Answer Key

Other (140 Questions)

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

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

Solutions

Q1. Solution

Correct Answer: (D)

The anode in diagram (a) has a lower voltage than the cathode. as a result it is skewed in the opposite direction .the anode in diagram(b) has a higher potential than the cathodes. as a result it is in forward biased

Q2. Solution

Correct Answer: (C)

The stationary wave is given by $y = 2\cos\frac{2\pi x}{\lambda}\sin\frac{2\pi t}{T}$ where $\lambda = 4$ m and T $= 0.4$ s Amplitude $A = 2\cos\frac{2\pi x}{\lambda}$
At $x = 0.5$ m, $A = 2\cos\frac{2\pi\times0.5}{4}$ $A = 2\cos\frac{\pi}{4} = 2\times\frac{1}{\sqrt{2}} = \sqrt{2}m$

Q3. Solution

Correct Answer: (A)

$$\text{Force, } F = ma = m\frac{dv}{dt}$$
$$3x = 8\frac{dv}{dx}\cdot\frac{dx}{dt}$$
$$3x = 8v\frac{dv}{dx}$$
$$3xdx = 8vdv$$
$$3\left[\frac{x^2}{2}\right]_2^{10} = 8\left[\frac{v^2}{2}\right]_0^{v}$$

Integrating both sides $\frac{3}{2}\left[10^2 - 2^2\right] = 4v^2$

$$\frac{3}{2}\times 96 = 4v^2$$
$$v = 6\ \text{m/s}$$

Q4. Solution

Correct Answer: (A)

Given, velocity of the wave v = 343 m/s
Tension required T = ?
Mass density $= \mu = \frac{m}{l} = \frac{2\cdot10}{12}$
= 0.175 kg/m
Speed of transverse wave in wire
$v = \sqrt{\frac{T}{\mu}} \Rightarrow T = v^2\mu = (343)^2 \times 0\cdot175$
= 20588.575 N
≈ 206 × 10^4 N

Note: Put the data in the final expression and take care of the units (they must be coherent, preferably SI) and than calculate in the minimum steps to get an accurate result.

Q5. Solution

Correct Answer: (A)

$f = \frac{1}{2\pi\sqrt{LC}}$

i.e., $f \propto \frac{1}{\sqrt{C}} \ \rightarrow \ \frac{1}{\sqrt{4}} = \frac{1}{2}$ time

Q6. Solution

Correct Answer: (A)

Here $d = 0.15 \text{ mm } = 0.15 \times 10^{-3} \text{ m } = 15 \times 10^{-5} \text{ m}$

$\lambda = 450 \text{ nm} = 450 \times 10^{-9} \text{ m} = 4.5 \times 10^{-7} \text{ m}, D = 1.0 \text{ m}$

(i) Distance of the second bright fringe

$x_2 = \frac{2\lambda D}{d} \qquad \left[\because x_n = \frac{n\lambda D}{d}\right]$

$= \frac{2\times4.5\times10^{-7}\times1.0}{15\times10^{-5}} = \frac{2\times4.5}{15} \times 10^{-2}$

$= 0.6 \times 10^{-2}\text{m} = 6 \text{ mm}$

(ii) Distance of the second dark fringe

$x_2 = \frac{3\lambda D}{2d} \qquad \left[\because x_n = \frac{(2n-1)\lambda D}{2d}\right]$

$= \frac{3\times4.5\times10^{-7}\times1.0}{2\times15\times10^{-5}} = \frac{3\times4.5}{30} \times 10^{-2}$

$= 0.45 \times 10^{-2}\text{m} = 4.5 \text{ mm}$

Q7. Solution

Correct Answer: (C)

Energy stored $(E) = \frac{75}{100} \times (12) = 9 \text{ J}$

As $E = \frac{1}{2}mv^2$

$\therefore \ v = \sqrt{\frac{2E}{m}} = \sqrt{\frac{2\times9}{1}} = \sqrt{18} \text{ ms}^{-1}$

