Answer Key

Other (130 Questions)

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

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

Solutions

Q1. Solution

Correct Answer: (A)

Maximum acceleration will be from 30 to 40 s, because slope in this interval is maximum.

$a = \frac{v_2 - v_1}{t_2 - t_1} = \frac{60-20}{40-30} = 4 \text{ m s}^{-2}$

Q2. Solution

Correct Answer: (A)

Object distance $u = -20 \text{ cm}$ from concave mirror.

Focal length of mirror $f = -15 \text{ cm}$.

By mirror formula,

$\frac{1}{v} - \frac{1}{20} = \frac{1}{-15} \Rightarrow \frac{1}{v} = \frac{-1}{15} + \frac{1}{20}$

$\therefore v = -60 \text{ cm}$ (Image distance).

For Speed of image,

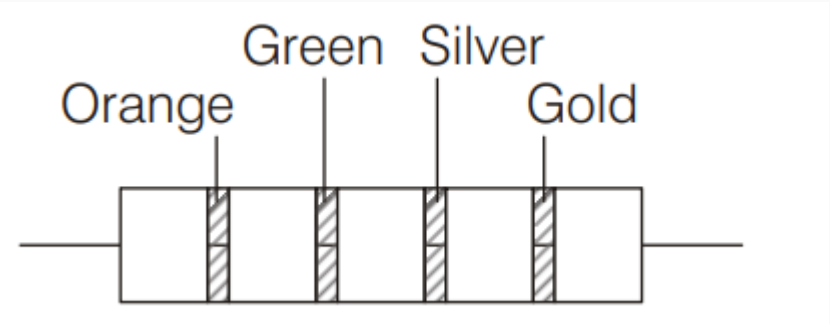
Image speed $= \left(\frac{v^2}{u^2}\right)$ (object speed)

$= \left(\frac{60}{20}\right)^2 (5)$

$= 45 \text{ m s}^{-1}$

Q3. Solution

Correct Answer: (B)



Given, orange $= 3$, Green $= 5$ Silver $= 10^{-2}$ Gold (tolerance) $= \pm 5\%$ From colour code, resistance value is

$[35 \times 10^{-2} \pm 5\%]$ $= 350 \times 10^{-3} \pm 5\% \text{ohms}$
$= 350 \text{ m} - \Omega \pm 17.5 \text{ m} - \Omega$

Q4. Solution

Correct Answer: (A)

Speed of electron in n^{th} orbit

$= 2.18 \times 10^6 \times \frac{Z}{n}$

For hydrogen atom, $Z = 1$

Speed of electron in n^{th} orbit for hydrogen atom

$= \frac{2.18 \times 10^6}{n}\ \text{m s}^{-1}$

So, as the value of n increases, orbiting speed of electron decreases.

Hence, I is correct.

Radii of an electron in n^{th} orbit

$= 0.529 \frac{n^2}{Z}\ \mathring{\text{A}}$

Radii of an electron for hydrogen atom in n^{th} orbit

$= 0.529 \frac{n^2}{1}\ \mathring{\text{A}}$

Radii are directly proportional to n^2 not to n.

Hence, II is incorrect.

Time taken by an electron to complete one revolution

$= 1.534 \times 10^{-10} \times \frac{n^3}{Z^2}\ \text{s}$

T is proportional to $\frac{n^3}{Z^2}$

We know, frequency with which electrons orbit in nucleus $f = \frac{1}{T}$

So, f is inversely proportional to n^3 for hydrogen atom.

Hence, III is correct.

Binding force with which electrons

is bound to nucleus$= \frac{KZe^2}{r^2}$

In hydrogen atom, binding force

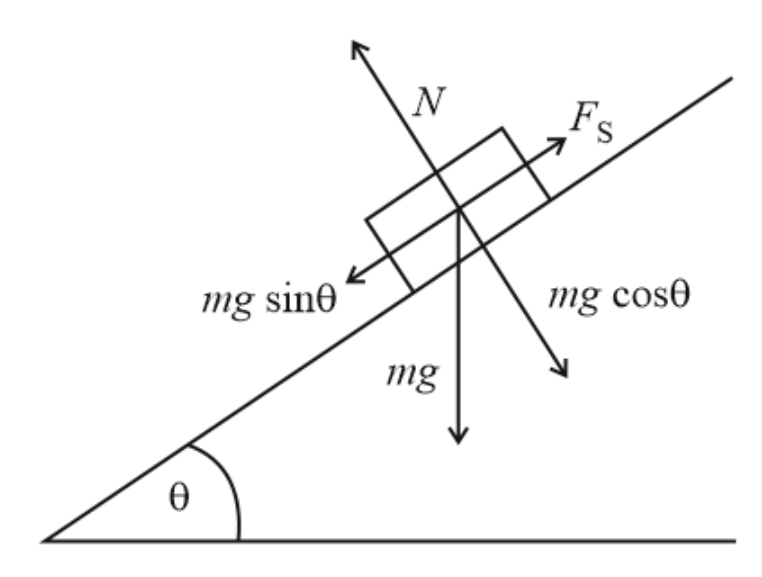
$= \frac{Ke^2}{r^2}$

And, we know, as we shift to outer orbit, r increases.

So, binding force decreases.

Hence, IV is incorrect.

Q5. Solution
Correct Answer: (B)



Given,

Mass of the block, $m = \ 5 \ \text{kg}$

The angle of inclination of the plane, $\theta = 30^\circ$.

From free body diagram, drawn in figure, we can say that downward force (component of gravitational force) along the inclined plane is,

$F_\text{d} = mg\sin\theta$

$\Rightarrow F_\text{d} = 5 \times 10 \times \sin 30^\circ = 25 \ \text{N}$

So, the spring balance will measure $F_\text{s} = 25 \ \text{N}$.

Q6. Solution
Correct Answer: (D)

(d) To redirect the light that enters the telescope to the eyepiece or camera. The primary mirror of a reflecting telescopes gathers the light and reflects towards the secondary mirror which then reflect the light towards the eyepiece allowing the observer to see image.
It has advantage of a large focal length in a short telescope.

Q7. Solution

Correct Answer: (A)

Maximum height, $H_0 = \frac{u^2 \sin_2 \theta}{2g}$ Range, $R = \frac{u^2 \sin 2\theta}{g}$ Given, $H_0 = \frac{R}{2}$

$$\begin{aligned} \therefore \quad \frac{u^2 \sin^2 \theta}{2g} &= \frac{u^2 2 \sin\theta \cos\theta}{2g} \\ \Rightarrow \quad \sin\theta &= 2\cos\theta \\ \Rightarrow \quad \tan\theta &= 2 \\ \therefore \quad \theta &= \tan^{-1}(2) \end{aligned}$$

Q8. Solution

Correct Answer: (C)

(1) Energy density,

$$= \frac{\text{Energy}}{\text{Volume}}$$

$$= \frac{\left[\mathrm{ML^2\ T^{-2}}\right]}{\left[\mathrm{L^3}\right]} = \left[\mathrm{ML^{-1}\ T^{-2}}\right]$$

(2) Refractive index hole no dimensions.

(3) Dielectric constant has no dimensions.

(4) Young's modulus,

$Y = \frac{Fl}{A\Delta l} = \frac{[\mathrm{MLT^{-2}}][\mathrm{L}]}{[\mathrm{L^2}][\mathrm{L}]} = \left[\mathrm{ML^{-1}\ T^{-2}}\right]$

(5) Magnetic field,

$B = \frac{F}{Il} = \frac{[\mathrm{MLT^{-2}}]}{[\mathrm{A}][\mathrm{L}]} = \left[\mathrm{MT^{-2}\ A^{-1}}\right]$

Therefore, option (c) is correct.

Q9. Solution

Correct Answer: (A)

Material A is paramagnetic and Material B is ferromagnetic.

The susceptibility of material B is larger than A at given magnetic field because ferromagnetic material gets strongly magnetised and hence produces a larger intensity of magnetization in comparison to paramagnetic substance, therefore it is strongly magnetised.

Q10. Solution

Correct Answer: (D)

In thermodynamics, pressure P, volume V and temperature T are the thermodynamic properties. If we have to describe the state of the system, then at least two parameters are required.

Only one of pressure, volume or temperature cannot define the state of the thermodynamic system.

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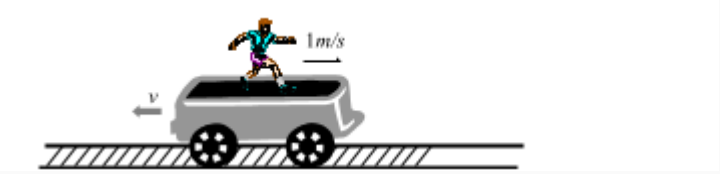
Q11. Solution

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 $= 0.8 \times 4 = 3.2 \text{ m}$

Q12. Solution

Correct Answer: (B)

$\mathrm{T} = 2\pi\sqrt{\dfrac{m}{\mathrm{K_{eq}}}}$

$\mathrm{F} = \mathrm{K}x + 2\ \mathrm{K}x\cos^2 45\ ,$

$\mathrm{K_{eq}}x = \mathrm{K}x + \mathrm{K}x$

$\mathrm{K_{eq}} = 2\ \mathrm{K}$

Q13. Solution

Correct Answer: (C)

$y_1 = \frac{n_1\lambda_1 D}{d}$ for bright fringes

$y_2 = \frac{n_2\lambda_2 D}{d}$ for bright fringes

To coincide

$n_1\lambda_1 = n_2\lambda_2$

$n_1 \times 650 = n_2 \times 520$

$\therefore \quad \frac{n_1}{n_2} = \frac{4}{5}$

For minimum value of n_1 and n_2

$n_1 = 4\ n_2 = 5$

$(y_1)_{min} = 4 \times 650 \times nm \times \frac{150m}{0.5\times10^{-3}m}$

$= 7800 \times 10^{-6}m$

$= 7.8\ mm\ .$

Q14. Solution

Correct Answer: (D)

Work done by the gun

=Total kinetic energy of the bullets

$= n = \frac{1}{2}mv^2$

$= 240 \times \frac{1}{2} \times 10 \times 10^{-3}(600)^2$

$= 120 \times \frac{1}{2} \times 10 \times 10^{-3} \times 600 \times 600$

$\therefore \quad Power\ of\ gun = \frac{work\ done}{time\ taken}$

$= \frac{120 \times 10 \times 10^{-3} \times 600 \times 600}{1min}$

$= \frac{120 \times 10 \times 360}{60} = 120 \times 10 \times 6$ W

$\frac{120 \times 10 \times 6}{1000}$ kW $= 7.2$ kW ~

Q15. Solution

Correct Answer: (D)

Given, mass of mucleus of nitrogen.

$m\left[_7\mathrm{N}^{14}\right] = 14.00307\mathrm{u}$

Mass of proton, $m_r = 1.00783\mathrm{amu}$

Mass of neutron, $m_n = 1.0087\mathrm{amu}$

Mass defect, $\Delta m = (7m_r + 7m_n) - m\left(_7\mathrm{N}^{14}\right)$

$= 7 \times 1.00783 + 7 \times 1.00807 - 14.00307$

$= 0.11243\mathrm{amu}$

$\therefore$ Binding energy of nitrogen nucleus

$= \Delta m \times 931 = 0.11243 \times 931$

$= 104.67 = 104.7\mathrm{MeV}$ ’

Q16. Solution

Correct Answer: (A)

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

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

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

$= 01.76$ mm ^

Q17. Solution

Correct Answer: (B)

We know that $K = \frac{1}{2}\mathrm{l}\omega^2$ where $K =$ kinetic energy $\begin{matrix} I = \text{ moment of inertia} \\ \omega = \text{ angular speed} \end{matrix}$ So, $\quad \omega \propto \frac{1}{\sqrt{I}}$

$$\omega_1 : \omega_2 : \omega_3 = \frac{1}{\sqrt{I_1}} : \frac{1}{\sqrt{I_2}} : \frac{1}{\sqrt{I_3}}$$

$$= \frac{1}{\sqrt{1}} : \frac{1}{\sqrt{1}} : \frac{1}{\sqrt{2}} = \sqrt{2} : \sqrt{2} : 1$$ ^

Q18. Solution

Correct Answer: (C)

$\text{Pitch} = \ 0.5 \text{ mm}$

$\text{L.C} \ \ = \frac{0.5}{50}$

$= \ 0.01 \text{ mm}$

$\text{M.S.R} = 2$

Neck reading = 25

$\text{d} = 2 \times (0.5) + 25 \times 0.01$

$= \ 1.25 \text{ mm}$

Considering zero error

Here zero error is

$= +5 \times 0.01$

$= +0.05 \text{ mm}$

so actual diameter

$= \text{d} - 0.05$

$= \ 1.20 \text{ mm}$ ^

Q19. Solution

Correct Answer: (C)

