\ \times\ 5, 80\ =\ 31+\ 7\times 7\,?\ =\ 80\ -\ 7\ \times\ 9\ =\ 17.$

Hence, the answer is 17.

Q63. Solution

Correct Answer: (A)

We have

$2,\ 7,\ 17,\ 32,\ 52,\ 77,\ \_\_\_$

Differences between the consecutive terms of the series are $5,\ 10,\ 15,\ 20, \ldots\ldots$

$7-2=5,$

$17-7=10,$

$32-17=15,$

$52-32=20,$

$77-52=25$

Following the same pattern, the next number of this series is $77+30=107$.

Hence, 107 is the correct answer.

Q64. Solution

Correct Answer: (D)

In all the letter- cluster there is gap of one letter between the 1st letter and the 4th letter from the left in the letter cluster except in the letter-cluster KGIH.

Q65. Solution

Correct Answer: (A)

Speaker is B pointing towards A.

B is saying that A is the only brother of his father's wife.

We will solve this question from right to left.

B's father wife = B's mother

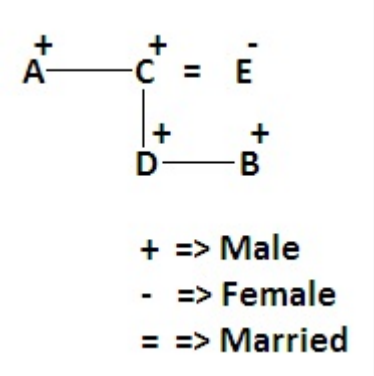
B's mother's only brother = B's maternal uncle.

Hence, A is B's maternal uncle.

Q66. Solution

Correct Answer: (D)

B and D are brothers and hence their father is C and their mother is E. So, C and E are related as husband and wife.

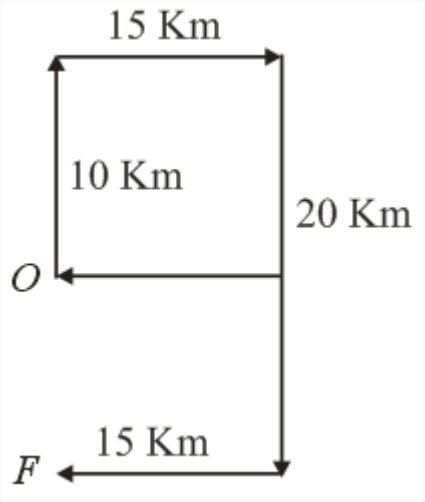


Hence, from above, E is the wife of C.

Q67. Solution

Correct Answer: (C)

Megha starts walking $10\ \text{km}$ towards North. Then, she turns right and walks $15\ \text{km}$. She again turns right and walks for another $20\ \text{km}$. Again turning right, she walks for about$15\ \text{km}$ more.



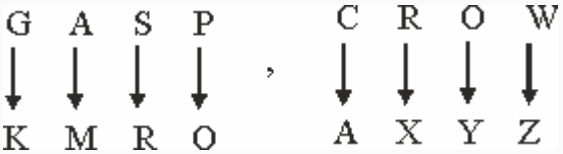
She starts from point O and finally reaches to F.

Distance between O to F from the image above is

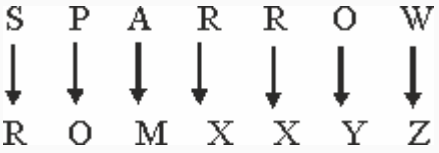
$(20\ -\ 10) =\ 10\ km$

Q68. Solution

Correct Answer: (C)



Then,



By studying the original words and their coded words it is clear that for S stands R, for P stands O and so on.

Q69. Solution
Correct Answer: (A)

According to the question

If we assign a number to each of the letters for the word CALANDER, the shifting of letters for code formation can be observed.

C - 1

A - 2

L - 3

A - 4

N - 5

D - 6

E - 7

R - 8

Thus, the code CLANAEDR was formed by arranging the letters in following sequence $1, 3, 2, 5, 4, 7, 6, 8$ which means, except first and last letters, all the two subsequent letters are reversed. In the same way we can reverse the sequence of letters in word CIRCULAR as CRIUCALR.

Hence, the correct answer is CRIUCALR.

Q70. Solution
Correct Answer: (D)

Here, the second number (m) is the difference between the cube of the first number(n) and the first number itself.

$m = n^3 - n$

$11^3 - 11 = 132014^3 - 14 = 273015^3 - 15 = 336018^3 - 18 = 5814$

Hence, the pair $18 - 5812$ is not correct.

Q71. Solution
Correct Answer: (C)

Venn Diagram Method:

Analytical Method:
In conclusion II we need to derive a relationship between the classes ‘manager’ and ‘clerk’ which are present in S3 and S1 respectively.
By applying the deduction method on S1 and S2, we get ‘No clerk is a doctor’. Now taking this and S3, we can once again apply the deduction method and get the conclusion as ‘Some managers are not clerks’ which is not given as a conclusion. Conclusion I hence doesn’t follow.
For conclusion II, we can take S2 and S3 and apply the deduction method. The derived conclusion is ‘Some managers are not professors’. Here, we are not sure of the elements of the class ‘professors’ and therefore the possibility ‘All professors being managers’ exists. Conclusion II, thus, follows.
Option C is hence the correct answer.

Q72. Solution
Correct Answer: (A)

Venn Diagram Method:

Analytical Method:
In the both the conclusions, the we need to derive a relationship between the classes ‘wish’ and ‘drop’ which are present in S3 and S1 respectively.
Here, the middle term ‘crop’ is distributed once in S3 and hence we can apply the deduction method and get the conclusion as ‘Some drops are not wishes’.
Clearly, neither of the two conclusions follows.
Option A is hence the correct answer.

Q73. Solution
Correct Answer: (D)

The middle position in the row of 33 persons from either end is 17^{th}.
Thus, the position of Pankaj from left end after shifting 7 places to the right is 17^{th}.
So the original position of Pankaj from the left end = 17 – 7 = 10.
This means the original position of Pankaj from the left end was 10^{th}.
Thus the original position of Pankaj from the right end = (33 – 10) + 1 = 24^{th}.
Hence the correct answer is option D.

Q74. Solution

Correct Answer: (D)

We have,

Rajat is 11^{th} from the right end of the row, and there 10 persons between Rajat and Manoj. Shobit is exactly between Manoj and Heera, who is 15^{th} from the left end of the row.

After using the above information, we have,

Order of persons in the row = (14 persons + Heera + x persons + Shobit + x persons + Manoj + 10 persons + Rajat + 10 persons**)**

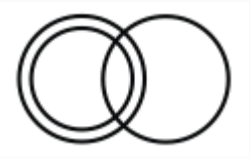
Here, we have no information about the total number of persons between Manoj and Heera.

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

Q75. Solution

Correct Answer: (D)

We know that every mother is a woman but only some (and not all) mothers or women are doctors. Therefore, the following diagram represents the three given classes best.



Hence, option D is correct.

Q76. Solution

Correct Answer: (D)

A **E** % 6 Y B **R** & # P U **W** © 2 I $ 3 * L O M V

Following the sequence above, it's clear that there are 3 such permutations.

Option D is hence the correct answer.

Q77. Solution

Correct Answer: (D)

Second is the mode of transfer of heat through the first.

Hence, option D is correct.

Q78. Solution
Correct Answer: (C)

Given analogy: Oxygen: Burn.
We know that Oxygen supports the chemical processes that happen during a fire.
So, we can say that 'Oxygen' helps in burning.
Similarly, Carbon dioxide extinguishers work by displacing oxygen or taking away the oxygen element of the fire triangle. So, we can say that it helps in extinguishing the fire.
Hence, the correct answer is Extinguish.