Q8. Solution

Correct Answer: (D)

If r_0 be the distance of closest approach, then $(\text{KE})_\alpha = \frac{(Ze)(2e)}{4\pi\varepsilon_0 \cdot (r_0)_\alpha} \Rightarrow \frac{1}{2}mv_\alpha^2 = \frac{(Ze)(2e)}{4\pi\varepsilon_0 \cdot (r_0)_\alpha}$

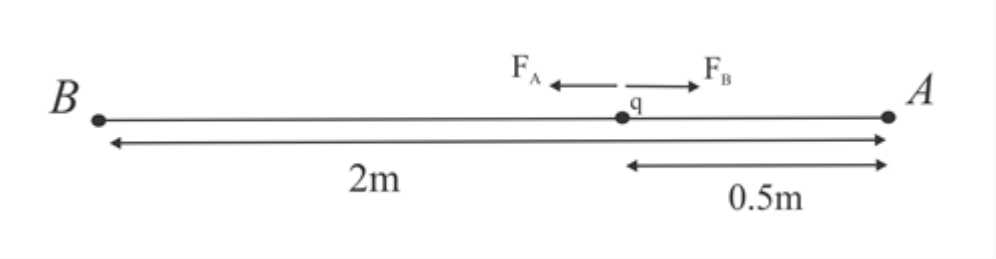
$\Rightarrow \quad v_\alpha^2 \propto \frac{1}{(r_0)_\alpha} \Rightarrow (r_0)_\alpha \propto \frac{1}{v_\alpha^2} \Rightarrow \quad \frac{(r_0)_{\alpha_i}}{(r_0)_{\alpha_f}} = \frac{v_{\alpha_f}^2}{v_{\alpha i}^2} = \frac{\left(2v_{\alpha_i}\right)^2}{v_{\alpha_i}^2} = 4$

$\therefore \quad (r_0)_{\alpha_f} = \frac{(r_0)\alpha_i}{4} = \frac{d}{4} \quad \left[\because (r_0)_{\alpha_i} = d\right]$

Q9. Solution
Correct Answer: (D)

Given that

charge $q = +1$ C



Net force on charge q is zero , so

$F_A = F_B$

$\Rightarrow \quad \frac{KQ_Aq}{(0.5)^2} = \frac{KQ_Bq}{(1.5)^2}$

$\Rightarrow \quad \frac{Q_A}{Q_B} = \frac{(0.5)^2}{(1.5)^2} = \frac{1}{9}$

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Q10. Solution
Correct Answer: (C)

$\gamma_{mix} = 1 + \frac{2}{f_{mix}}$
$\frac{C_p}{C_v} = \frac{f_{mix}+2}{f_{mix}} = \frac{3}{2}$
$\Rightarrow \quad f_{mix} = 4$
$f_{mix} = \frac{n_1 f_1 + n f_2}{n_1 + n_2}$
$\Rightarrow 4 = \frac{2\times 3 + n \times 5}{2+n}$
$\Rightarrow n = 2$ mole ,

Q11. Solution
Correct Answer: (D)

$N = m\omega^2 R$

Given $m = 0.2$ kg, $T = 40$ S, $R = 0.2$ m

Put values in equation (1)

$N = 9.859 \times 10^{-4}$ N

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Q12. Solution

Correct Answer: (B)

Dimensionally, Energy = mass × (velocity)^2

$$= \text{mass} \times \left(\frac{\text{length}}{\text{time}}\right)^2 = \mathrm{ML^2T^{-2}}$$