$m_1 : m_2$

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

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

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

$A \, \alpha \, m$

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

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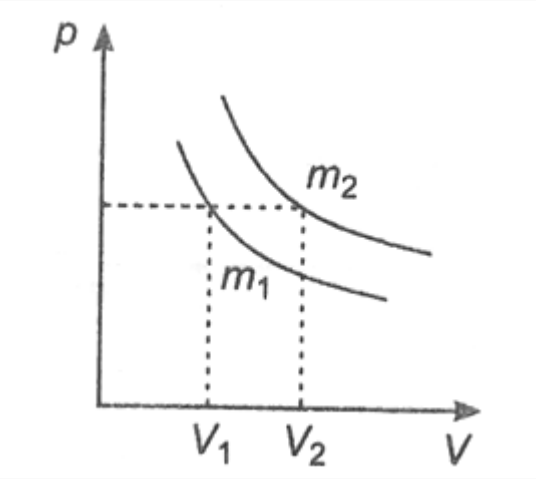
Q20. Solution

Correct Answer: (C)



$pV = nRT = \frac{m}{M}RT$

For lst graph, $p = \frac{m_1}{M}\frac{RT}{V_1}$ For 2nd graph, $p = \frac{m_2}{M}\frac{RT}{V_2}$ Equating the two, we get $\frac{m_1}{m_2} = \frac{V_1}{V_2}$

$\Rightarrow \quad m \propto \frac{1}{V}$

As $V_2 > V_1 \Rightarrow m_1 < m_2$,

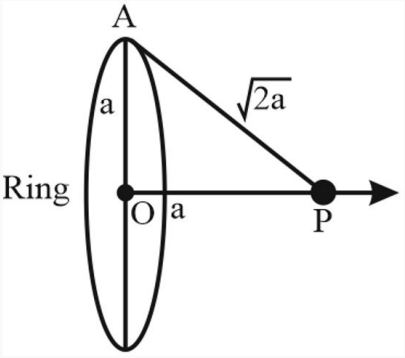
Q21. Solution

Correct Answer: (A)

By using Gauss's Law. It is given as $\Phi = \oint \vec{E} \cdot d\vec{s} = \frac{q}{\epsilon_0}$ Now, the flux passing through all the six surfaces would be $\Phi = 6\phi = \frac{q}{\epsilon_0}$ And the flux passing through each surface would be $\phi = \frac{q}{6\in_0}$

Q22. Solution

Correct Answer: (D)



The gravitational potential at P, $V_P = -\frac{GM}{AP}$

$V_P = -\frac{GM}{\sqrt{a^2+a^2}} = -\frac{GM}{\sqrt{2}a}$ and gravitational potential at O, $V_O = -\frac{GM}{a}$

Let v be the velocity of the particle when it reaches O.

$\therefore$ K.E. at $O = \frac{1}{2}mv^2$

Gravitational P.E. = Gravitational potential × mass

$\therefore$ P.E. at $P = -\frac{GMm}{\sqrt{2}a}$ and P.E. at $O = -\frac{GMm}{a}$

By the principle of conservation of mechanical energy

$\frac{1}{2}mv^2 - \frac{GMm}{a} = -\frac{GMm}{\sqrt{2}a}$

$\therefore v^2 = 2\left[\frac{GMm}{a} - \frac{GMm}{\sqrt{2}a}\right] = \frac{2GM}{a}\left[1 - \frac{1}{\sqrt{2}}\right]$

$\therefore v = \sqrt{\frac{2GM}{a}\left(1 - \frac{1}{\sqrt{2}}\right)}$

Q23. Solution

Correct Answer: (A)

When brakes are on, there is no rolling of the wheels and the wheels slide. The sliding friction is greater than the rolling friction. Thus it is difficult to move a cycle along the road with its breaks on.

Q24. Solution

Correct Answer: (C)

Magnetic induction inside the solenoid

$B = \frac{\mu_0 NI}{\mathrm{L}}$

Magnetic flux, $\phi = \mathrm{BA}$

$= \frac{\mu_0\, NI.A}{\mathrm{L}}$

Magnetic moment $= NIA = \frac{\phi \mathrm{L}}{\mu_0}$

$= \frac{1.57\times10^{-6}\times0.6}{4\times3.14\times10^{-7}}$

$= 0.75\ \mathrm{A\ m^2}$

Q25. Solution

Correct Answer: (A)

According to work energy theorem,

$$W = \Delta \mathrm{K \cdot E.} \quad \Rightarrow W = \frac{1}{2}mv_2^2 - \frac{1}{2}mv_1^2$$

$$\Rightarrow F \cdot dx = \mathrm{K \cdot E \cdot} f - \frac{1}{2} \times 10 \times 100$$

$$\Rightarrow F \cdot dx = \mathrm{K \cdot E \cdot} f - 500$$

$$\Rightarrow \int_{20}^{30} -0.1x dx = \mathrm{K \cdot E \cdot} f - 500$$

$$\Rightarrow -0.1\left[\frac{x^2}{2}\right]_{20}^{30} = \mathrm{K \cdot E \cdot} f - 500$$

$$\Rightarrow -0.1\left[\frac{900 - 400}{2}\right] = \mathrm{K \cdot E \cdot} f - 500$$

$\Rightarrow \mathrm{K.E.}_f = 500 - 25 = 475 \text{ J}$

Q26. Solution

Correct Answer: (A)

According to the figure

$\mathrm{H} = \mathrm{H}_1 + \mathrm{H}_2$

$\frac{3\mathrm{KA(100-T)}}{l} = \frac{2\mathrm{KA(T-50)}}{l} + \frac{\mathrm{KA(T-0)}}{l}$

$300 - 3\mathrm{T} = 2\mathrm{T} - 100 + \mathrm{T}$

$6\mathrm{T} = 400$

Or $\mathrm{T} = \frac{200}{3}\ ^{\circ}\mathrm{C}$

Q27. Solution

Correct Answer: (D)

The three experimental facts listed under (a), (b) and (c) cannot be explained on the basis of wave theory of light. All these facts support the quantum (photon) nature of light.

Q28. Solution

Correct Answer: (B)

If the train is going away from the observer, the apparent frequency is

$v_1 = \frac{vu}{v+u} = \frac{v}{1+\frac{u}{v}}$

It is observed that $v = 1.2v_1$ (Given),

In the second case the apparent frequency is

$v_2 = \frac{v(v-u)}{v} = v\left(1 - \frac{u}{v}\right)$

or

$\frac{v}{v_2} = \frac{1}{1-\frac{M}{v}}$

Now, from equation (1) we have

$\frac{v}{v_1} = 1 + \frac{u}{v}$

or

$1.2 = 1 + \frac{u}{v}$

$u = 0.2v$

That is,

$\frac{u}{v} = 0.2$

Using this in equation (2), we get,

$\frac{v}{v_2} = \frac{5}{4} = 1.25$

Q29. Solution

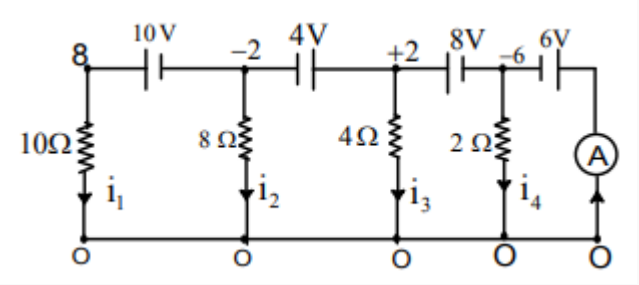
Correct Answer: (C)

Impulse $J = \Delta P$ $\Rightarrow MV = 2Mv' - 0$ $\Rightarrow v' = \frac{V}{2}$ The rod will rotate about its COM. Thus, $v' = \omega R = \omega\left(\frac{L}{2}\right)$

$\Rightarrow \omega = \frac{2v'}{L} = \frac{V}{L}$

Q30. Solution

Correct Answer: (C)



$i = i_1 + i_2 + i_3 + i_4 = \frac{8}{10} + \frac{-2}{8} + \frac{2}{4} + \frac{-6}{2}$

$= -1.95$ A reading $= 1.95$ A

Q31. Solution

Correct Answer: (B)

The chemical and their mole reaction can be expressed as follows

$$\begin{aligned}
\mathrm{CH_4 + 2O_2} &\rightarrow \mathrm{CO_2 + H_2O} \\
\mathrm{C_3H_8 + 5O_2} &\rightarrow \mathrm{3CO_2 + 4H_2O} \\
\mathrm{CH_4 + C_3H_8} &= \frac{5}{22.4} = 0.22 \text{ moles} \\
\mathrm{O_2} &= \frac{16}{224} = 0.71 \text{ moles} \\
2x + (0.22 - x)5 &= 0.71 \\
\mathrm{x} &= 0.13 \\
\text{Heat liberated} &= 0.13 \times 890 + 0.09 \\
&= 316 \text{ kJ}
\end{aligned}$$

Q32. Solution

Correct Answer: (B)

$$\begin{aligned}
&\Lambda_{\mathrm{m}}^{\infty}\left(\mathrm{CH_3COOH}\right) = \Lambda_{\mathrm{m}}^{\infty}\left(\mathrm{CH_3COONa}\right) + \Lambda_{\mathrm{m}}^{\infty}(\mathrm{HCl}) - \Lambda_{\mathrm{m}}^{\infty}(\mathrm{NaCl}) \\
&= 91 + 426.16 - 126.45 \\
&= 390.71 \text{ S cm}^2\text{mol}^{-1}
\end{aligned}$$

Q33. Solution

Correct Answer: (C)

$$\mathrm{(CH_3)_2 - C = CH - \overset{\overset{\mathrm{O}}{\|}}{\mathrm{C}} - CH_3}$$

Q34. Solution

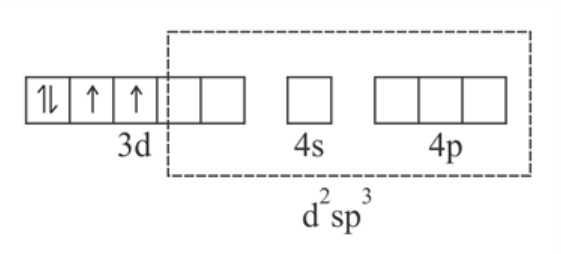
Correct Answer: (C)

$[\mathrm{Mn}(\mathrm{CN})_6]^{3-}$

$\mathrm{Mn(III)} = [\mathrm{Ar}]3\mathrm{d}^4$

CN^- being strong field ligand forces pairing of electrons.

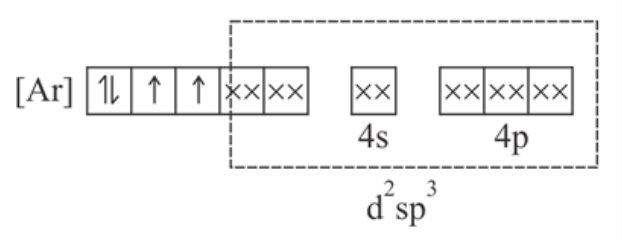
This gives $\mathrm{t}_{2\mathrm{g}}^4\ \mathrm{e}_{\mathrm{g}}^0$



$\because$ The coordination number of $\mathrm{Mn} = 6$

$\therefore$ Structure=octahedral

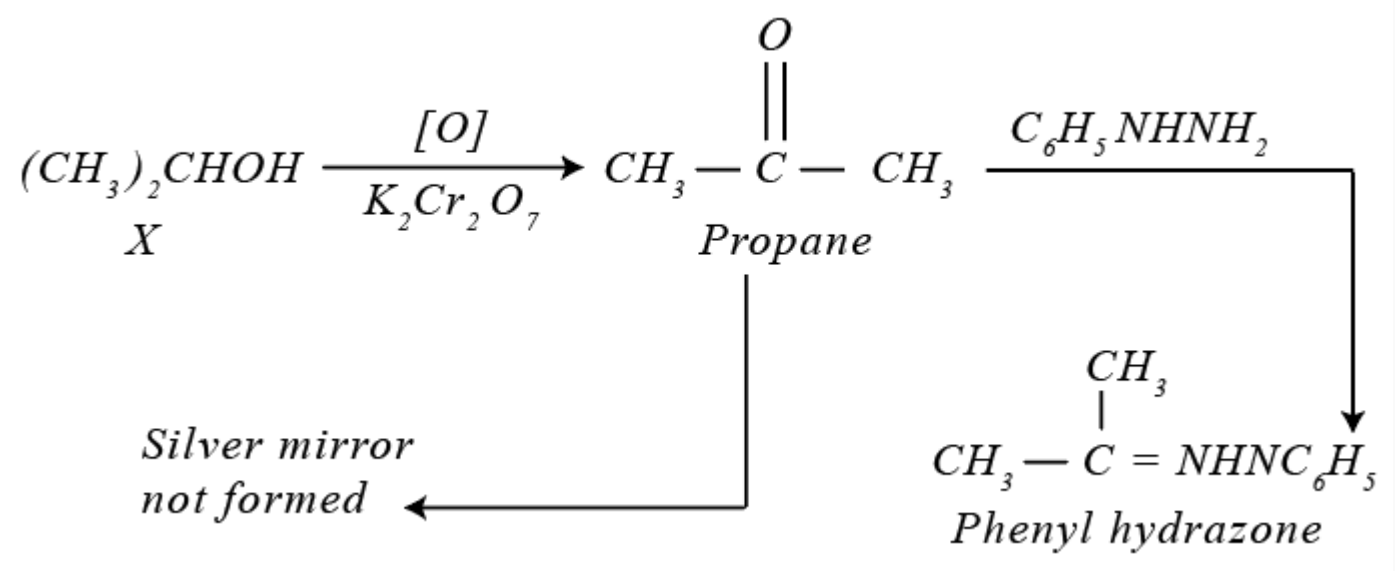
$[\mathrm{Mn}(\mathrm{CN})_6]^{3-} =$



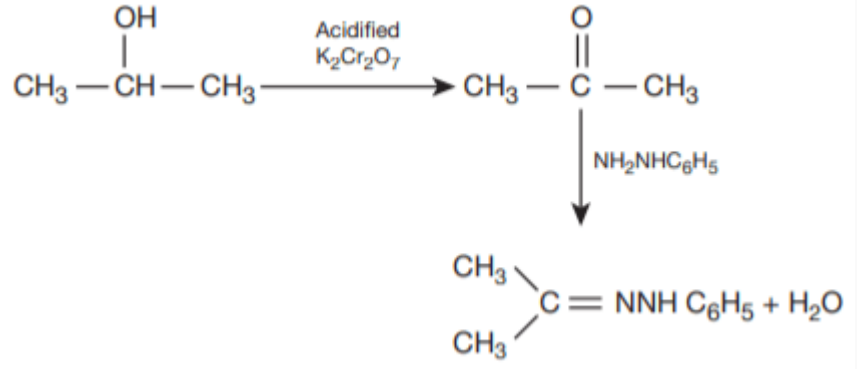
Q35. Solution

Correct Answer: (A)