Q79. Solution
Correct Answer: (A)

In the given option B, C and D, they name of the mountain pass, whereas option A is a famous mountain peak in India.

- Saltoro Kangri is the mountain peak
- Kongka, Zoli La and Kumbharli Ghat are Mountain Pass.
- Zoji la is a high mountain pass in the Himalayas in the Indian union territory of Ladakh.

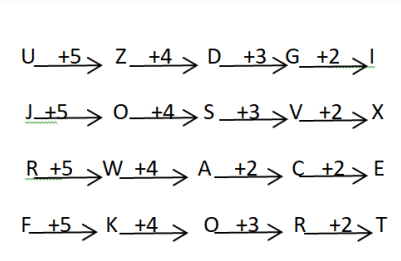
Hence, Saltoro Kangri is the odd one.

Q80. Solution
Correct Answer: (C)

The given groups of letters are,

UZDGI, JOSVX, RWACE and FKORT

Here, the pattern follows in all groups is plus five in the first letter then we get the second letter, plus four in the second letter then we get the third letter, plus three in the third letter then we get the fourth letter, and finally plus two in the fourth letter then we get the fifth letter.



Thus, all groups are following the same pattern except RWACE.

So, RWACE is odd in all groups.

Hence, this is the correct answer.

Q81. Solution
Correct Answer: (B)

The error lies in section (B).

Use "would" in place of "will" in section (B).

If the reporting verb is in the past tense, the reported speech should also be in the corresponding past tense, if it is not some historical fact, geographical fact, quotation, habitual truth, scientific fact, universal truth etc. In the given sentence, the reporting verb "declared" is in the past tense. So, the reported speech "that all will go wrong without her" should also be in the past tense.

Hence, the correct sentence will be "I declared that all would go wrong without her".

Q82. Solution
Correct Answer: (C)

The phrase ‘hand down’ means 'to give knowledge or skill to someone who is younger than someone and will live after they have died'. Here, the stories have been handed down from generation to generation.
Thus, 'handed down' is the correct phrase to be filled in the given blank.
'Handed in' means to submit something like an assignment or project.
'Handed back' refers to returning something.
'Handed up' means to give assistance for moving up in office or authority.

Q83. Solution
Correct Answer: (B)

'Bale' is a large amount of a light material pressed tightly together.
Example: Bales of hay/straw/cotton/wool.
Here, bale is the right usage as it refers to a standard-sized and weighted pack of compressed cotton lint after ginning.

Hence, the correct sentence is:

The bale of cotton is very heavy.

Q84. Solution
Correct Answer: (C)

'IMPECCABLE' is an adjective, which means simply 'perfect' or 'having no faults'. So, the correct answer is 'Flawless'.
Whereas, 'Remarkable' means something exceptional, 'Unbelievable' means something not able to be believed, and 'Displeasing' means causing dissatisfaction.

Q85. Solution
Correct Answer: (A)

‘Fantastic’ means extremely good. ‘Wonderful’ means extremely good. ‘Fantastic’ and ‘wonderful’ mean extremely good as stated in their meanings. Therefore, they are synonyms.

‘Charming’ means very pleasing or appealing. ‘Beautiful’ means having beauty. ‘Intelligent’ means having or showing a lot of intelligence. ‘Charming’ is eliminated because it highlights pleasant appearance and not nobility. ‘Beautiful’ is eliminated because it highlights beauty whereas fantastic is not only related to beauty only. ‘Intelligent’ is eliminated because it highlights intelligence which is related to mental capability and fantastic applies to everything.

Therefore, the correct answer is ‘wonderful’.

Q86. Solution

Correct Answer: (A)

It is given that D is the last statement. Out of the rest, E is the best fit for being the first statement as A and C are clearly continuations of previous statements. B cannot be the first statement as then E would not fit anywhere else. Hence, E is the first statement.

Connectors:

E and F:

E. Iraq's parliamentary election results marked a remarkable comeback for Muqtada al-Sadr, the nationalist Shia cleric who for years had been sidelined both by the Iraqi establishment and its Iranian backers.

F. He is the nationalist Shia cleric who for years had been sidelined both by the Iraqi establishment and its Iranian backers.

F and B: B gives the background for statements E and F

F. He is the nationalist Shia cleric who for years had been sidelined both by the Iraqi establishment and its Iranian backers.

B. The May 12 parliamentary vote was crucial for all the main blocs in Iraq.

B and A:

B. The May 12 parliamentary vote was crucial for all the main blocs in Iraq.

A. Prime Minister Haider al-Abadi, who led the Victory Alliance, bet on the gains the Iraqi army made under his leadership in the war against the Islamic State to win political points.

A and C:

A. Prime Minister Haider al-Abadi, who led the Victory Alliance, bet on the gains the Iraqi army made under his leadership in the war against the Islamic State to win political points.

C. For the Al-Fatih bloc, a coalition of parties and leaders that have close ties with Iran, capturing power was important at a time when Iran is facing new regional challenges, and they ran a largely pro-Shia campaign.

C and D:

C. For the Al-Fatih bloc, a coalition of parties and leaders that have close ties with Iran, capturing power was important at a time when Iran is facing new regional challenges, and they ran a largely pro-Shia campaign.

D. Mr. Sadr, on the other side, shed his early sectarian image, focussed his campaign on social justice and government failure, attacked Iran's deepening influence in Iraq from a nationalist perspective and stitched up alliances with liberals and communists to expand his base.

The correct sequence is E-F-B-A-C-D.

As per this, statement F is the second statement.

Hence, option A is correct.

Q87. Solution

Correct Answer: (C)

It is given that D is the last statement. Out of the rest, E is the best fit for being the first statement as A and C are clearly continuations of previous statements. B cannot be the first statement as then E would not fit anywhere else. Hence, E is the first statement.

Connectors:

E and F:

E. Iraq's parliamentary election results marked a remarkable comeback for Muqtada al-Sadr, the nationalist Shia cleric who for years had been sidelined both by the Iraqi establishment and its Iranian backers.

F. He is the nationalist Shia cleric who for years had been sidelined both by the Iraqi establishment and its Iranian backers.

F and B: B gives the background for statements E and F

F. He is the nationalist Shia cleric who for years had been sidelined both by the Iraqi establishment and its Iranian backers.

B. The May 12 parliamentary vote was crucial for all the main blocs in Iraq.

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B. The May 12 parliamentary vote was crucial for all the main blocs in Iraq.

A. Prime Minister Haider al-Abadi, who led the Victory Alliance, bet on the gains the Iraqi army made under his leadership in the war against the Islamic State to win political points.

A and C:

A. Prime Minister Haider al-Abadi, who led the Victory Alliance, bet on the gains the Iraqi army made under his leadership in the war against the Islamic State to win political points.

C. For the Al-Fatih bloc, a coalition of parties and leaders that have close ties with Iran, capturing power was important at a time when Iran is facing new regional challenges, and they ran a largely pro-Shia campaign.

C and D:

C. For the Al-Fatih bloc, a coalition of parties and leaders that have close ties with Iran, capturing power was important at a time when Iran is facing new regional challenges, and they ran a largely pro-Shia campaign.

D. Mr. Sadr, on the other side, shed his early sectarian image, focussed his campaign on social justice and government failure, attacked Iran's deepening influence in Iraq from a nationalist perspective and stitched up alliances with liberals and communists to expand his base.

The correct sequence is E-F-B-A-C-D.

As per this, statement C is the fifth statement.

Hence, option C is correct.

Q88. Solution

Correct Answer: (C)

Paucity: a scarcity or lack of something.