Thus, 1 joule = (1 kg) (1 m)^2 (1 s)$^{-2}$

and 1 erg = (1 g) (1 cm)^2 (1 s)$^{-2}$

$$\frac{1 \text{ joule}}{1 \text{ erg}} = \left(\frac{1 \text{ kg}}{1 \text{ g}}\right)\left(\frac{1 \text{ m}}{1 \text{ cm}}\right)^2\left(\frac{1 \text{ s}}{1 \text{ s}}\right)^{-2}$$

$$= \left(\frac{1000 \text{ g}}{1 \text{ g}}\right)\left(\frac{100 \text{ cm}}{1 \text{ cm}}\right)^2 = 1000 \times 10000 = 10^7$$

So, 1 joule = 10^7 erg. ^

Q13. Solution

Correct Answer: (C)

By using mass action law $\Rightarrow n_n = \frac{n^2}{n_e} = \frac{\left(10^{16}\right)^2}{10^{21}} = 10^{11}$ per m ^{3} .

Q14. Solution

Correct Answer: (D)

$\mathrm{N} = \mathrm{N_0}\left(\frac{1}{2}\right)^{\mathrm{n}}$

$\mathrm{N} = \frac{\mathrm{N_0}}{8}$

$\frac{\mathrm{N_0}}{8} = \mathrm{N_0}\left(\frac{1}{2}\right)^{\mathrm{n}} \Rightarrow \left(\frac{1}{2}\right)^3 = \left(\frac{1}{2}\right)^{\mathrm{n}}$

$\mathrm{n} = 3$

3 half lives $= 3$ days

1 half life $= 1$ day

5 days $= 5$ half life

$\mathrm{N} = \mathrm{N_0}\left(\frac{1}{2}\right)^{\mathrm{n}} \Rightarrow 8 \times 10^{-3} = \mathrm{N_0}\left(\frac{1}{2}\right)^5$

$\Rightarrow \quad N_0 = 2^5 \times 8 \times 10^{-3} = 256\mathrm{gm}$,

Q15. Solution

Correct Answer: (C)

When a charged particle of charge q is accelerated through a potential V, then de-Broglie wavelength is given as

$\lambda = \frac{h}{\sqrt{2mqV}}$

$\Rightarrow \quad \lambda \propto \frac{1}{\sqrt{mq}}$

$\Rightarrow \quad \frac{\lambda_\alpha}{\lambda_p} = \sqrt{\frac{m_p}{m_\alpha}} \cdot \sqrt{\frac{q_p}{q_\alpha}}$

$\Rightarrow \quad \frac{\lambda_\alpha}{\lambda} = \sqrt{\frac{m_p}{4m_p}}\sqrt{\frac{q_p}{2q_p}} \quad \left[\because m_\alpha = 4m_p \text{ and } q_\alpha = 2q_p\right]$

$\Rightarrow \quad \frac{\lambda_\alpha}{\lambda} = \frac{1}{\sqrt{8}}$

$\Rightarrow \quad \lambda_\alpha = \frac{\lambda}{2\sqrt{2}}$ ^

Q16. Solution

Correct Answer: (C)

$\frac{1}{\lambda}=R\left[\frac{1}{n_f^2}-\frac{1}{n_i^2}\right]$

Balmer Series; $n_f=2; n_i=3,4,5,\ldots\ldots$

$\frac{1}{\lambda}=1.097\times10^7\ \text{m}=\left[\frac{1}{4}-\frac{1}{9}\right]$

$\Rightarrow\frac{1}{\lambda}=1.097\times10^7\ \text{m}=\left[\frac{5}{36}\right]$

$\Rightarrow\lambda=\frac{36}{5}\times\frac{10^{-7}}{1.097}\ \text{m}$

$\Rightarrow\lambda=6.56\times10^{-7}\ \text{m}$

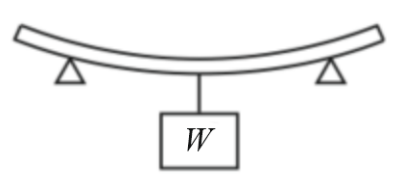
$\Rightarrow\lambda=656\times10^{-9}\ \text{m}$

This wavelength falls in visible range. ^

Q17. Solution

Correct Answer: (C)

According to the question,



the depression (δ) *at the centre is given by,*

$\delta=\frac{Wl^3}{4Ybd^3}$,

where

$W\rightarrow$ *Applied weight,*

$l\rightarrow$ *Length of the wire,*

$Y\rightarrow$ *Young's modulus of the wire,*

$b\rightarrow$ *Breadth of the wire and*

$d\rightarrow$ *Thickness of the wire.*

As all the quantities in R.H.S of the above expression are constant, except the Y*. The depression at the centre is*

$\therefore\delta\propto\frac{1}{Y}$

!