In the question, the oxidation product of organic compound (X) do not answer silver mirror test but react with phenyl
hydrazine,



No silver mirror test
therefore, X is propan-2-ol, which on oxidation give acetone which further react with phenyl hydrazine to give acetone
phenylhydrazone, but not react give silver mirror test. The reactions involved are



Acetone phenylhydrazone

Q36. Solution

Correct Answer: (B)

$NaNO_3$ is salt formed by the combination of a strong acid HNO_3 and a strong base $NaOH$ and hence it is neutral with a pH. CH_3COOK is formed by the combination of weak acid CH_3COOH and strong base KOH and hence pH will be above 7 . NH_4Cl is formed by the formation of strong and HCl and a weak base NH_4OH and hence pH will be lesser than 7. Na_2CO_3 is a salt formed by the strong base $NaOH$ and weak acid H_2CO_3. Hence, pH of the salt will be highest. The pH scale was invented in 1909 by a Danish biochemist Soren Sorensen. It describes how many hydrogen ions (protons) are present in a solution: the higher the pH, the lower the hydrogen ion concentration, and vice versa. But the scale does not have fixed limits, so it is indeed possible to have a pH above 14 or below zero. For example, concentrated hydrochloric acid can have a pH of around -1 , while sodium hydroxide solution can have a pH as high as 15 .

Q37. Solution

Correct Answer: (C)

$$N_2O_5 \rightleftharpoons 2NO_2 + \frac{1}{2}O_2$$

A $t = 0$	50 mm Hg	0	0
At $t = 50$ mm	$50 - p_1$	$2p_1$	$\frac{p_1}{2}$

Total pressure at $t = 50$ min is

$50 - p_1 + 2p_1 + \frac{p_1}{2} = 87.5$ mmHg

$p_1 = \frac{37.5}{1.5} = 25$ mmHg

Since, $t = 50$ minutes is the half life period for reaction.

$$N_2O_5 \rightleftharpoons 2NO_2 + \frac{1}{2}O_2$$

$t = 100$ min	$50 - p_2$	$2p_2$	$\frac{p_2}{2}$

Thus $t = 100$ min is equal to 2 halflives.

$\therefore \quad 50 - p_2 = \frac{25}{2}$

(At 2^{nd} half life)

$p_2 = 37.5$ mmHg

Total pressure at $t = 100$ min $\Rightarrow 50 - p_2 + 2p_2 + \frac{p_2}{2}$

$= 50 + 15p_2 \Rightarrow 50 + 15 \times 375$

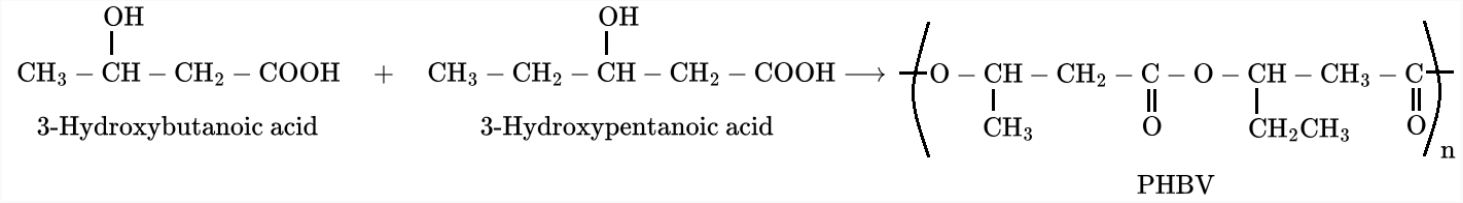
$= 106.25$ mmHg

Hence, nearest integer will be 106.

Q38. Solution

Correct Answer: (A)

PHBV is obtained by the copolymerisation of 3 -hydroxybutanoic acid & 3- hydroxypentanoic acid.



Q39. Solution

Correct Answer: (C)

The formation of $O_2^+[PtF_6]^-$ is the basis for the formation of xenon fluorides because O_2 and Xe have - comparable ionisation energies.

Q40. Solution

Correct Answer: (D)

An electrolyte MX_2 undergoes dissociation as follows :-

$MX_2 \rightleftharpoons M^{+2} + 2X^-$

Concentration	MX_2	M^{+2}	X^-
Initial concentration	1	0	0
Concentration at Equilibrium	$1-s$	s	$2\,s$

Thus from the above condition we can say that,

$K_{sp} = s \times (2\,s)^2 = 4 \times (s)^3$

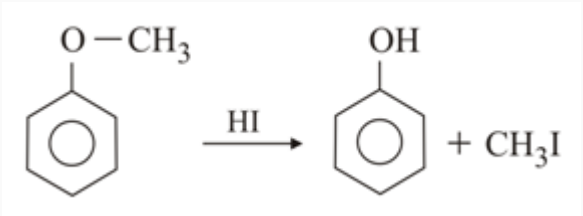
Here, s (the solubility) is 0.5×10^{-4} mole/lit.

$\therefore K_{sp} = 4 \times \left(0.5 \times 10^{-4}\right)^3$

$\therefore K_{sp} = 5 \times 10^{-13}$

Q41. Solution

Correct Answer: (C)



Q42. Solution

Correct Answer: (A)

$\mathrm{Pb_{(s)}}\ \mathrm{Pb^{++}_{(1M)}}\ \ \mathrm{Ag^{+}_{(10M)}}\ \mathrm{Ag_{(s)}}$

Reaction: $\mathrm{Pb_{(s)}} + 2\mathrm{Ag^{+}_{(10M)}} \rightarrow \mathrm{Pb^{++}_{(1M)}} + 2\mathrm{Ag_{(s)}}$ Nernst equation at $25^{\circ}\mathrm{C}$:

$$\mathrm{E_{cell}} = \mathrm{E^{o}_{cell}} - \frac{0.0592}{2}\log_{10}\frac{\left[\mathrm{Pb^{++}}\right]}{\left[\mathrm{Ag^{+}}\right]^{2}}$$

$$\mathrm{E_{cell}} = \mathrm{E^{o}_{cell}} - \frac{0.0592}{2}\log_{10}\frac{1}{100}$$

$$\mathrm{E_{cell}} = \mathrm{E^{o}_{cell}} - \frac{0.0592}{2}\log_{10}10^{-2}$$

$$\mathrm{E_{cell}} = \mathrm{E^{o}_{cell}} - \frac{0.0592}{2} \times (-2)$$

$$\mathrm{E_{cell}} = (\mathrm{E^{o}_{cell}} + 0.0592)\mathrm{V}$$

Q43. Solution

Correct Answer: (A)

$$\underbrace{\mathrm{Au} + 4\mathrm{H^{+}} + \overset{+5}{\mathrm{N}}\mathrm{O_3^{-}} + 4\mathrm{Cl^{-}}}_{\text{aqua-regia}} \rightarrow \mathrm{AuCl_4^{-}} + \overset{+2}{\mathrm{N}}\mathrm{O} + 2\mathrm{H_2O}$$

Q44. Solution

Correct Answer: (D)

Key Idea : The Arrhenius equation is represented as

$k = Ae^{-E_a/RT}$

In the given equations, first take log and then compare them.

$k_1 = 10^{16}e^{-2000/T}$

$k_2 = 10^{15}e^{-1000/T}$

On taking log, we get

$$\log k_1 = \log 10^{16} - \frac{2000}{2.303T}$$

$$\log k_2 = \log 10^{15} - \frac{1000}{2.303T}$$

$\because k_1 = k_2$

Hence, from Eqs (i) and (ii)

$T = \frac{1000}{2.303}\ \mathrm{K}$

Q45. Solution

Correct Answer: (C)

Oxidation state of Cr , $x + 0 \times 6 - 1 \times 3 = 0$ $In\ [\mathrm{Cr(H_2}O)_6]\mathrm{Cl_3}$ $\ln\ [\mathrm{Cr(C_6H_6)_2}]$ $x + 0 \times 2 = 0$ $x = 0..(ii)$ $x = 3...(i)$

$\mathrm{In\ K_2\ [Cr(CN)_2(O)_2\ (O_2)\ (NH_3)]}$ $(1 \times 2) + x - (1 \times 2) - (2 \times 2) - (1 \times 2) - (0 \times 1) = 0$ $x - 6 = 0$ $x = +6...(iii)$ Therefore, oxidation states are $+3, 0, +6$.

Q46. Solution

Correct Answer: (B)

$\Delta T_f = i \times K_t \times m$

$\therefore i = \dfrac{\Delta T_f}{K_t \times m} = \dfrac{0.19}{1.86 \times 0.1} = 1.02$

Again from, $\alpha = \frac{i-1}{n-1} = \frac{1.02-1}{2-1} = 0.02 = 2.0 \times 10^{-2}$

for $\mathrm{CH_3COOH} \rightleftharpoons \mathrm{CH_3COO^-} + \mathrm{H^+}$

$$\begin{aligned} Ka &= C\alpha^2 \\ &= 0.1 \times \left(2 \times 10^{-2}\right)^2 \\ &= 4 \times 10^{-5} \end{aligned}$$

Q47. Solution

Correct Answer: (B)

Gene acts as the instruction manual for the synthesis of protein.

Q48. Solution

Correct Answer: (A)

Normality of salt solution $= \frac{3.92}{392} \times \frac{1}{100} \times 1000 = 0.1$ N 20 mL of 0.1 N salt solution $\equiv 18$ mL of $\mathrm{KMnO_4}$ solution 20 mL of 0.1 N salt solution $\equiv 18$ mL of $\mathrm{KMnO_4}$ solution $\therefore$ Normality of $\mathrm{KMnO_4}$ solution $= \frac{20 \times 0.1}{18}$

$\therefore$ Normality of $\mathrm{KMnO_4}$ solution $= \frac{20 \times 0.1}{18} = \frac{1}{9}$ N

$\therefore$ Strength of $\mathrm{KMnO_4}$ solution $= \dfrac{1}{9} \times 31.6 = 3.5\ \mathrm{g\ L^{-1}}$

Q49. Solution

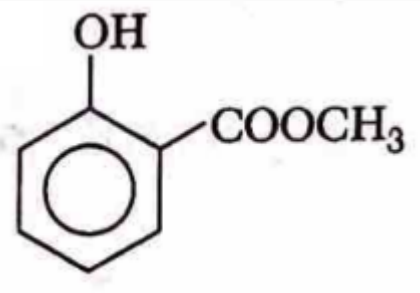
Correct Answer: (B)

Total volume after mixing $= 50 + 30 = 80$cc Moles of HCl after mixing $= \frac{50}{80}$M Moles of NaOH after mixing $= \frac{30}{80}$M Remaining number of moles of HCl after mixing

$$\begin{aligned} &= \frac{50}{80} - \frac{30}{80} = 0.25\mathrm{M} \\ \left[\mathrm{H^+}\right] &= 0.25 = 2.5 \times 10^{-1} \\ \mathrm{pH} &= -\log\left[2.5 \times 10^{-1}\right] \\ &= 1 - 0.3979 = 0.6021 \end{aligned}$$

Q50. Solution

Correct Answer: (A)



Methyl salicylate is known as oil of winter green. It is the methyl ester of salicyclic acid.
It is colourless, viscous liquid with a sweet, fruity odour.