Dearth, insufficient and want all are synonyms of paucity.

Only **surfeit** meaning plenty is correct.

Hence, option C is correct.

Q89. Solution
Correct Answer: (B)

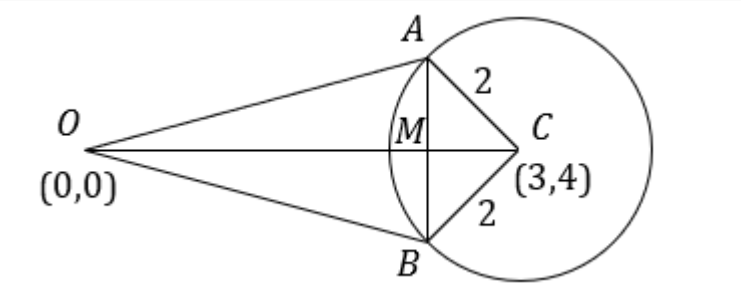
The idiom 'To change colour' usually means 'To resile oneself from their earlier position, or to shift positions'.
E.g., She immediately changed colours when her friend lost all her money.
Hence, the correct meaning is 'to shift allegiance to', which is given in the second option. Thus, option B is the correct answer.

Q90. Solution
Correct Answer: (A)

The idiom "turn him off" means to stop something to function or to dismiss something or release someone from a duty whereas warn scold and punish are used in other context when someone is angry.

Q91. Solution
Correct Answer: (B)

Here the equation of AB (chord of contact) is $0+0-3(x+0)-4(y+0)+21=0$
$\Rightarrow 3x+4y-21=0 \ldots (i)$



$\frac{3\times3+4\times4-21}{\sqrt{9+16}}=\frac{4}{5}$

$CM=$ perpendicular distance from $(3,4)$ to line (i) is $AM=\sqrt{AC^2-CM^2}=\sqrt{4-\frac{16}{25}}=\frac{2}{5}\sqrt{21}$

$\therefore AB=2AM=\frac{4}{5}\sqrt{21}$

Q92. Solution

Correct Answer: (D)

$f(x) = (3x^2 + ax - 2 - a)e^x$
$f\prime(x) = (3x^2 + ax - 2 - a)e^x + e^x(6x + a) = e^x(3x^2 + (a + 6)x - 2)$

$\because$ $x = 1$ is a critical point $\therefore$ $f'(1) = 0$

$\therefore 3 + a + 6 - 2 = 0$
$a = -7$

$\therefore f'(x) = e^x(3x^2 - x - 2) = e^x(3x^2 - 3x + 2x - 2) = e^x(3x + 2)(x - 1)$

$\therefore$ maxima at x $= \frac{-2}{3}$ $\therefore$ minima at x $= 1$

Q93. Solution

Correct Answer: (A)

We know that, area bounded by the curve $y = f(x)$ and x-axis for $x \in [a, b]$ is given by,

Area $\Delta = \int_a^b f\Big(x\Big)dx$

Here, the given curve is $y = 1 - 2^{1+\sin x}$ and $x \in \left[0, \frac{\pi}{2}\right]$.

Therefore, Area $\Delta = \int\limits_0^{\frac{\pi}{2}} \left(1 - 2^{1+\sin x}\right)dx = \frac{\pi}{2} - 2\int\limits_0^{\frac{\pi}{2}} 2^{\sin x}dx$

$= \frac{\pi}{2} - 2k \left(\because \int\limits_0^{\frac{\pi}{2}} 2^{\sin x}dx = k\right)$

$= \frac{\pi - 4k}{2}$ sq. units.

Q94. Solution

Correct Answer: (A)

Given,

Radius of the first and second circle $= b$

Centre of first circle $= (0, 0)$

Centre of the second circle $= (a, 0)$

$\mathrm{y = mx - b\sqrt{1 + m^2}}$ touches both the circles, so distance from centre = radius of both the circles.

$\frac{\mathrm{ma - 0 - b\sqrt{1+m^2}}}{\sqrt{\mathrm{m^2+1}}} = b$

$\mathrm{ma - b\sqrt{1 + m^2} \;=\; -b\sqrt{1 + m^2}}$

$\mathrm{m^2a^2 - 2abm\sqrt{1 + m^2} + b^2\left(1 + m^2\right) = b^2\left(1 + m^2\right)}$

$\mathrm{\Rightarrow ma - 2b\sqrt{1 + m^2} = 0}$

$\mathrm{\Rightarrow m^2a^2 = 4b^2\left(1 + m^2\right)}$

$\mathrm{\Rightarrow m = \frac{2b}{\sqrt{a^2 - 4b^2}}}$

Q95. Solution

Correct Answer: (A)

Since, we know the matrix, we can find the characteristics polynomial of this matrix, $p(\lambda)$ when λ are the eigenvalue of the matrix which are the roots of polynomial.

So, $p(\lambda) = \det[A - \lambda I],\ I$ is the identity matrix.

$$A - \lambda I = \begin{bmatrix} 1 & 0 & 2 \\ 0 & 2 & 1 \\ 2 & 0 & 3 \end{bmatrix} - \begin{bmatrix} \lambda & 0 & 0 \\ 0 & \lambda & 0 \\ 0 & 0 & \lambda \end{bmatrix} = \begin{bmatrix} 1 - \lambda & 0 & 2 \\ 0 & 2 - \lambda & 1 \\ 2 & 0 & 3 - \lambda \end{bmatrix}$$

So, $\det(A - \lambda I)$

$= (1 - \lambda)[(2 - \lambda)(3 - \lambda) - 0] + 2(-2 \times (2 - \lambda))$

$= \left(1 - \lambda\right)\left[6 - 5\lambda + \lambda^2\right] + 0 + 2\left(-4 + 2\lambda\right)$

$= 6 - 5\lambda + \lambda^2 - 6\lambda + 5\lambda^2 - \lambda^3 - 8 + 4\lambda$

$= -\lambda^3 + 6\lambda^2 - 7\lambda - 2$

We see, that the characteristic polynomial is same as the polynomial given. If we compare both, $k = 2$.

Q96. Solution

Correct Answer: (B)

$|z| = \left(z - \frac{4}{z}\right) + \frac{4}{z}$

$\Rightarrow |z| \leq \left| z - \frac{4}{z} \right| + \frac{4}{|z|}$

$\Rightarrow |z| \leq 2 + \frac{4}{|z|}$

$\Rightarrow |z|^2 \leq 2|z| + 4$

$\Rightarrow |z|^2 - 2|z| - 4 \leq 0$

$|z| = \frac{-(-2) \pm \sqrt{(2)^2 - 4(1)(-4)}}{2(1)}$

$|z| = \frac{2 \pm \sqrt{20}}{2}$

$|z| = \frac{2 \pm 2\sqrt{5}}{2} = 1 \pm \sqrt{5}$

Hence

$\Rightarrow \left(|z| - \left(\sqrt{5} + 1\right)\right)\left(|z| - \left(1 - \sqrt{5}\right)\right) \leq 0$

$\Rightarrow \quad 1 - \sqrt{5} \leq |z| \leq \sqrt{5} + 1$

Q97. Solution

Correct Answer: (C)

Given curve $y^2 = 6x$ difference w.r.t ' x ' $\Rightarrow \quad 2y\frac{dy}{dx} = 6$

$$\Rightarrow \qquad \frac{dy}{dx} = \frac{3}{y} \qquad \ldots \text{(i)}$$

Given equation of tangent is $5x - 2y + k = 0$ Slope $= \frac{5}{2}$

$\therefore \quad \frac{3}{y} = \frac{5}{2} \Rightarrow y = \frac{6}{5}$ Substitute value of y in $y^2 = 6x$