Q18. Solution

Correct Answer: (B)

Let the rate of heat flow from point C to A and C to B is H_1 and H_2 respectively.

In steady state,

$H_1 + H_2 = 40$

$\Rightarrow \quad \frac{\Delta T}{R_1} + \frac{\Delta T}{R_2} = 40$

$\Rightarrow \quad \frac{T-0}{\frac{0.5}{400\times2\times10^{-4}}} + \frac{T-100}{\frac{0.5}{400\times2\times10^{-4}}} = 40$

$\Rightarrow \quad 2\,\mathrm{T} - 100 = 40 \times \frac{0.5}{400\times2\times10^{-4}}$

$\Rightarrow \; T = \; 175\ ^{\circ}\mathrm{C}$

Temperature gradient on higher temperature side $= \frac{175-100}{\frac{1}{2}} = 150^{\circ}\ \mathrm{cm}^{-1}$

,

Q19. Solution

Correct Answer: (A)

Using $pV = RT$ and $p = 3 - g\left(\frac{V^2}{V_0^2}\right)$, we get $T = \frac{3V}{R} - \frac{g\,\mathrm{V}^3}{RV_0^2}$ ...(i) Differentiating w.r.t. volume, we get $\frac{dT}{dV} = \frac{3}{R} - \frac{g}{RV_0^2} \times 3V^2$ For maximum T, $\frac{dT}{dV} = 0 \Rightarrow \frac{3}{R} - \frac{g}{RV_0^2} \times 3V^2 = 0 \Rightarrow V = \frac{V_0}{\sqrt{g}}$ Substituting in Eq. (i), we get

$$T_{\max} = \frac{3V_0}{R\sqrt{g}} - \frac{g\left(V_0/\sqrt{g}\right)^3}{RV_0^2}$$
$$= \frac{2V_0}{R\sqrt{g}}$$

Q20. Solution

Correct Answer: (A)

Current through a discharging capacitor in $R-C$ circuit is given by
$i = \frac{Q_0}{RC}e^{-\frac{t}{RC}}$
, where resistance and capacitance are given by
$R = \rho\frac{d}{A}$ and $C = \frac{\varepsilon_0 KA}{d}$
The time constant of the $R-C$ circuit is given by
$\tau = CR = \frac{\varepsilon_0 KA}{d} \times \rho\frac{d}{A} = \varepsilon_0 K\rho$
Thus, the current density is given by
$J = \frac{i}{A} = \frac{Q_0}{\rho K\varepsilon_0 A}e^{-\left(\frac{t}{\varepsilon_0 K\rho}\right)}$

Q21. Solution

Correct Answer: (C)

Time period of magnet, $\mathrm{T} = 2\pi\sqrt{\frac{\mathrm{I}}{\mathrm{MB}}}$

When magnet is cut parallel to its length into four equal pieces. Then new

magnetic moment, M' = $\frac{M}{4}$
New moment of inertia, I' = $\frac{I}{4}$

New time period, $\mathrm{T}' = 2\pi\sqrt{\frac{\mathrm{I}'}{\mathrm{M}'\mathrm{B}'}}$

=> T=T'= 4s

Q22. Solution

Correct Answer: (B)

The self-inductance of a long solenoid of cross-sectional area A and length l, having n turns per unit length, filled the inside with the solenoid with a material of relative permeability μ_r (e.g., soft iron, which has a high value of relative permeability) is given by

$L = \mu_r \mu_0 n^2 Al$; where, $n = \frac{N}{l}$

$L = \frac{\mu_r \mu_0 N^2 A}{l}$

$L \propto \frac{A}{l}$; hence self inductance will increase as l decreases and A increases.