Q51. Solution

Correct Answer: (A)

The complete reaction is as follow.

$$2CuSO_4 + 10KCN \longrightarrow \underset{(A)}{2K_3[Cu(CN)_4]} + 2K_2SO_4 + (CN)_2$$

$$\downarrow H_2S$$

No precipitate (B)

As CN^- is a strong ligand, the complex formed is highly stable and does not dissociate to give Cu^+ ions. However, no precipitate of CuS is formed when H_2S gas is passes through solution.

Q52. Solution

Correct Answer: (C)

During the preparation of Mohr's salt, dilute sulphuric acid is added to prevent the hydrolysis of Fe^{2+} ion.

Q53. Solution

Correct Answer: (B)

In each row, the second figure is obtained from the first figure by adding two mutually perpendicular line segments at the centre and the third figure is obtained from the first figure by adding four circles outside the main figure.

Q54. Solution

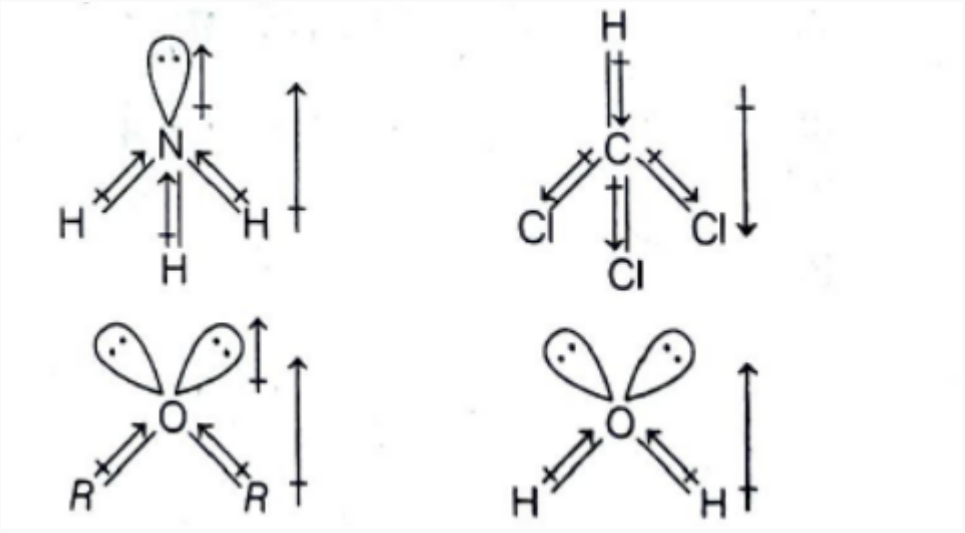
Correct Answer: (B)

Vitamin C is also called as ascorbic acid.

Q55. Solution

Correct Answer: (C)

Dipole moments cancel out reach other in CCl_4 and CO_2 resulting in net dipole moment as zero because these



are symmetrical structures.

Q56. Solution

Correct Answer: (A)

Given series:

$6,\ 12,\ 48\ ,\ 264,\ ?$

By observing closely, we find the following pattern:

$6 + 6 = 12$

$12 + (6)^2 = 48$

$48 + (6)^3 = 264$

$264 + (6)^4 = \textcircled{1560}$

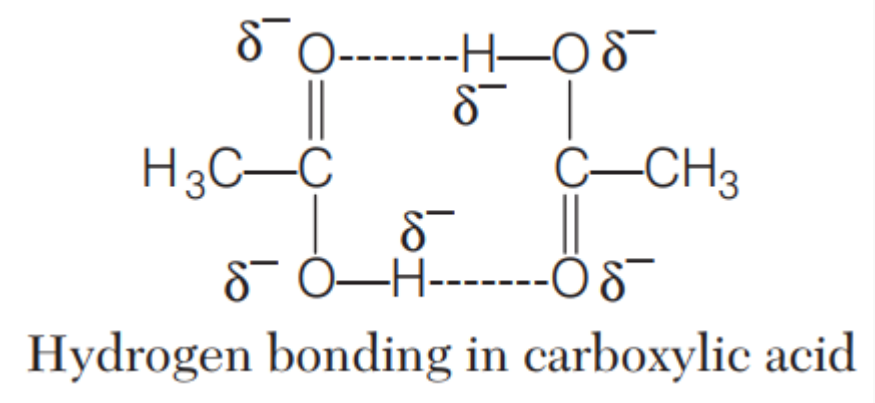
The missing number in the series is 1560.

Hence, option A is the correct answer

Q57. Solution

Correct Answer: (C)

Due to intermolecular hydrogen bonding, ketones and carboxylic acids have higher boiling point as compare to aldehyde.



Hydrogen bonding in carboxylic acid

Q58. Solution

Correct Answer: (C)

$$K_{sp} = 10^{-8}\text{M}^2$$
$$K_{sp} = [A^+][B^-]$$
$$10^{-8} = (10^{-3})[B^-]$$
$$[B^-] = 10^{-5}\text{M}$$

$\therefore$ Salt will precipitate, when concentration of $[B^-] > 10^{-5}$M.

Q59. Solution

Correct Answer: (D)

According to the situation, poverty is an inescapable (one cannot escape from it) part of social milieu (environment) and it is difficult to eliminate it. Pallbearers of society are the supporters of poverty.

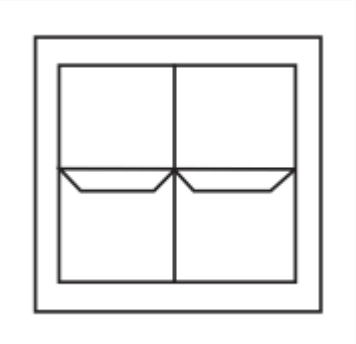
Hence, option D is correct.

Q60. Solution

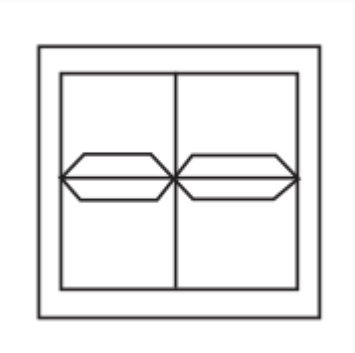
Correct Answer: (A)

The paper is folded along the horizontal axis first and then, folded along the vertical axis.

The mirror image along the vertical axis :



Then, the mirror image along the horizontal axis:



The above figure is similar to the image given in option A.

Hence, the figure in option A will appear when cut paper is opened.

Q61. Solution

Correct Answer: (A)

In one unit cell, number of $O^{2-} = 4$

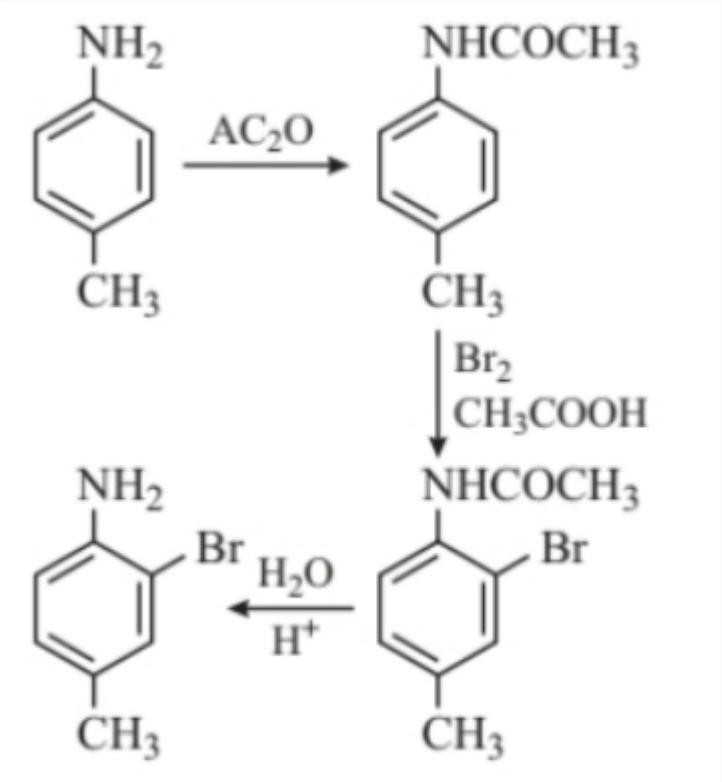
The number of $Zn^{2+} = \frac{1}{8} \times 8 = 1$

The number of $Fe^{3+} = \frac{1}{2} \times 4 = 2$

$\therefore$ Molecular formula of given spinel structure is $ZnFe_2O_4$

Q62. Solution

Correct Answer: (C)



After bromination, bromoacetanilide is acid hydrolysed to yield the desired halogenated amine.

Q63. Solution

Correct Answer: (C)

The complete given chemical reaction take place as follows

$2NO(g)$ + O_2 ⟶ $2NO_2(g)$

Nitric oxide (*P*) (Colourless gas)

Nitrogen dioxide (*Q*) (Reddish brown gas)

Cooling ⟶ $N_2O_4(g)$ (Dinitrogen tetraoxide (*R*) (Colourless))

2 NO ⟶ $2N_2O_3(g)$ (Dinitrogen trioxide (*S*) (Blue solid))

Note: Nitric oxide is paramagnetic as it contain unpaired electron as per molecular orbital theory.

Q64. Solution

Correct Answer: (D)

According to the passage, the ant came to the stream to to drink at it.

Q65. Solution
Correct Answer: (B)

$2NaOH_{(dilute)} + Br_2 \xrightarrow{cold} NaBrO + NaBr + H_2O$ $\underset{\text{Sodium hypobromide}}{3NaBrO} \xrightarrow{300\ K} 3NaBrO$

On acidification, the final mixture gives bromine.
$5NaBrO + NaBrO_3 + 6HCl \longrightarrow 6NaCl + 3Br_2 + 3H_2O$ Thus, during the reaction, bromine is present in four different oxidation states i.e., zero in Br_2, $+1$ in $NaBrO$, -1 in $NaBr$ and +5 in $NaBrO_3$. The greatest difference between various oxidation states of bromine is 6 and not 5. On acidification of the final mixture, Br_2 is formed and disproportionation of Br_2 occurs during the reaction giving BrO^-, Br^- and BrO_3^- ions.

Q66. Solution
Correct Answer: (A)

According to the passage, the ant repaid the dove by biting the hunter.

Q67. Solution
Correct Answer: (D)

Correct Answer: full of faults

The phrase 'have feet of clay' means 'full of weaknesses, mistakes or failures to do things even after continuous preparations and practices'.
Here, it means that an inexperienced person will commit mistakes in every step.

Example - Sindhu is getting arrested because she has feet of clay despite her helpful attitude.

Q68. Solution
Correct Answer: (A)

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

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

Superficial: appearing to be true or real.

Depend: be able to trust or rely on.

Obvious: easily understood; clear.

Therefore, this option is correct.

Q69. Solution
Correct Answer: (D)

The correct sentence will be: A lion is the king of beasts.
When we use the article ‘the’, we show that we are talking about a specific thing only, which is called the definite article. We use the indefinite article, 'a', and 'an' to refer to a general statement and not about a specific thing. Here, we are generally referring 'lion' to have a specific position of being the king of beasts. Hence this is the correct answer.

Q70. Solution
Correct Answer: (A)

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

His gesticulations got bigger and wilder while explaining the matter.

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

Q71. Solution
Correct Answer: (C)

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

Meanings of the other alternatives:

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

Therefore, the correct answer is consent.

Q72. Solution
Correct Answer: (B)

The correct option is explosive.

The word 'explosive' means rising to fame very quickly. It is signifying the growth of something and not a regression.
Sluggish is generally used for economics terms and means a slow delayed progression.
Delayed means very late.
Progressing means gradually developing.
So, other options are irrelevant in the context. Hence, 'explosive' is the correct answer.

Q73. Solution
Correct Answer: (C)

This part of the sentence contains an error.

The sentence is a type of imperative statement because it is a type of advice given to someone.
The verb 'advise' is used to give advice to someone and takes the form 'advise + pronoun + to'. But when the sentence uses 'not', then it must be placed after the concerned person to form the structure as 'advise + pronoun + not + to.' So, the structure 'advise + pronoun + to + not + to' is incorrect.
So, the third part must be changed to 'not to' to frame a correct sentence.

Therefore, this is the correct option.

Q74. Solution
Correct Answer: (B)

A sentence has a noun or pronoun component called the subject, and a verb part called the predicate. The subject is missing from the sentence so first the subject 'I' should be included. Since an experience is being related to the tense of the verb here so 'find' cannot be used, thus the option (d) is eliminated. Whatever phrase follows the subject Taj Mahal will act as the adjective attached to the verb 'found', the remaining expression will then become only supportive or additional information. That is in option (b) 'I found the Taj Mahal truly impressive' is the chief part of the sentence and 'in the moonlight' is additional information, without which also the sentence makes sense. In option (c) I found the Taj Mahal in the moonlight will be the chief sentence which is not the appropriate usage.

Q75. Solution

Correct Answer: (B)

Letters of the word PARKAR written in alphabetical order are AAKPRR.