$\left(\frac{6}{5}\right)^2 = 6x \Rightarrow \frac{36}{25} = 6x$ Hence, point of contact is $\left(\frac{6}{25}, \frac{6}{5}\right)$

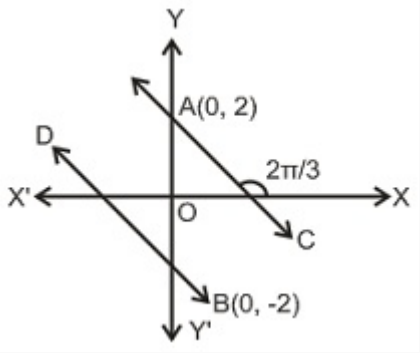
$\Rightarrow \quad x = \frac{6}{25}$

Q98. Solution

Correct Answer: (A)

$\text{Slope of the line} = \tan\frac{2\pi}{3}$

$= \tan\left(\pi - \frac{\pi}{3}\right) = \tan\left(-\frac{\pi}{3}\right) = -\sqrt{3}$



Equation of the line AC passing through (0,2) and having the slope $-\sqrt{3}$ is

$y - 2 = -\sqrt{3}(x - 0) \Rightarrow \sqrt{3}x + y - 2 = 0$

Since, another line BD is parallel to AC

$\therefore$ Slope of BD = Slope of AC $= -\sqrt{3}$

BD is passing through the point B(0, –2)

$\therefore$ Equation of BD is $y + 2 = -\sqrt{3}\ (x - 0)$

$\Rightarrow \quad \sqrt{3}x + y + 2 = 0$

Thus, equation of AC and BD are

$\sqrt{3}x + y - 2 = 0$ and $\sqrt{3}x + y + 2 = 0$

Q99. Solution

Correct Answer: (A)

We have, $\sin^4 x - \cos^2 x \sin x + 2\sin^2 x + \sin x = 0$

$\Rightarrow \sin^4 x - \left(1 - \sin^2 x\right)\sin x + 2\sin^2 x + \sin x = 0$

$\Rightarrow \sin^4 x + \sin^3 x + 2\sin^2 x = 0$

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

$\Rightarrow \sin^2 x = 0 \ \&\ \sin^2 x + \sin x + 2 = 0$

$\therefore$ $\sin x = 0$ because $\sin^2 x + \sin x + 2 = 0$ has imaginary roots.

Then, the general solution of $\sin x = 0$ is $x = n\pi$.

$\therefore\ x = 0,\ \pi,\ 2\pi,\ 3\pi\ (\because x \in [0, 3\pi])$

So, their is 4 solutions.

Q100. Solution
Correct Answer: (C)

For the given system to have a non-trivial solution, we must have

$$\begin{matrix} 1 & \mathrm{k} & 3 \\ 3 & \mathrm{k} & -2 \\ 2 & 3 & -4 \end{matrix} = 0 \Rightarrow \mathrm{k} = \frac{33}{2}$$

Q101. Solution
Correct Answer: (D)

We have,

$f(x) = e^{\sin\,(x-[x])} + [x]\cos\left(\frac{\pi}{[x+1]}\right)$

For $f(x)$ to be defined,

$[x+1] \neq 0$

$\Rightarrow [x] + 1 \neq 0$

$\Rightarrow [x] \neq -1$

$\Rightarrow x \notin [-1,\ 0)$

Hence, domain of $f(x)$ is $x \in R - [-1,\ 0)$.

Q102. Solution
Correct Answer: (B)

Given, $\frac{dy}{dx} = \frac{x^3+y^3}{xy^2}$
Put $y = vx$
$\Rightarrow \frac{dy}{dx} = v + x\ \frac{dv}{dx}$
$\Rightarrow x\frac{dv}{dx} + v = \frac{1+v^3}{v^2}$
$\Rightarrow v^2 dv = \frac{dx}{x}$
$\Rightarrow \frac{v^3}{3} = \log x + \log c$
$\Rightarrow \frac{1}{3}\ \left(\frac{y}{x}\right)^3 = \log x + \log c$
$\Rightarrow y^3 = 3x^3 \log\,(\mathrm{cx})$

Q103. Solution
Correct Answer: (D)

Total number of ways in which boys and girls can seat alternatively $= 4! \times 4! \times 2 = 1152$.
When particular boy and particular girl are always together, then number of ways $= 3! \times 3! \times 7 \times 2 = 504$.
$\therefore$ Required number of ways $= 1152 - 504 =$ 648.

Q104. Solution

Correct Answer: (B)

Let, $S = \frac{3}{1^2} + \frac{5}{1^2+2^2} + \frac{7}{1^2+2^2+3^2} + \ldots$

Clearly the numbers in the numerator forms an arithmetic progression having common difference equal to 3

Therefore, the rth term can be written as, $2r + 1$

Now, the rth term of the given series can be written as,

$\mathrm{T}_r = \frac{(2r+1)}{1^2+2^2+\ldots+r^2} = \frac{6(2r+1)}{r(r+1)(2r+1)}$ [Using formula of Sum of Squares of First r Natural Numbers]

$= \frac{6}{r(r+1)} = 6\left[\frac{1}{r} - \frac{1}{r+1}\right]$
$\Rightarrow S_n = T_1 + T_2 + \ldots + T_n$
$= 6\left[1 - \frac{1}{2} + \frac{1}{2} - \frac{1}{3} + \frac{1}{3} - \frac{1}{4} + \ldots + \frac{1}{n} - \frac{1}{n+1}\right]$
$= \frac{6n}{n+1}$

Therefore,

$\frac{3}{1^2} + \frac{5}{1^2+2^2} + \frac{7}{1^2+2^2+3^2} + \ldots$ n terms is equal to

$\frac{6n}{n+1}$.

Q105. Solution

Correct Answer: (A)

$n(A \cup B) = n(A) + n(B) - n(A \cap B)$

$\Rightarrow 4 \leq n(A \cup B) \leq 7$

Q106. Solution

Correct Answer: (C)

Given $\sum_{i=1}^{n}\left(x_i^2+2x_i+1\right)=9n \quad \ldots(1)$

$\sum_{i=1}^{n}\left(x_i^2-2x_i+1\right)=5n \quad \ldots(2)$

Form $(1)+(2)$ we get,

$\Rightarrow \sum_{i=1}^{n}\left(2x_i^2+2\right)=14n$

$\Rightarrow \quad \sum_{i=1}^{n} x_i^2=6n \quad \ldots(3)$

From $(1)-(2)$ we get,

$\Rightarrow \sum_{i=1}^{n} x_i=n \quad \ldots(4)$

$\therefore$ Variance, $\sigma^2=E\left(x^2\right)-(E(x))^2$

$\Rightarrow \sigma^2=\frac{\sum x^2}{n}-\frac{\sum x}{n}$

$\Rightarrow \sigma^2=\frac{6n}{n}-\left(\frac{n}{n}\right)^2=6-1=5$

$\therefore$ Standard deviation, $\sigma=\sqrt{5}$

Q107. Solution

Correct Answer: (D)

Given function $f(x)=\frac{\tan \pi[x-\pi]}{1+[x]^2}$

$\therefore \ [x-\pi] \in I$

Basically $f(x)=0 \forall x \in R$

Q108. Solution

Correct Answer: (B)

Given distribution is

X	1	2	3	4	5
$P(X=x)$	K	2k	3k	2k	k

$\therefore$ Variance $= \sum x_i^2 p - \left(\sum x_i p\right)^2$
$= (1k + 8k + 27k + 32k + 25k) - (k + 4k + 9k + 8k + 5k)^2$
$= (93k) - (27k)^2 = \left(93 \times \frac{1}{9}\right) - \left(27 \times \frac{1}{9}\right)^2$
$\left(\because \quad \Sigma p = 1, \quad \therefore \quad k = \frac{1}{9}\right)$
$= \frac{93}{9} - 9 = \frac{93-81}{9} = \frac{12}{9} = \frac{4}{3}$

Q109. Solution

Correct Answer: (C)

$\lim\limits_{x \to \infty} \frac{x^2+3x+5}{4x+1+x^k}$

Since numerator is a quadratic function, the degree of denominator should be greater than or equal to two for the limit to exist finitely.