Q23. Solution

Correct Answer: (C)

Given,

$\overrightarrow{\mathrm{OC}} = \overrightarrow{\mathrm{OB}} = \overrightarrow{\mathrm{OA}} = r.$

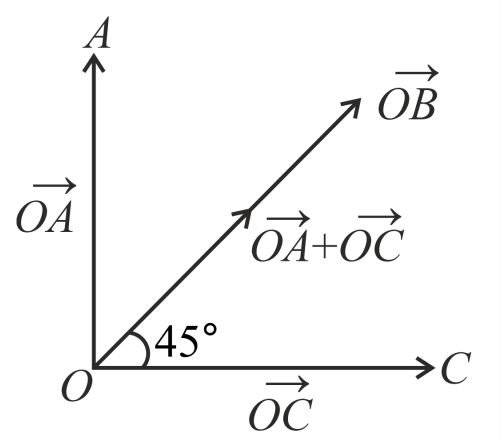
$\overrightarrow{\mathrm{OC}}$ and $\overrightarrow{\mathrm{OA}}$ are equal in magnitude and inclined to each other at an angle of 90°.

And their resultant is given by, $\overrightarrow{\mathrm{OC}} + \overrightarrow{\mathrm{OA}} = \sqrt{\overrightarrow{\mathrm{OC}}^{\,2} + \overrightarrow{\mathrm{OA}}^{\,2}}$

$\Rightarrow \overrightarrow{\mathrm{OC}} + \overrightarrow{\mathrm{OA}} = \sqrt{r^2 + r^2} = r\sqrt{2}.$

Also, its direction is at 45° from horizontal or mid of the two vectors as their magnitudes are same.

Now resultant of $\overrightarrow{\mathrm{OC}}$ & $\overrightarrow{\mathrm{OA}}$ along with $\overrightarrow{\mathrm{OB}}$ is shown in the below figure,



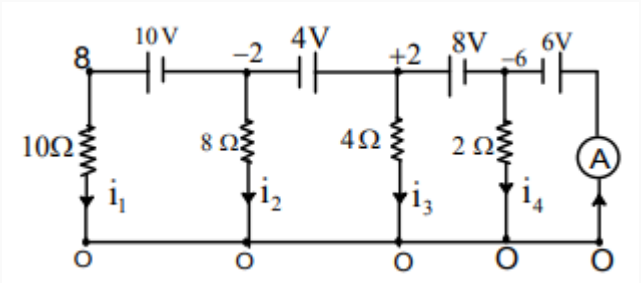
So their resultant is $\sqrt{2}r$. It acts mid-way between $\overrightarrow{\mathrm{OC}}$ and $\overrightarrow{\mathrm{OA}}$, i.e., along OB.

Now, both r and $\sqrt{2}r$ are along the same line and in the same direction as shown in the figure.

So, resultant is given by, $R = r + \sqrt{2}r = r\left(1 + \sqrt{2}\right)$.

Q24. Solution

Correct Answer: (C)



$\mathrm{i} = \mathrm{i}_1 + \mathrm{i}_2 + \mathrm{i}_3 + \mathrm{i}_4 = \frac{8}{10} + \frac{-2}{8} + \frac{2}{4} + \frac{-6}{2}$

$= -1.95\ \mathrm{A}$ reading $= 1.95\ \mathrm{A}$

Q25. Solution
Correct Answer: (B)

According to the question, it is mentioned that the converging lens forms a real image on the other side of the lens.

When light rays coming from the source they have to travel some optical distance to form an image another side.

Now, i object is shifted by some little distance on the main axis. The rays take some time to make an image on other side of the lens.