Number of words starting with $\mathrm{A} = \frac{5!}{2!} = 60$

Number of words starting with $\mathrm{K} = \frac{5!}{2!2!} = 30$

Number of words starting with $\mathrm{PAA} = \frac{3!}{2!} = 3$

Number of words starting with $\mathrm{PAK} = \frac{3!}{2!} = 3$

Number of words starting with $\mathrm{PARA} = 2! = 2$

Number of words starting with $\mathrm{PARKAR} = 1$

$\therefore$ Rank of word PARKAR is 99.

Q76. Solution

Correct Answer: (B)

From the given words,

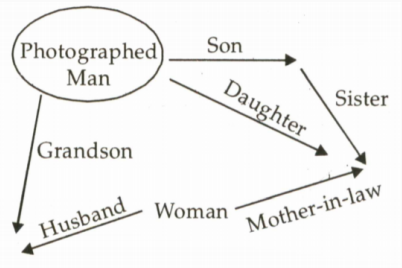
Kerosene, petrol , diesel exists in same state of matter i.e., liquid.

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

Hence, second option is different among all.

Q77. Solution

Correct Answer: (A)



This man's son's sister is this man's daughter, who is the woman's mother-in-law. So the man is the father of the lady's mother-in-law. So, he is the grandfather of the woman's husband. The woman's husband is the grandson of the man in the photograph. Hence, the correct option is the Grand-son.

Q78. Solution

Correct Answer: (A)

As we know 29th February falls in a leap year and leap year is the year that is a multiple of 4 eg. 2004, 2008, 2012 and so on.

So 29th February or leap year falls in a century 25 times.

As we know tuesday repeat after 7 days in a week.

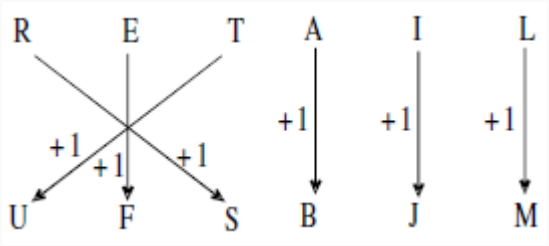
So In a leap year tuesday repeat after 28 year.

So in a century 29th February falls in 3 times.

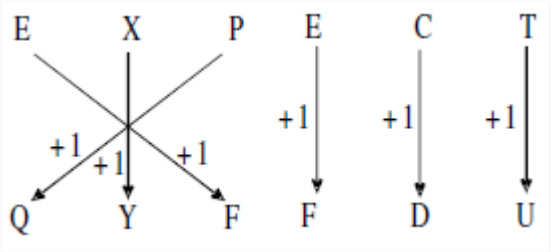
Q79. Solution

Correct Answer: (D)

As,



Similarly,



Q80. Solution

Correct Answer: (A)

The pair of words given in the question depicts a certain relation. The first one of them is of higher intensity than the second word. For example, Stare means to continuously see someone or a particular object whereas glance means to take a slight look at someone.

The pair 'Gulp: Sip' has also the same kind of relationship as the word 'gulp' means to intake a large quantity of a liquid inside the mouth whereas the word 'sip' means to intake a very light quantity of the liquid. The other pair of words have the opposite relationship between them.

Hence, Gulp: Sip is the answer.

Q81. Solution

Correct Answer: (D)

If P draws black card from box I and if Q also draws black card, then both may lose.

Q82. Solution

Correct Answer: (B)

We are given the sales data (in thousand numbers) for six branches of a publishing company in the years 2000 and 2001. We need to calculate the absolute difference between: 1. Total sales of branches B1, B3, and B5 for both years (2000 and 2001). 2. Total sales of branches B2 and B6 in the year 2001. The sales data extracted from the graph is as follows:

Branch	Sales in 2000	Sales in 2001
B1	80	105
B2	75	65
B3	95	110
B4	95	75
B5	70	95
B6	70	80

Total sales of B1, B3, and B5 in both years: $(B1_{2000} + B1_{2001}) + (B3_{2000} + B3_{2001}) + (B5_{2000} + B5_{2001})$

$(80 + 105) + (95 + 110) + (75 + 95)$

$185 + 205 + 170 = 560$

Total sales of B2 and B6 in 2001: $B2_{2001} + B6_{2001}$

$65 + 80 = 145$

The absolute difference is: $|560 - 145| = 415$

Q83. Solution

Correct Answer: (B)

According to the given statement,

Laughter is the best medicine.

Except for the second conclusion, all others are irrelevant because the statement implies that laughter is something that is beneficial from a health perspective. Laughing triggers healthy physical and emotional changes in the body.

Hence, laughter is good for health, is the correct answer.

Q84. Solution

Correct Answer: (D)

1. C went to Karnataka by Truck. 2. B went to Maharashtra by Train. 3. D travelled by Bike. 4. E travelled by Bus. 5. The one who went to Rajasthan did not travel by Bike. 6. Tamil Nadu is not connected by Cycle to Uttar Pradesh and Rajasthan. Now, let's determine who went where and by what transport:

Person	Destination	Mode of Transport
C	Karnataka	Truck
B	Maharashtra	Train
D	?	Bike
E	?	Bus
A	?	?

- Since C already traveled by Truck, the means of transport for C is Truck. - Since the one who went to Rajasthan did not travel by Bike, and D traveled by Bike, D did not go to Rajasthan. - Tamil Nadu is not connected by Cycle to Uttar Pradesh and Rajasthan, meaning the person who traveled to these states did not use Cycle. Thus, the means of transport C used is Truck.

Q85. Solution

Correct Answer: (D)

From 1^{st} and 3^{rd} dice, it can be observed that 1, 2 and 3 are adjacent to 4. So, it means that either 5 or 6 can be opposite to 4.

Now, from 1^{st} and 2^{nd} dice, it can be observed that 3, 4, 6 and 2 are adjacent to 1 that implies 5 is opposite to 1.

Since, 5 is opposite to 1 so, it means that 5 cannot be opposite to 4.

Hence, we get that 6 is opposite to 4.

Q86. 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.

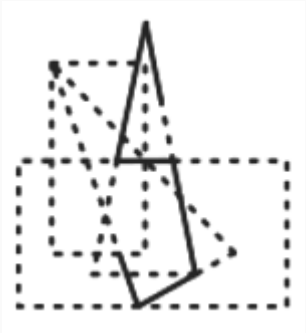
Hence, Nilima is in the middle of the row.

Q87. Solution

Correct Answer: (C)

Given: 

The logic followed here is: only option (3) is embedded as shown below,

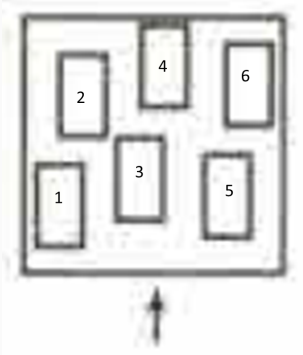


Hence, option (3) is the correct answer.

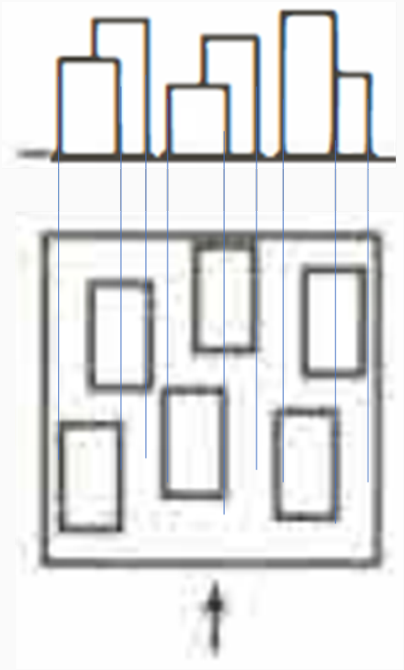
Q88. Solution

Correct Answer: (A)

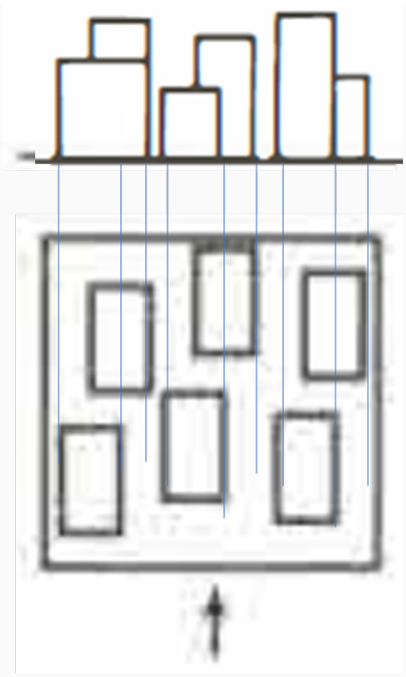
In the given top view, we have below 6 rectangles.



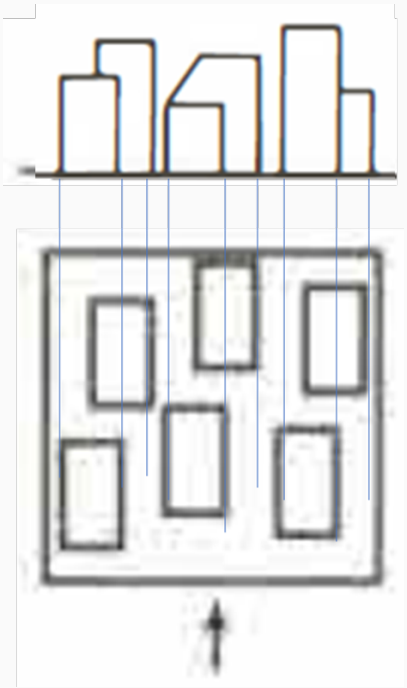
In option A: all the projected lines from the plan meet the lines of the elevation.



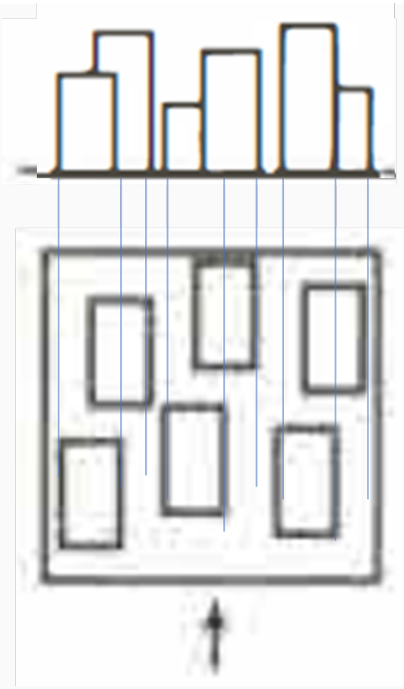
In option B: object 1 in the elevation does not match with the lines from the plan.



In option C: Object 4 from the elevation does not match with the lines projected from the plan.



In option D: object 3 from the elevation does not with the lines projected from the plan.



Hence, answer figure (a) is the correct elevation of the problem figure in the direction of the arrow, as shown in the above figure.

Q89. 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.

XXIV (24) : 48

Similarly,

XIV(14) : 28

Hence, the answer is 28.

Therefore, the correct option is 'A'.

Q90. Solution

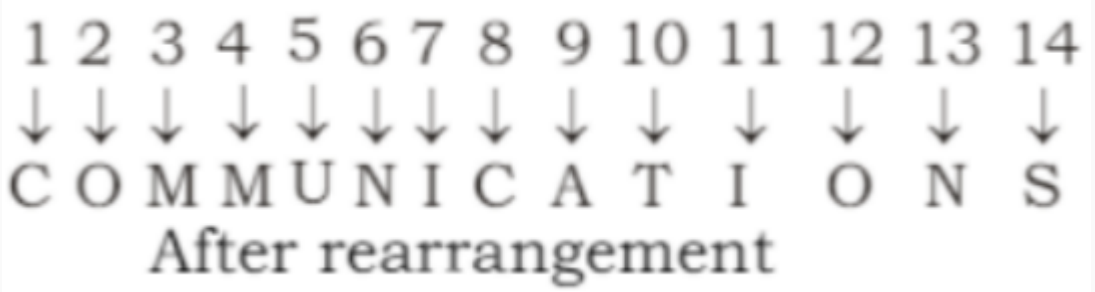
Correct Answer: (A)

Analyze the Clues: - Rosy → Yellow, Student - The Librarian → Green → Therefore, Daisy is the Librarian. - Mary → Purple, not a Teacher → Therefore, Mary cannot be the Principal. - Andy → Blue, Inspector - One of the five is a Principal → By elimination, Lily must be the Principal. Final Assignment Table:

Friend	Likes	Profession
Rosy	Yellow	Student
Daisy	Green	Librarian
Mary	Purple	Not a Teacher (implies she can't be Principal)
Andy	Blue	Inspector
Lily	Brown	Principal

Q91. Solution

Correct Answer: (A)



Q92. Solution

Correct Answer: (C)

$\bar{a}=\hat{i}+\hat{j}+\hat{k}, \bar{b}=\hat{i}-\hat{j}+\hat{k}$ and $\bar{c}=\hat{i}-\hat{j}-\hat{k}$ $\bar{v}$ is in the plane of $\bar{a}$ and $\bar{b}$.