For $k < 2$,

$\lim\limits_{x \to \infty} \frac{x^2+3x+5}{4x+1+x^k} = \infty$

For $k = 2$,

$\lim\limits_{x \to \infty} \frac{x^2+3x+5}{4x+1+x^k} = 1$

For $k > 2$,

$\lim\limits_{x \to \infty} \frac{x^2+3x+5}{4x+1+x^k} = 0$

Therefore, the limit will give a finite value if $k \geq 2$.

Q110. Solution

Correct Answer: (A)

Let

$I = \int \frac{(4x+7)}{(x+2)\sqrt{x^2+4x+8}} dx$

$\Rightarrow I = \int \left[\frac{4(x+2)-1}{(x+2)\sqrt{x^2+4x+8}}\right] dx$

$\Rightarrow I = 4\int \left[\frac{1}{\sqrt{x^2+4x+8}}\right] dx - \int \left[\frac{1}{(x+2)\sqrt{x^2+4x+8}}\right] dx$

$\Rightarrow I = 4I_1 - I_2 + C$

where,

$I_1 = \int \left[\frac{1}{\sqrt{x^2+4x+8}}\right] dx$

$\Rightarrow I_1 = \int \left[\frac{1}{\sqrt{(x+2)^2+4}}\right] dx$

$\Rightarrow I_1 = \log\,(x+2) + \sqrt{x^2+4x+8}$

$\left[\because \int \frac{dx}{\sqrt{x^2+a^2}} = \log\, x + \sqrt{x^2+a^2}\ + c\right]$

And,

$I_2 = \int \left[\frac{1}{(x+2)\sqrt{x^2+4x+8}}\right] dx$

Put $x + 2 = \frac{1}{t} \Rightarrow dx = -\frac{dt}{t^2}$

$\Rightarrow I_2 = \int \left[\frac{1}{(\frac{1}{t})\sqrt{(\frac{1-2t}{t})^2+4(\frac{1-2t}{t})+8}}\right] \frac{dt}{(-t^2)}$

$\Rightarrow I_2 = \int \left[\frac{1}{(\frac{1}{t})\frac{\sqrt{(1-2t)^2+4t(1-2t)+8t^2}}{t}}\right] \frac{dt}{(-t^2)}$

$\Rightarrow I_2 = -\int \left[\frac{1}{\sqrt{(1-2t)^2+4t(1-2t)+8t^2}}\right] dt$

$\Rightarrow I_2 = -\int \left[\frac{1}{\sqrt{1+4t^2}}\right] dt$

$\Rightarrow I_2 = -\frac{1}{2}\int \frac{1}{\sqrt{\frac{1}{4}+t^2}} dt$

$\Rightarrow I_2 = -\frac{1}{2}\log\, t + \sqrt{\frac{1}{4}+t^2}$

$\Rightarrow I_2 = -\frac{1}{2}\log\, \frac{1}{x+2} + \sqrt{\frac{1}{4}+\frac{1}{(x+2)^2}}$

Putting the value of I_1 and I_2 in (i), we get

$I = 4\log\,(x+2) + \sqrt{x^2+4x+8}\; + \frac{1}{2}\log\,\frac{1}{x+2} + \sqrt{\frac{1}{4}+\frac{1}{(x+2)^2}}\; + C$

Q111. Solution

Correct Answer: (B)

Vector perpendicular to $\hat{i}+\hat{j}+\widehat{k}$ and $\hat{i}+2\hat{j}+3\widehat{k}$

$$= \begin{matrix} \hat{i} & \hat{j} & \widehat{k} \\ 1 & 1 & 1 \\ 1 & 2 & 3 \end{matrix} = \hat{i} - 2\hat{j} + \widehat{k}$$

$\therefore$ Required projection

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

$= \frac{|2-6+1|}{\sqrt{6}} = \frac{3}{\sqrt{6}} = \sqrt{\frac{3}{2}}$

Q112. Solution

Correct Answer: (C)

Here the statements are $p : \triangle ABC$ is equilateral; $q : \triangle ABC$ is isosceles.

Inverse of $p \Rightarrow q$ is $\sim p \Rightarrow \sim q$

Inverse statement is: If $\triangle ABC$ is not equilateral then it is not isosceles.

Q113. Solution
Correct Answer: (B)

We have,

$f(x) = y = \left(\frac{5x+3}{6x-\alpha}\right) \quad \ldots (\mathrm{i})$

$\Rightarrow 5x + 3 = 6xy - \alpha y$

$\Rightarrow x(6y - 5) = \alpha y + 3$

$\Rightarrow x = \frac{\alpha y+3}{6y-5}$

Hence,

$f^{-1}(x) = \left(\frac{\alpha x+3}{6x-5}\right) \quad \ldots (\mathrm{ii})$

Now,

$(fof)(x) = x$

$f\big(x\big) = f^{-1}\big(x\big)$

From equation (i) and (ii), we have

$\left(\frac{5x+3}{6x-\alpha}\right) = \left(\frac{\alpha x+3}{6x-5}\right)$

Clearly, $\alpha = 5$

Q114. Solution
Correct Answer: (D)

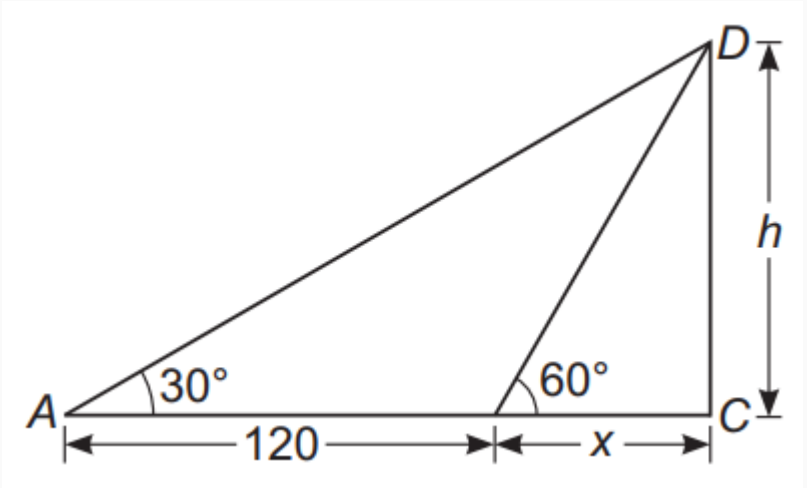
Let $(4, 2) = S_1$ and $(2, 2) = S_2$ and

the eccentricity of the hyperbola is e, then

$S_1S_2 = 2ae$ and $|PS_1 - PS_2| = 2a$ (where, $2a$ is the length of the transverse axis)
$\Rightarrow e = \frac{S_1S_2}{|PS_1 - PS_2|} = \frac{2}{2\sqrt{2}-2}$
$\Rightarrow e = \frac{1}{\sqrt{2}-1} = \sqrt{2} + 1 = \tan\frac{3\pi}{8}$

Q115. Solution

Correct Answer: (B)



Let h be the height of the object. In $\triangle ACD$

$\tan 30^\circ = \frac{CD}{AC} \Rightarrow \quad \frac{1}{\sqrt{3}} = \frac{h}{120+x} \Rightarrow \quad \sqrt{3}h = 120 + x$ ...(i) and in $\triangle BCD \tan 60^\circ = \frac{CD}{BC} \Rightarrow \quad \sqrt{3} = \frac{h}{x}$ $\Rightarrow \quad h = \sqrt{3}x$ ...(ii) From (i) and (ii), we get $3x = 120 + x \Rightarrow x = 60$ From Eq. (ii) Height of the object $= 60\sqrt{3}$ m.