$\bar{v}=m\bar{a}+n\,\bar{b}$

$\Rightarrow \bar{v}=(m+n)\hat{i}+(m-n)\hat{j}+(m+n)\hat{k} \ldots (i)$

$$\Rightarrow \frac{(m+n)(1)+(m-n)(-1)+(m+n)(-1)}{\sqrt{1+1+1}}=\frac{1}{\sqrt{3}}$$

Projection of $\bar{v}$ on $\bar{c}=\frac{\bar{v}\cdot\bar{c}}{|\bar{c}|}=\frac{1}{\sqrt{3}} \Rightarrow -m+n=1$

$\Rightarrow n=1+m$

$v=(2m+1)\hat{i}-\hat{j}+(2m+1)\hat{k} \quad \ldots[\text{From (i)}]$

When $m=1$ then $\bar{v}=3\hat{i}-\hat{j}+3\hat{k}$

Q93. Solution

Correct Answer: (B)

On rearranging the given equation, we reduce the equation in the form.

$\frac{x^2dx}{1+x^3} = \frac{y^2dy}{1+y^3}$

Integrating both side, using method of substitution

let $\left(1+x^3\right) = t$, on differentiating both sides we get $3x^2 = \frac{dt}{dx} \Rightarrow x^2dx = \frac{dt}{3}$

Now, $\int \frac{x^2dx}{1+x^3} = \frac{1}{3}\int \frac{dt}{t} = \frac{1}{3}\ln t$

Doing similarly for right-hand side we obtain, $\frac{1}{3}\ln\left(1+x^3\right) = \frac{1}{3}\ln\left(1+y^3\right) + \frac{\ln C}{3}$

$\ln\left(1+x^3\right) = \ln\left(c\left(1+y^3\right)\right)$

$\left(1+x^3\right) = \left(c\left(1+y^3\right)\right)$

Q94. Solution

Correct Answer: (B)

We know that

$\left(1+x^2\right)^n = C_0 + C_1x^2 + C_2x^4 + \ldots + C_nx^{2n}$

$\Rightarrow x\left(1+x^2\right)^n = C_0x + C_1x^3 + C_2x^5 + \ldots + C_nx^{2n+1}$

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

$\left(1+x^2\right)^n + 2nx^2\left(1+x^2\right)^{n-1} = C_0 + 3C_1x^2 + 5C_2x^4 + \ldots + (2n+1)C_nx^{2n}$

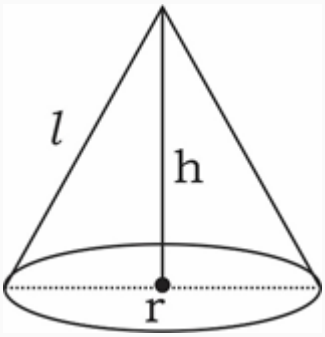
Putting $x = 1$, we get

$(n+1)\cdot 2^n = C_0 + 3C_1 + 5C_2 + \ldots + (2n+1)C_n$

Q95. 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

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

Q96. Solution

Correct Answer: (B)

For the circle $x^2 + y^2 = 4$ centre is $C_1(0, 0)$ and the radius $r_1 = 2$.

For the circle $x^2 + y^2 - 6x - 8y = 24$ centre is $C_2(3, 4)$ and radius is $r_2 = \sqrt{3^2 + 4^2 - (-24)} = 7$

Therefore, $r_1 + r_2 = 2 + 7 = 9$.

$C_1C_2 = \sqrt{(3-0)^2 + (4-0)^2} = 5$

$\Rightarrow C_1C_2 < r_1 + r_2$

$r_2 - r_1 = 7 - 2 = 5$

$\Rightarrow C_1C_2 = r_2 - r_1$

Thus, the given circles touch each other internally. Hence, the number of common tangents is only one.

Q97. Solution

Correct Answer: (C)

For slope, differentiating both curves $\frac{2x}{a}+\frac{2y}{4}y'=0\Rightarrow y'=-\frac{4x}{ay}$.....(i) and $3y^2y^1=16\Rightarrow y^1=\frac{16}{3y^2}$.....(ii)

$\because$ Both curves are orthogonal

$$\therefore \frac{-4x}{ay}\times\frac{16}{3y^2}=-1$$

$$\Rightarrow 64x=3y^3a$$

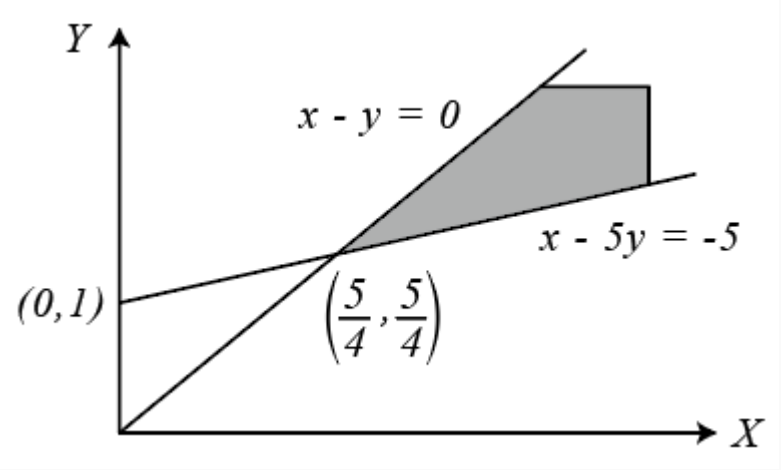
$$\Rightarrow a=\frac{64x}{3y^3}=\frac{64x}{3(16x)}$$

$$\Rightarrow a=\frac{4}{3}$$

Q98. Solution

Correct Answer: (B)

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



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

Q99. Solution

Correct Answer: (D)

Given that, if x is prime number, then x is odd. The contrapositive statement of this statement is:
If x is not odd then x is not prime.

Q100. Solution

Correct Answer: (A)

$$\text{Here, } R_1 = \int_{-1}^{2} xf(x)dx \qquad \text{.....(i)}$$

$$\Rightarrow R_1 = \int_{-1}^{2} (1-x)f(1-x)dx = \int_{-1}^{2} (1-x)f(x) \qquad \text{.....(ii)}$$

[as $\int_a^b f(x)dx = \int_a^b f(a+b-x)$ also $f(1-x) = f(x)$]

$$\text{from (i)} + \text{(ii)} 2R_1 = \int_{-1}^{2} f(x)dx \qquad \text{.....(iii)}$$

$$\text{and } R_2 = \int_{-1}^{2} f(x)dx \qquad \text{.....(iv)}$$

from (iii) and (iv) $2R_1 = R_2$

Q101. Solution

Correct Answer: (C)

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

Let us first check continuity of $f(x)$ at $x=2$.

Now, $\text{LHL}=\lim\limits_{x\to 2^-} f(x)=\lim\limits_{h\to 0}(1+2-h)=3$

and $\text{RHL}=\lim\limits_{x\to 2^+} f(x)=\lim\limits_{h\to 0}(3-(2+h))=1$

Thus, $\text{LHL}\neq\text{RHL}$ at $x=2$

Hence, $f(x)$ is discontinuous at $x=2$.

So, $f(f(x))$ may be discontinuous when $(i)\ 1+x=2$ (when $0\le x\le 2$) or

$(ii)\ 3-x=2$ (when $2<x\le 3$)

$\Rightarrow\ x=1$ is the common solution for the both.

Hence, $f(f(x))$ is discontinuous at $x=1$ and $x=2$.

Q102. Solution

Correct Answer: (C)

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

Q103. Solution

Correct Answer: (C)

The total number of injective functions from a set A containing 3 elements to a set B containing 4 elements is equal to the total number of arrangements of 4 by taking 3 at a time i.e., ${}^4P_3=24$.

Q104. Solution

Correct Answer: (B)

If angle between $\overline{\text{b}}$ and $\overline{\text{c}}$ is α and

$$\begin{aligned}&|\overline{\text{b}}\times\overline{\text{c}}|=\sqrt{15}\\ &\Rightarrow|\overline{\text{b}}||\overline{\text{c}}|\sin\alpha=\sqrt{15}\\ &\Rightarrow(4)(1)\sin\alpha=\sqrt{15}\\ &\Rightarrow\sin\alpha=\frac{\sqrt{15}}{4}\\ &\Rightarrow\cos\alpha=\frac{1}{4}\end{aligned}$$

$$\begin{aligned}&\text{Now, }\overline{\text{b}}-2\overline{\text{c}}=\lambda\overline{\text{a}}\\ &\Rightarrow|\overline{\text{b}}-2\overline{\text{c}}|^2=\lambda^2|\overline{\text{a}}|^2\\ &\Rightarrow|\overline{\text{b}}|^2+4|\overline{\text{c}}|^2-4\,\overline{\text{b}}\cdot\overline{\text{c}}=\lambda^2|\overline{\text{a}}|^2\\ &\Rightarrow 16+4-4(|\overline{\text{b}}|\overline{\text{a}}\,|\cos\alpha)=\lambda^2\\ &\Rightarrow 20-4\left(4\times 1\times\frac{1}{4}\right)=\lambda^2\\ &\Rightarrow 16=\lambda^2\\ &\Rightarrow\lambda=\pm 4\end{aligned}$$

Q105. Solution

Correct Answer: (B)

Equation of family of parabolas with focus at $(0,0)$ and x-axis as axis is $y^2 = 4a(x+a)$ ...(i)

Differentiating (i) with respect to x,

$2yy_1 = 4a, y^2 = 2yy_1\left(x + \frac{yy_1}{2}\right)$

$y = 2xy_1 + yy_1^2 \Rightarrow y\left(\frac{dy}{dx}\right)^2 + 2x\frac{dy}{dx} = y.$

Q106. Solution

Correct Answer: (B)

The odds against A are $8:3$. $\therefore \quad \mathrm{P}(\mathrm{A}) = \frac{3}{11}$ Odds against B are $5:2$

$\therefore \quad P(B) = \frac{2}{7}$

$\therefore \quad P(A) + P(B) + P(C) = 1$

$\Rightarrow \frac{3}{11} + \frac{2}{7} + P(C) = 1 \quad \therefore$

$\therefore \quad P(C) = 1 - \frac{2}{7} - \frac{3}{11}$

$\therefore \quad P(C) = \frac{34}{77}$

odds against $\mathrm{P(C)} = \frac{77-34}{34} = \frac{43}{34}$ But odds against $\mathrm{C} = \frac{43}{17\mathrm{k}} \quad \therefore \quad \dfrac{43}{17k} = \dfrac{43}{34}$

$\therefore \quad k = 2$

Q107. Solution

Correct Answer: (D)

Let $z_1 = x_1 + iy_1$ and $z_2 = x_2 + iy_2$

$\mathrm{Re}\,(z_1) > 0 \Rightarrow x_1 > 0$

and $\quad \mathrm{Im}\,(z_2) < 0$

$\Rightarrow \quad y_2 < 0$

Given, $\quad |z_1| = |z_2|$

$\Rightarrow \quad |z_1|^2 = z_2^2$

$\Rightarrow \quad z_1\bar{z}_1 = z_2\bar{z}_2$

Now, $\left(\frac{z_1+z_2}{z_1-z_2}\right) + \left(\frac{z_1+z_2}{z_1-z_2}\right)$

$= \left(\frac{z_1+z_2}{z_1-z_2}\right) + \left(\frac{\bar{z}_1+\bar{z}_2}{\bar{z}_1-\bar{z}_2}\right)$

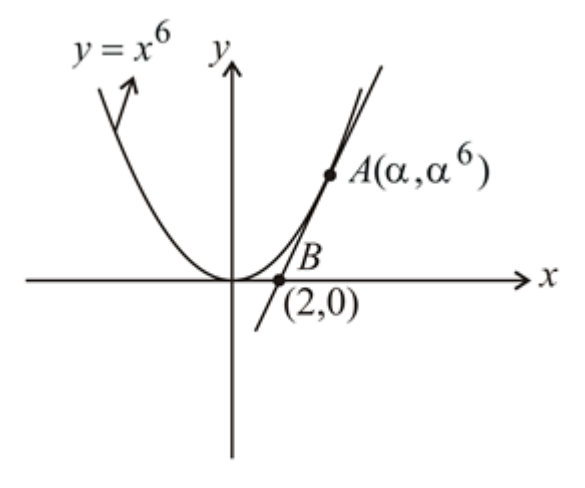
$= \frac{z_1\bar{z}_1+z_2\bar{z}_1-z_1\bar{z}_2-z_2\bar{z}_2+z_1\bar{z}_1+z_1\bar{z}_2-z_2\bar{z}_1+z_2\bar{z}_2}{(z_1-z_2)(\bar{z}_1-\bar{z}_2)}$

$= \frac{2\left(|z_1|^2-|z_2|^2\right)}{(z_1-z_2)(\bar{z}_1-\bar{z}_2)} = 0 \quad \left(\because |z_1|^2 = |z_2|^2\right)$

$= \frac{z_1+z_2}{z_1-z_2}$ is purely imaginary.

Q108. Solution

Correct Answer: (C)



Let A be (α, α^6) & B be $(2,0)$

So, slope of $AB = 6\alpha^5 = \frac{\alpha^6}{\alpha-2}$

$\Rightarrow \alpha = 0$ or $6\alpha - 12 = \alpha$

$\Rightarrow \alpha = 0$ or $\alpha = \frac{12}{5}$

$\Rightarrow 2$ tangents are possible

Q109. Solution

Correct Answer: (A)

$f(x) = [x]\sin(\pi x)$

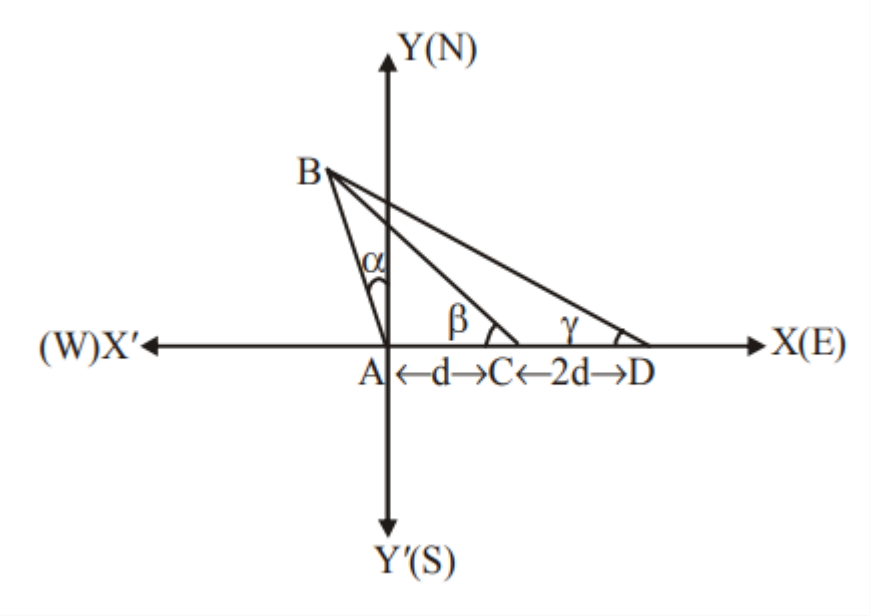
$$\begin{aligned}
\text{LHD} &= \lim_{h\to 0} \frac{f(k-h) - f(k)}{-h} \\
&= \lim_{h\to 0} \frac{[k-h]\sin\pi(k-h) - [k]\sin k\pi}{-h} \\
&= \lim_{h\to 0} \frac{(k-1)\sin(k\pi - \pi h) - k\sin k\pi}{-h} \\
&= \lim_{h\to 0} \frac{(-1)^{k+1}(k-1)\sinh\pi - 0}{-h} \quad \ldots[\because k \in I] \\
&= (-1)^k(k-1)\pi
\end{aligned}$$

Q110. Solution

Correct Answer: (C)

By $\mathrm{m}-\mathrm{n}$ theorem at C

$(\mathrm{d}+2\ \mathrm{d})\cot\beta=\mathrm{d}\cot\gamma-2\ \mathrm{d}\cot(90^\circ+\alpha)$



$3d\cot\beta=d\cot\gamma+2d\tan\alpha$

$\Rightarrow 3\cot\beta=\cot\gamma+2\tan\alpha$

$\therefore 2\tan\alpha=3\cot\beta-\cot\gamma$

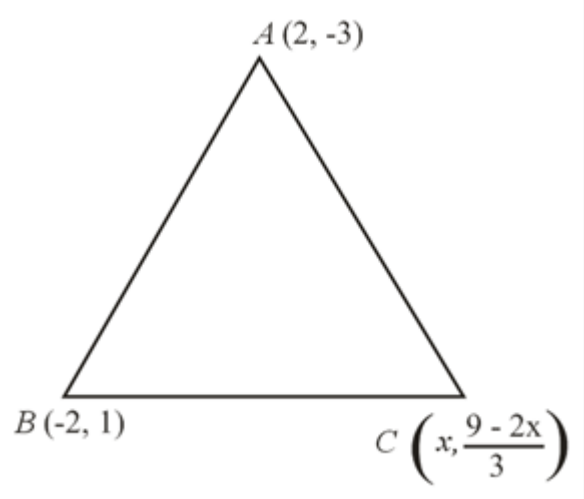
Q111. Solution

Correct Answer: (C)

Given $A(2,-3)$ $B(-2,1)$

The third vertex lies on $2\ x+3\ y=9$

i.e. $C\left(x,\ \frac{9-2x}{3}\right)$



$\therefore$ Let $P(h,k)$ be any point on the required locus i.e P is the centroid of the triangle ABC

$\Rightarrow \left(\frac{2-2+x}{3},\ \frac{-3+1+\frac{9-2x}{3}}{3}\right)=(h,k)$

$\therefore\ h=\frac{x}{3},\ k=\frac{3-2x}{9}$

Eliminating x from the above equations

$\Rightarrow 9\ k=3-2(3\ h)$

$\Rightarrow 9\mathrm{k}=3-6h$

$\Rightarrow 2h+3k=1$

Hence, the locus of $P(h,k)$ is $2\ x+3\ y=1$

Q112. Solution

Correct Answer: (A)

Equation of plane containing the line of intersection of planes is, $(2x-y)+\lambda\ (y-3z)=0$ .....(i)

Also, plane (i) is perpendicular to $4x+5y-3z-8=0$

$\therefore\ 4\ (2)+5\ (\lambda-1)-3\ (-3\lambda)=0$

$\Rightarrow 14\lambda=-3\Rightarrow\lambda=-\frac{3}{14}$

Put the value of λ in (i), we get $28x-17y+9z=0$, which is the required plane.

Q113. Solution

Correct Answer: (B)

Given vectors $\bar{a}\&\bar{b}$ are unit vectors.

$$\begin{aligned}\text{Now } (2\bar{a}-\bar{b})\cdot[(\bar{a}\times\bar{b})\times(\bar{a}+2\bar{b})]&=-(2\bar{a}-\bar{b})\cdot[(\bar{a}+2\bar{b})\times(\bar{a}\times\bar{b})]\\&=-(2\bar{a}-\bar{b})\cdot[\bar{a}\times(\bar{a}\times\bar{b})+2\bar{b}\times(\bar{a}\times\bar{b})]\\&=-(2\bar{a}-\bar{b})[(\bar{a}\cdot\bar{b})\cdot\bar{a}-(\bar{a}\cdot\bar{a})\cdot\bar{b}+2(\bar{b}\cdot\bar{b})\cdot\bar{a}-2(\bar{b}\cdot\bar{a})\cdot\bar{b}]\\&=-(2\bar{a}-\bar{b})[(\bar{a}\cdot\bar{b})\bar{a}-\bar{b}+2\bar{a}-2(\bar{b}\cdot\bar{a})\bar{b}]\end{aligned}$$ Hence

Here $\bar{a}\cdot\bar{b}=\frac{3(2)}{7\sqrt{10}}-\frac{1(6)}{7\sqrt{10}}=0$

given expression becomes $= -(2\bar{a}-\bar{b})[-\bar{b}+2\bar{a}] = -(2\bar{a}-\bar{b})^2$

$= -\left[4\bar{a}^2+\bar{b}^2-4\bar{a}\cdot\bar{b}\right] = -(4+1) = -5$

Q114. Solution

Correct Answer: (B)

$5f(x)+3f\left(\frac{1}{x}\right)=x+2 \quad \ldots(1)$

Replacing x by $\frac{1}{\mathrm{x}}$

$\therefore\ 5\mathrm{f}\left(\frac{1}{\mathrm{x}}\right)\ +\ 3\mathrm{f}(\mathrm{x})=\frac{1}{\mathrm{x}}+\ 2 \quad \ldots\ (2)$

From (1)

$25f(x)+15f\left(\frac{1}{x}\right)=5x+10 \qquad \ldots(3)$

and from (2)

$9\mathrm{f}(\mathrm{x})+15\mathrm{f}\left(\frac{1}{\mathrm{x}}\right)=\frac{3}{\mathrm{x}}+6 \quad \ldots\ (4)$

Subtracting(4) from (3)

$\therefore 16f(x)=5x-\ \frac{3}{x}\ +\ 4$

$\therefore \mathrm{xf}(\mathrm{x})=\frac{5\mathrm{x}^2-3+4\mathrm{x}}{16}=\mathrm{y}$

$\therefore \frac{dy}{dx}=\frac{10x+4}{16}$

$\left.\frac{dy}{dx}\right|_{x=1}=\frac{10+4}{16}=\frac{7}{8}$.

Q115. Solution

Correct Answer: (B)

$\frac{dy}{dx} = \frac{x+y+1}{x+y-1}$ Put $x + y = v \Rightarrow 1 + \frac{dy}{dx} = \frac{dv}{dx}$

$$\therefore \frac{dv}{dx} - 1 = \frac{v+1}{v-1} \Rightarrow \frac{dv}{dx} = \frac{v+1}{v-1} + 1 = \frac{2v}{v-1}$$

$$\therefore \int \frac{(v-1)dv}{2v} = \int dx$$

$$\therefore \int \frac{1}{2} dV - \int \frac{1}{2v} dv = \int dx = \frac{v}{2} - \frac{1}{2}\log|v| = x + c$$

$$\therefore \frac{x+y}{2} - \frac{1}{2}\log|x+y| = x + c$$

We have $x = \frac{2}{3}, y = \frac{1}{3}$

$$\therefore \frac{1}{2} - \frac{1}{2}\log|1| = \frac{2}{3} + c \Rightarrow c = \frac{1}{2} - \frac{2}{3} = \frac{-1}{6}$$

$$\therefore \frac{x+y}{2} - \frac{1}{2}\log|x+y| = x - \frac{1}{6}$$

$$\therefore \frac{x+y}{2} - \frac{1}{2}\log|x+y| = x - \frac{1}{6}$$

$$\therefore (x+y) - \log|x+y| = 2x - \frac{2}{6} \Rightarrow y - x + \frac{1}{3} = \log|x+y|$$

Q116. Solution

Correct Answer: (D)

Given, $a,\ b,\ c$ are in GP.

$\therefore\ b^2 = ac$

and $2(\log 2b - \log 3c) = \log a - \log 2b + \log 3c - \log a$

$\Rightarrow b^2 = ac$ and $2b = 3c$

$\because\ a + b = \frac{5a}{3} > c,\ b + c = \frac{10a}{9} > a$

and $c + a = \frac{13a}{9} > b$

$\therefore\ a,\ b,\ c$ are the sides of a triangle.

Also, a is the greatest side

$\therefore\ \cos A = \frac{b^2+c^2-a^2}{2bc} = -\frac{29}{48} < 0$

$\therefore\ \Delta$ ABC is an obtuse angled triangle.

Hence, option (d) is correct.

Q117. Solution

Correct Answer: (C)

$\frac{x-1}{2}=\frac{y+1}{3}=\frac{z-1}{4}=r(\text{ say })$

$\Rightarrow x=2r+1, y=3r-1, z=4r+1$

Since, the two lines intersect.