Q116. Solution

Correct Answer: (B)

$(a-1)\left(x^4+x^2+1\right)+(a+1)\left(x^2+x+1\right)^2=0$

$\left(x^2+x+1\right)\left[(a-1)\left(x^2-x+1\right)+(a+1)\left(x^2+\ x+1\right)\right]=0$

$\left(x^2+x+1\right)\left[2ax^2+2x+2a\right]=0$

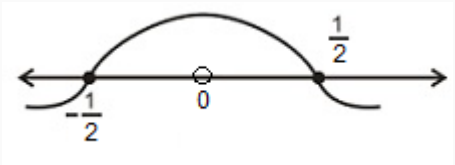
$\Rightarrow \ \left(x^2+x+1\right)\left[ax^2+x+a\right]=0$

If two Roots are real

Then, roots of $ax^2 + x + a = 0$ should be real & distinct.

$\therefore 1 - 4\mathrm{a}^2 > 0$

$(1 - 2\mathrm{a})(1 + 2\mathrm{a}) > 0$



As a $\neq 0$ therefore

$\mathrm{a} \in \left(-\frac{1}{2}, 0\right) \cup \left(0, \frac{1}{2}\right)$

Q117. Solution

Correct Answer: (B)

Given, $\arg\left(\frac{z+i}{z-i}\right) = \frac{2\pi}{3}$

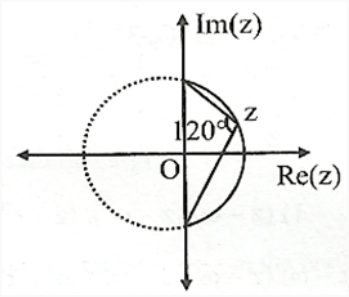
Let, $z = x + iy$

$\Rightarrow \frac{x+i(y+1)}{x+i(y-1)} = \frac{x^2+(y^2-1)+2ix}{x^2+(y-1)^2}$

$\Rightarrow \tan^{-1}\frac{2x}{x^2+y^2-1} = \frac{2\pi}{3}$

$\Rightarrow x^2 + y^2 + \frac{2}{\sqrt{3}}x - 1 = 0$

Hence, the given locus is a circle with centre $\left(-\frac{1}{\sqrt{3}}, 0\right)$ and radius $\frac{2}{\sqrt{3}}$ units



$\Rightarrow$ Length of the arc of the circle is $\frac{2\pi}{3} \times \left(\frac{2}{\sqrt{3}}\right) = \frac{4\pi}{3\sqrt{3}}$ units

Q118. Solution

Correct Answer: (B)

Let the centre of circle be $(g,\ 5)$

$\therefore \quad \frac{3(g)-4(5)}{\sqrt{3^2+4^2}} = 5$ [radius]

$\Rightarrow \quad 3g = 25 + 20 \quad \Rightarrow \quad g = 15$

$\therefore$ Equation of circle whose centre (15, 5) and radius 5 is

$(x-15)^2 + (y-5)^2 = 5^2$

$\Rightarrow \quad x^2 - 30x + y^2 - 10y + 225 = 0$

Q119. Solution
Correct Answer: (D)

We have to choose three sides out of $(3,\ 4,\ 5,\ 6)$ to form the triangles, so the possibilities are

Number of Triangles

$= {}^{3}\mathrm{C}_1.\ {}^{4}\mathrm{C}_1.\ {}^{5}\mathrm{C}_1 + {}^{4}\mathrm{C}_1.\ {}^{5}\mathrm{C}_1.\ {}^{6}\mathrm{C}_1$

$+ {}^{5}\mathrm{C}_1.\ {}^{6}\mathrm{C}_1.\ {}^{3}\mathrm{C}_1 + {}^{6}\mathrm{C}_1.\ {}^{3}\mathrm{C}_1.\ {}^{4}\mathrm{C}_1$
$= 60 + 120 + 90 + 72 = 342$

Q120. Solution
Correct Answer: (B)

The equation of straight line touching the given circle is

$x\cos\theta + y\sin\theta = a \qquad \ldots(1)$

On differentiating $\mathrm{w.r.t.}\ x$, regarding θ as a constant

$\Rightarrow \quad \cos\theta + \frac{dy}{dx}\sin\theta = 0 \qquad \ldots(2)$

From eqs. (1) and (2), we get

$\cos\theta = \frac{a\frac{dy}{dx}}{x\frac{dy}{dx} - y}$ and $\sin\theta = -\frac{a}{x\frac{dy}{dx} - y}$

$\therefore \quad \cos^2\theta + \sin^2\theta = 1$

$\therefore \quad \frac{a^2\left(\frac{dy}{dx}\right)^2 + a^2}{\left(x\ \frac{dy}{dx} - y\right)^2} = 1$

$\Rightarrow \quad \left(y - x\ \frac{dy}{dx}\right)^2 = a^2\left[1 + \left(\frac{dy}{dx}\right)^2\right]$

Q121. Solution
Correct Answer: (A)

$\mathrm{I}_2 = \int\limits_0^{\pi/2} \frac{e^{\sin^2\theta}\sin\theta\cos\theta\,d\theta}{2 - \sin^2\theta}$

Put $\sin^2\theta = t \Rightarrow 2\sin\theta\cos\theta\,d\theta = dt$

$\therefore \quad \mathrm{I}_2 = \frac{1}{2}\int\limits_0^1 \frac{e^t}{2-t}dt; \quad \mathrm{I}_1 = \int\limits_0^1 \frac{dx}{e^x(1+x)}$

$x \to 1 - x$

$\Rightarrow \mathrm{I}_1 = \int\limits_0^1 \frac{dx}{e^{1-x}(2-x)} = \frac{1}{e}\int\limits_0^1 \frac{e^x}{2-x}dx$

$\mathrm{I}_1 = \frac{1}{e} \times 2\mathrm{I}_2\ ;\ \frac{\mathrm{I}_1}{\mathrm{I}_2} = \frac{2}{e}$

Q122. Solution

Correct Answer: (A)

The equation of the line is $\vec{r} = \vec{a} + \lambda\vec{b}$

$\vec{a} = 5\hat{i} - 2\hat{j} + 4\hat{k}$

$\vec{b} = 2\hat{i} - \hat{j} + 3\hat{k}$

$\therefore \vec{r} = (5\hat{i} - 2\hat{j} + 4\hat{k}) + \lambda(2\hat{i} - \hat{j} + 3\hat{k})$