So, putting above values in second line, we get

$\frac{2r+1-3}{1}=\frac{3r-1-k}{2}=\frac{4r+1}{1}$

$2r-2=4r+1$

$\Rightarrow \mathrm{r}=-3/2$

Also $3\mathrm{r}-1-\mathrm{k}=8\mathrm{r}+2$

$\Rightarrow \mathrm{k}=-5\mathrm{r}-3=\dfrac{15}{2}-3=\dfrac{9}{2}$

Q118. Solution

Correct Answer: (C)

Differentiation of $x\sin x+\cos x$ is $x\cos x$, then

$$I=\int \frac{x^2dx}{(x\sin x+\cos x)^2}=\int \frac{x\cos x}{(x\sin x+\cos x)^2}\cdot\frac{x}{\cos x}dx$$

$$\text{Integrate by parts } \left[\int \frac{1}{t^2}dt=-\frac{1}{t}\right]$$

$$\therefore I=\frac{-1}{(x\sin x+\cos x)}\cdot\frac{x}{\cos x}$$

$$+\int \frac{1}{(x\sin x+\cos x)}\cdot\frac{\cos x\cdot 1-x(-\sin x)}{\cos^2 x}dx$$

$$=-\frac{1}{x\sin x+\cos x}\cdot\frac{x}{\cos x}+\int \sec^2 x dx$$

$$=-\frac{1}{x\sin x+\cos x}\cdot\frac{x}{\cos x}+\frac{\sin x}{\cos x}$$

$$=\frac{-x+x\sin^2 x+\sin x\cos x}{(x\sin x+\cos x)\cos x}$$

$$=\frac{\sin x\cos x-x\left(1-\sin^2 x\right)}{(x\sin x+\cos x)\cos x}=\frac{\sin x-x\cos x}{x\sin x+\cos x}+C.$$

Q119. Solution

Correct Answer: (C)

The formula for combined mean is $\bar{x}=\frac{n_1\bar{x}_1+n_2\bar{x}_2}{n_1+n_2}$ Given, $\bar{x}=500, \bar{x}_1=510, \bar{x}_2=460$ Let $n_1+n_2=100$

and n_1 denotes male, n_2 denotes female for this $n_2=100-n_1$

$$500=\frac{510n_1+(100-n_1)460}{100}$$

$$\Rightarrow 50000=510n_1+46000-460n_1$$

$$\Rightarrow 50000-46000=50n_1$$

$$\Rightarrow 4000=50n_1$$

$$\Rightarrow n_1=\frac{4000}{50}=80.$$

Q120. Solution

Correct Answer: (D)

We have $p = \frac{3}{4} \Rightarrow q = \frac{1}{4}$ and $n = 5$

Therefore required probability

$= {}^5C_3\left(\frac{3}{4}\right)^3\left(\frac{1}{4}\right)^2 + {}^5C_4\left(\frac{3}{4}\right)^4\left(\frac{1}{4}\right) + {}^5C_5\left(\frac{3}{4}\right)^5$

$= \frac{10.27}{4^5} + \frac{5.81}{4^5} + \frac{243}{4^5} = \frac{270+405+243}{1024} = \frac{459}{512}.$

Q121. 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 $k = 2$

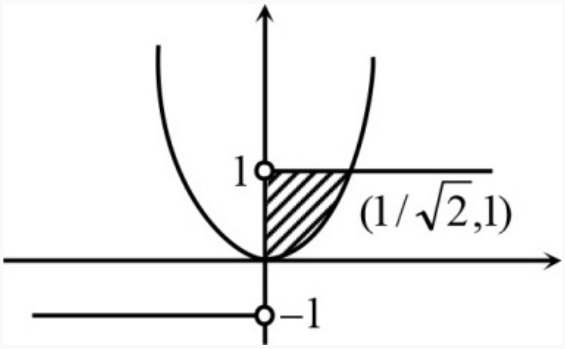
$$D_1 = \begin{vmatrix} 1 & -2 & 0 \\ -2 & -1 & 2 \\ 6 & 2 & 4 \end{vmatrix} = -48 \neq 0$$

So no solution

Q122. Solution

Correct Answer: (B)

To find the bounded area first draw the graph of $y = 2x^2$ which is a parabola opening upward, $y = \frac{|x|}{x}$ which is two horizontal rays and $y-$ axis.



Now we can easily find the bounded area by integrating the curve parabola with respect to x from $x = 0$ to $x = 1$.

$\text{Area} = \int_0^1 \sqrt{\frac{y}{2}}\,dy$

$= \frac{1}{\sqrt{2}} \cdot \frac{2}{3}\left(y^{\frac{3}{2}}\right)_0^1 = \frac{2\sqrt{2}}{6}$ sq. unit

Q123. Solution

Correct Answer: (A)

Given

$$\sin^{-1}\left[\cot\left(\sin^{-1}\sqrt{\left(\frac{2-\sqrt{3}}{4}\right)}+\cos^{-1}\frac{\sqrt{12}}{4}+\sec^{-1}\sqrt{2}\right)\right]$$

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

$$=\sin^{-1}[\cot(15^\circ+30^\circ+45^\circ)]$$

$$=\sin^{-1}\{\cot(90^\circ)\}=\sin^{-1}0=0.$$

Q124. Solution

Correct Answer: (B)

$$\mathrm{I}=\int\frac{\tan x+\tan\alpha}{\tan x-\tan\alpha}\mathrm{d}x$$

$$=\int\frac{\frac{\sin x}{\cos x}+\frac{\sin\alpha}{\cos\alpha}}{\frac{\sin x}{\cos x}-\frac{\sin\alpha}{\cos\alpha}}\mathrm{d}x$$

Let $\qquad$ Let $x-\alpha=\mathrm{t}$

$$=\int\frac{\sin x\cos\alpha+\sin\alpha\cos x}{\sin x\cos\alpha-\sin\alpha\cos x}\,\mathrm{d}x$$

$$=\int\frac{\sin(x+\alpha)}{\sin(x-\alpha)}\mathrm{d}x$$

$$\therefore\quad \mathrm{I}=\frac{\sin(\mathrm{t}+2\alpha)}{\sin\mathrm{t}}$$

$$=\int\frac{\sin(\mathrm{t})\cos 2\alpha+\cos(\mathrm{t})\sin 2\alpha}{\sin(\mathrm{t})}\mathrm{d}x$$

$$=\cos 2\alpha\int 1\mathrm{dt}+\sin 2\alpha\int\cot(\mathrm{t})\mathrm{dt}$$

$$=\cos 2\alpha\cdot\mathrm{t}+\sin 2\alpha\cdot\log|\sin(\mathrm{t})|+\mathrm{c}$$

$$\therefore\quad \mathrm{I}=(x-\alpha)\cos 2\alpha+\log|\sin(x-\alpha)|\sin 2\alpha+\mathrm{c}$$

But $\int\frac{\tan x+\tan\alpha}{\tan x-\tan\alpha}\mathrm{d}x=\mathrm{A}(x)\cos 2\alpha+\mathrm{B}(x)\sin 2\alpha+\mathrm{c}\ldots[Given]$

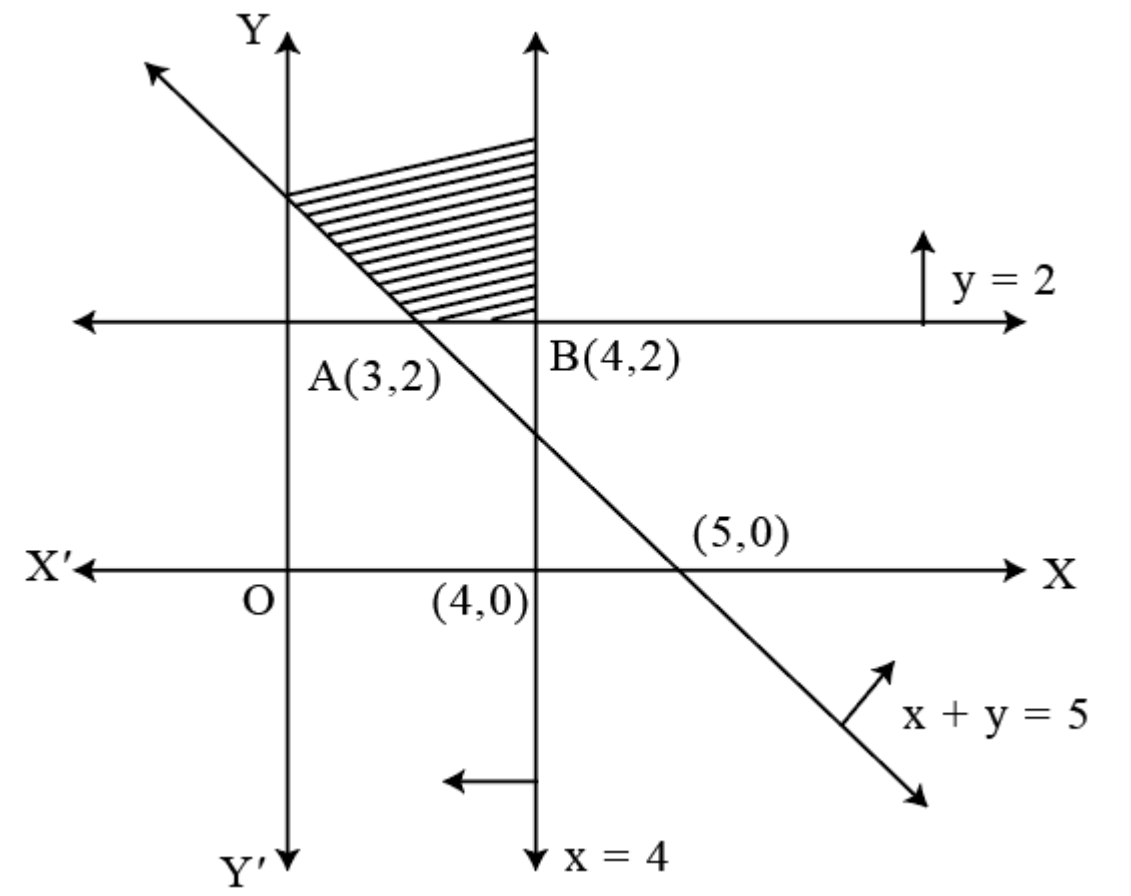
$\Rightarrow \mathrm{A}(x)=x-\alpha,\mathrm{B}(x)=\log|\sin(x-\alpha)|+\mathrm{c}$

Q125. Solution

Correct Answer: (C)

Given minimize $Z = 5x + 8y$ Subject to constraints $x + y \geq 5, 0 \leq x \leq 4, y \geq 2, x, y \geq 0$

Corner point	$Z = 5x + 8y$
$A(3, 2)$	$15 + 16 = 31$
$B(4, 2)$	$20 + 16 = 36$
$C(0, 5)$	$0 + 40 = 40$



$\therefore$ Minimum value $= 31$

Q126. Solution

Correct Answer: (B)

Since, telephone number start with 67, so two digits is already fixed.

Now, we have to arrangement of three digits from remaining eight digits (i.e., $0, 1, 2, 3, 4, 5, 8, 9$)

$= 8_{P_3}$ways $= \frac{8!}{5!}$

$= 8 \times 7 \times 6$

$= 336$ ways

Q127. Solution

Correct Answer: (C)

Let equation of plane be

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

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

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

$a-b+2c=0$

$2a-2b+c=0$

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

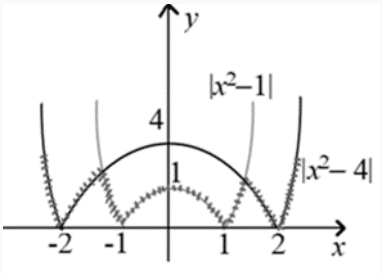
Distance from $(1,\ -2,\ 4)$ will be

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

Q128. Solution

Correct Answer: (C)

Using the graph of $y=\ x^2-4$, $y=\ x^2-1$



Add that curve is non- differentiable at corner points.

Clearly, from the graph we can see $f(x)$ is non-differentiable at 6 points.

Q129. Solution

Correct Answer: (D)

Given, α and β are roots of $px^2 + qx + r = 0, p \neq 0$.

$\therefore\ \alpha + \beta = \frac{-q}{p}, \alpha\beta = \frac{r}{p} \quad \ldots (\text{i})$

Since, p, q and r are in AP.

$\therefore\ 2q = p + r \quad \ldots (\text{ii})$

Also, $\frac{1}{\alpha} + \frac{1}{\beta} = 4$

$\Rightarrow \frac{\alpha+\beta}{\alpha\beta} = 4$

$\Rightarrow \alpha + \beta = 4\alpha\beta \Rightarrow \frac{-q}{p} = \frac{4r}{p}$ [from Eq (i)]

$\Rightarrow q = -4r$

On putting the value of q in equation (ii), we get

$2(-4r) = p + r$

$\Rightarrow p = -9r$

Now, $\alpha + \beta = \frac{-q}{p} = \frac{4r}{p} = \frac{4r}{-9r} = -\frac{4}{9}$

and $\alpha\beta = \frac{r}{p} = \frac{r}{-9r} = \frac{1}{-9}$

$\therefore\ (\alpha - \beta)^2 = (\alpha + \beta)^2 - 4\alpha\beta = \frac{16}{81} + \frac{4}{9} = \frac{16+36}{81}$

$\Rightarrow (\alpha - \beta)^2 = \frac{52}{81} \Rightarrow |\alpha - \beta| = \frac{2}{9}\sqrt{13}$

Q130. Solution

Correct Answer: (B)

Given that, $x^2y - x^3\ \frac{dy}{dx} = y^4 \cos x$

i.e., $x^3 \frac{dy}{dx} - x^2y = -y^4 \cos x$

on dividing by $-y^4x^3$, we get

$$-\frac{1}{y^4}\ \frac{dy}{dx} + \frac{1}{y^3}.\ \frac{1}{x} = \frac{1}{x^3}\cos x$$

Put $\frac{1}{y^3} = V$

$$\Rightarrow \quad -\frac{1}{y^4}\ \frac{dy}{dx} = \frac{1}{3}\frac{dV}{dx}$$

$$\therefore \quad \frac{1}{3}\ \frac{dV}{dx} + \frac{1}{x}V = \frac{1}{x^3}\cos x$$

$$\Rightarrow \quad \frac{dV}{dx} + \frac{3}{x}\ V = \frac{3}{x^3}\cos x$$

Which is linear in V.

$$\therefore \quad IF = e^{\int \frac{3}{x}\,dx} = e^{3\log x} = x^3$$

So, the solution is

$$x^3V = \int x^3.\ \frac{3}{x^3}\cos x\ dx + c$$

$$= 3\sin x + c$$

$$\Rightarrow \quad \frac{x^3}{y^3} = 3\sin x + c$$

Putting $x = 0,\ y = 1$, we get $c = 0$

Hence, the solution is $x^3 = 3y^3 \sin x$