Equation of line in cartesian form is

$\frac{x-5}{2} = \frac{y+2}{-1} = \frac{z-4}{3} = \lambda$

Q123. Solution

Correct Answer: (B)

$$A = \begin{bmatrix} 1 & 0 & 1 \\ 0 & 2 & 0 \\ 1 & -1 & 4 \end{bmatrix}$$

$$A^T = \begin{bmatrix} 1 & 0 & 1 \\ 0 & 2 & -1 \\ 1 & 0 & 4 \end{bmatrix}$$

We have, $A + A^T = \begin{bmatrix} 2 & 0 & 2 \\ 0 & 4 & -1 \\ 2 & -1 & 8 \end{bmatrix}$ $A - A^T = \begin{bmatrix} 0 & 0 & 0 \\ 0 & 0 & 1 \\ 0 & -1 & 0 \end{bmatrix}$ $C = \begin{bmatrix} 0 & 0 & 0 \\ 0 & 0 & 0.5 \\ 0 & -0.5 & 0 \end{bmatrix} = -C^T$

$$A = \frac{1}{2}(A + A^T) + \frac{1}{2}(A - A^T)$$

$$A = \begin{bmatrix} 1 & 0 & 1 \\ 0 & 2 & -0.5 \\ 1 & -0.5 & 4 \end{bmatrix} + \begin{bmatrix} 0 & 0 & 0 \\ 0 & 0 & 0.5 \\ 0 & -0.5 & 0 \end{bmatrix}$$

$$A = B + C$$

Q124. Solution

Correct Answer: (C)

$S_n = \sum_{i=1}^{n} \frac{1}{n}\left(\frac{i}{n}\right)^{2014} = \int_0^1 x^{2014} dx = \frac{1}{2015}$

Q125. Solution

Correct Answer: (B)

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

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

$$=\sin^{-1}\left(\sin\left(\frac{\tan^{-1}1+\tan^{-1}\left(\frac{2+3}{1-(2\times3)}\right)}{\tan^{-1}1+\tan^{-1}\left(\frac{\frac{1}{2}+\frac{1}{3}}{1-\left(\frac{1}{2}\times\frac{1}{3}\right)}\right)}\right)\right)\left[\because \tan^{-1}A+\tan^{-1}B=\tan^{-1}\left(\frac{A+B}{1-AB}\right)\right]$$

$$=\sin^{-1}\left(\sin\left(\frac{\tan^{-1}1+\tan^{-1}\left(\frac{5}{-5}\right)}{\tan^{-1}1+\tan^{-1}\left(\frac{\frac{5}{6}}{\frac{5}{6}}\right)}\right)\right)$$

$$=\sin^{-1}\left(\sin\left(\frac{\tan^{-1}1+\tan^{-1}(-1)}{\tan^{-1}1+\tan^{-1}(1)}\right)\right)$$

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

$$=\sin^{-1}\left(\sin\left(\frac{\pi}{\frac{\pi}{2}}\right)\right)$$

$$=\sin^{-1}(\sin(2))$$

We know that $\sin^{-1}(\sin(x))=x$ if $x\in\left[-\frac{\pi}{2},\ \frac{\pi}{2}\right]$.

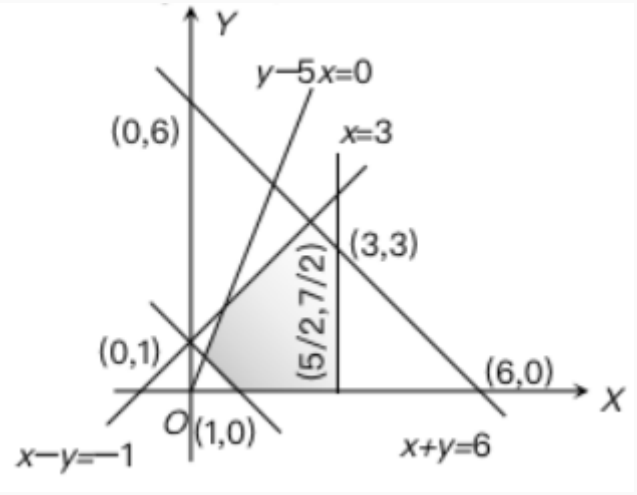
Since, $2\notin\left[-\frac{\pi}{2},\ \frac{\pi}{2}\right]$

Also, $\sin(\pi-2)=\sin 2$ & $(\pi-2)\in\left[-\frac{\pi}{2},\ \frac{\pi}{2}\right]$.

$\therefore \sin^{-1}(\sin(2))=\sin^{-1}(\sin(\pi-2))=\pi-2.$

Q126. Solution

Correct Answer: (D)



The shaded region represents the bounded region.

Now, we get the maximum value of z at vertex $(3, 3)$. So $\text{Max}\, z = 3(3) + 2(3) = 15$.

Q127. Solution

Correct Answer: (A)

Given, curve is

$(7x + 5)^2 + (7y + 3)^2 = \lambda^2(4x + 3y - 24)^2,$

$\Rightarrow \left\{7\left(x + \frac{5}{7}\right)\right\}^2 + \left\{7\left(y + \frac{3}{7}\right)\right\}^2 = \lambda^2\left\{\left(\sqrt{4^2 + 3^2}\right)^2 \times \left(\frac{4x+3y-24}{\sqrt{4^2+3^2}}\right)\right\}^2,$

$\Rightarrow 49\left[\left(x + \frac{5}{7}\right)^2 + \left(y + \frac{3}{7}\right)^2\right] = 25\lambda^2\left(\frac{4x+3y-24}{\sqrt{4^2+3^2}}\right)^2,$

$\Rightarrow \left(x + \frac{5}{7}\right)^2 + \left(y + \frac{3}{7}\right)^2 = \frac{25\lambda^2}{49}\left(\frac{4x+3y-24}{\sqrt{4^2+3^2}}\right)^2,$

$\Rightarrow \sqrt{\left(x + \frac{5}{7}\right)^2 + \left(y + \frac{3}{7}\right)^2} = \frac{5|\lambda|}{7} \times \frac{4x+3y-24}{\sqrt{4^2+3^2}}$.

The L. H. S. of the above equation represent distance of a point (x, y) from a point $\left(-\frac{5}{7}, -\frac{3}{7}\right)$ and R. H. S. represent its perpendicular distance from a line $4x + 3y - 24 = 0$.

Hence, the above equation satisfy the basic definition of a conic section, i.e., $(PS) = e(PM)$, where PS is the distance of a variable point from a fixed point (focus) and PM is its perpendicular distance from a fixed line (directrix) and e is the eccentricity.

And, we know that, for parabola $e = 1$.

$\therefore |\lambda| = \frac{7}{5}, \Rightarrow \lambda = \pm\frac{7}{5}.$

Q128. Solution

Correct Answer: (C)

$2^{a_1},\ 2^{a_2}, 2^{a_3}.....$ are in $\mathrm{G.P}$

$\Rightarrow\ a_2 -\ a_1 = a_3 -\ a_2 = a_4 -\ a_3 =.....$

$\Rightarrow\ a_1,\ a_2,\ a_3\ .....$ are in $\mathrm{A.P}$.

$\Rightarrow\ a_{2n+1}\ +\ a_1 = 2a_{n+1},\ a_2\ +\ a_{2n+2} = 2a_{n+2},$

$a_3\ +\ a_{2n+3} = 2a_{n+3}$

So, by operation $R_2 \to R_2 - \frac{1}{2}(R_1 + R_3)$

$$\Rightarrow \Delta = \begin{matrix} a_1 & a_2 & a_3 \\ 0 & 0 & 0 \\ a_{2n+1} & a_{2n+2} & a_{2n+3} \end{matrix} = 0$$

Q129. Solution

Correct Answer: (B)

1. Consider the function $f(x)\ =\ x$, its a linear function.

It's continuous function. Also its differentiable because it has no sharp corners.

2. Consider the function $f(x)\ =\ |x|$, it's a continuous function. It's non differentiable at $x = 0$ because it has a sharp corner at this point.

So, if a function $f(x)$ is continuous at $x = a$, then it may or may not be differentiable at $x = a$

$\therefore$ Option (b) is correct

Q130. Solution

Correct Answer: (B)

Here equations of pair of straight lines are $\begin{matrix} x^2 - 2mxy - y^2 = 0 ...(i) \\ x^2 - 2nxy - y^2 = 0 ...(ii) \end{matrix}$ Therefore, equations of bisectors of these lines are $\begin{matrix} mx^2 + 2xy - my^2 = 0 ...(iii) \\ nx^2 + 2xy - ny^2 = 0 ...(iv) \end{matrix}$ But according to the condition (i) and (iv), (ii) and (iii) must be coincident, $\therefore\ \frac{n}{1} = \frac{2}{-2m} = \frac{-n}{-1} \Rightarrow mn = -1.$

Q131. Solution

Correct Answer: (A)

Equivalent resistance of $3\ \Omega$ and $6\ \Omega$

$R' = \frac{3\times6}{3+6}$ (in parallel)

$R' = \frac{3\times6}{3+6}$ (in parallel)

$= \frac{18}{9} = 2\ \Omega$

Total resistance $= 2 + R$ (in series)

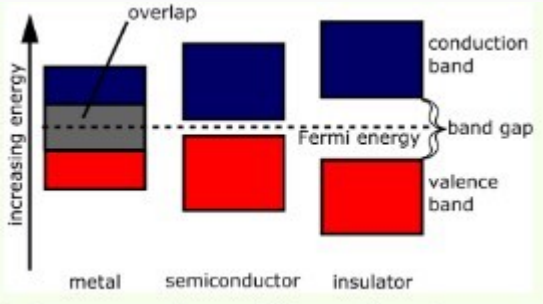
$i = \frac{V}{R};\ 2 = \frac{6}{2+R}$

$2 + R = 3 \Rightarrow R = 1\ \Omega$

Q132. Solution

Correct Answer: (C)

Energy Band Gap: It is the energy difference between the energy of the conduction band and the valence band. The explanation for the correct answer: Option C: Insulators 1. There are no electrons present in the conduction band for insulators. 2. Due to this, there will be a large gap between the conduction and valence bands. 3. It is very difficult to send electrons from the valence band to the conduction band. 4. Hence, the energy band gap is very high.



Q133. Solution

Correct Answer: (B)

During a small elapsed time Δt , the mass of water ejected is $k(v\ \Delta t)$.

The kinetic energy of the water is $\frac{1}{2}(kv\Delta t)v^2$.

The rate at which kinetic energy is imparted is $\lim_{\Delta t\to 0} \frac{\frac{1}{2}kv^3\Delta t}{\Delta t} = \frac{1}{2}kv^3$

Q134. Solution

Correct Answer: (B)

When N_2 goes to N_2^+, the $N-N$ bond distance increase, and when O_2 goes to O_2^+, the $O-O$ bond distance decrease.

The bond order of the nitrogen molecule is 3 . An electron from bonding pi MO is lost to form N_2^+. The bond order decreases to 2.5.

This decreases the strength of the bond and the bond distance increase.

The bond order of oxygen is 2 . An electron is lost from antibonding pi MO to form O_2^+. The bond order increases to 2.5. This increases the strength of the bond and the bond distance decreases.

Q135. Solution

Correct Answer: (B)

In this complex, 2 'chloro' ligands and 2 'urea' ligands are present. By following alphabetical order, chloro comes first with its number (i.e., dichloro) followed by the second ligand $(O=C(NH_2)_2)_2$. Since, it is a bidentate ligand (i.e., can attach at more than one binding sites), the prefix 'bis' is used followed by the name of ligand urea. Cu oxidation state will be $+2(x-2=0)$. So, the correct answer is $\left[CuCl_2(O=C(NH_2)_2)_2\right]$.

Q136. Solution

Correct Answer: (D)

Roasting (Sulphide ore is heated in excess of air)

Q137. Solution

Correct Answer: (B)

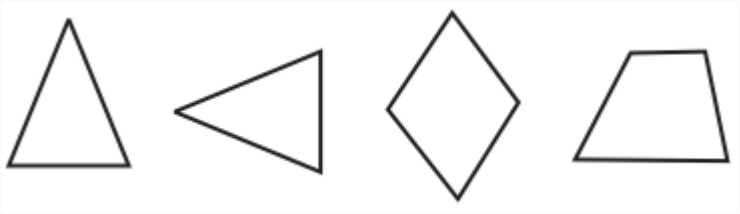
According to the given question the series is combination of three series i.e. 1st is 0, 3, 6, 2nd is 4, 7, (?), and 3rd is 6, 9, 12. Here we can see addition of 3 in each term of each series. So, the missing number is 10.

Hence, the right answer is 'B'.

Q138. Solution

Correct Answer: (B)

Given figures:

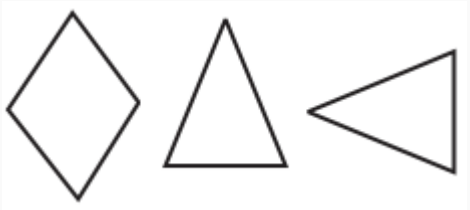


Here, we have to form an equilateral triangle by combining the given figures.

Here we have two triangles, one rhombus and one trapezium.

Now, if we insert the rhombus in between two small triangles, then the following figure is formed which looks like an equilateral triangle.

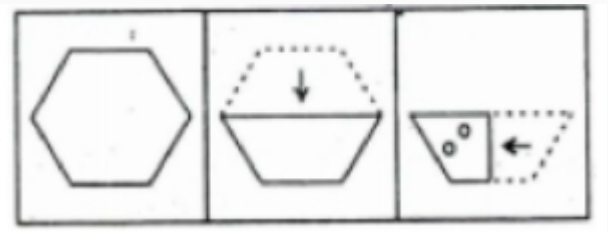
Hence, the correct answer is



Q139. Solution

Correct Answer: (D)

As given in this series:



As we can observe that the last part of the given figure having a small two circles.
In option A, there are more than two circles which can not make the perfect design.
In option B, there are two circles but the direction of two circles not perfect to complete this figure.
In option C, there are two circles but the direction of the two circles not perfect to complete this figure.
Hence, option D is the correct answer.

Q140. Solution

Correct Answer: (B)

$\frac{x^2(x\,dx+y\,dy)}{\sqrt{x^2+y^2}} = ydx - x\,dy$

or $\int \frac{1}{2}\frac{d(x^2+y^2)}{\sqrt{x^2+y^2}} = \int \frac{ydx-xdy}{x^2}$

$\Rightarrow \frac{1}{2}2.\sqrt{x^2+y^2} = -\frac{y}{x} + C$

Q141. Solution

Correct Answer: (D)

Coefficient of variation $= \frac{\text{S.D.}}{\text{Mean}} \times 100$
$= \frac{19.76}{35.16} \times 100.$

Q142. Solution

Correct Answer: (A)

The given line is $\frac{1}{2}(x-1) = -y = z+2$

$\therefore \frac{x-1}{2} = \frac{y-0}{-1} = \frac{z+2}{1} = \lambda$

$\therefore$ Coordinates of any point on the given line are $(2\lambda+1, -\lambda, \lambda-2)$

On substituting the point $(2\lambda+1, -\lambda, \lambda-2)$, on the given plane $2x+y-3z=4$, we get

$2(2\lambda+1) + (-\lambda) - 3(\lambda-2) = 4$

$\Rightarrow 8 = 4$ (not possible)

Hence, the point $(2\lambda+1, -\lambda, \lambda-2)$ cannot lie on the given plane.

The given line is parallel to the given plane. There is no point of intersection of line and the plane.

Hence, the direction cosines of the projected line are same as the direction cosine of the given line.

$\therefore$ Required direction cosines $= \left(\frac{2}{\sqrt{6}}, \frac{-1}{\sqrt{6}}, \frac{1}{\sqrt{6}}\right)$