Due to the very large speed of light $\left(3 \times 10^{8}\ \mathrm{m\ s^{-1}}\right)$, this delay is very small.

Therefore, the image will be shifted a little later than the object

Q26. 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.

Q27. Solution
Correct Answer: (C)

Earth revolves around sun in circular orbit as there is gravitational force of attraction by sun on earth.

Also, mercury revolves around sun in circular orbit as there is gravitational force of attraction by sun on mercury.

But when observed from earth, mercury's orbit is not circular because mercury is moving around the sun and not the earth. The gravitational force of the sun on mercury is much stronger than that of earth on mercury.

Q28. Solution

Correct Answer: (C)

Specific heat at constant pressure (C_p) is the amount of heat Q required to raise n moles of substance by $\Delta\theta$ when pressure is kept constant. Then

$C_p = \frac{Q}{n\Delta\theta}$

Given, Q=70 cal, $n = 2$,

$\Delta\theta = (35 - 35)℃ = 5℃$

$\therefore C_p = \frac{70}{2\times5}$=7 cal mol^{-1} $-\text{K}^{-1}$

From Mayer's formula $C_p - C_V = R$

where R is gas constant $\left(= 2 \text{ cal mol}^{-1}\right)$

$\therefore \quad 7 - C_V = 2$

$\Rightarrow \quad C_V = 5 \text{ cal mol}^{-1} - \text{K}^{-1}$

Hence, amount of heat required at constant volume (C_V) is

$Q' = nC_V\ \Delta\ \theta$

$Q' = 2 \times 5 \times 5 = 50 \text{ cal}$

Q29. Solution

Correct Answer: (C)

$E_{\text{cell}} = E^o_{Au^{3+}/Au} - E^o_{Ni^{2+}/Ni} = 1.50 - (-0.25) = 1.75V$

Q30. Solution

Correct Answer: (A)

$E_{\text{cell}} = E^\circ_{\text{cell}} - \frac{0.059}{2}\log\frac{(Zn^+)}{(Cu^{++})}$

$= 1.10 - \frac{0.059}{2}\log\frac{0.1}{0.1} = 1.10 \text{ V}.$

Q31. Solution

Correct Answer: (D)

Ionic product of water is given as the product of concentration of H^+ and OH^- ions. It can be represented as,

$\text{K}_\text{w} = [\text{H}^+]\left[\text{OH}^-\right] = 10^{-14}$

Substituting the value of $[\text{H}^+]$,

$\Rightarrow 1.3 \times 10^{-4}\text{M} \times \left[\text{OH}^-\right] = 10^{-14}\,\text{mol}^2\,\text{L}^{-2} \Rightarrow \left[\text{OH}^-\right] = \frac{10^{-14}}{1.3\times10^{-4}}\text{M} \Rightarrow \left[\text{OH}^-\right] = 7.7 \times 10^{-11}\text{M}$

Q32. Solution

Correct Answer: (A)

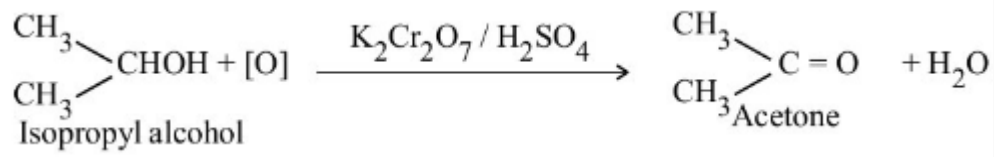
Bakelite is a thermosetting polymer which is made by reaction between phenol and HCHO.

Q33. Solution

Correct Answer: (A)

Aldehydes and ketones can be prepared by the oxidation of alcohols. Primary alcohols upon oxidation give aldehydes whereas secondary alcohols give ketones. The most commonly used oxidants are $KMnO_4$ or $K_2Cr_2O_7$ acidified with sulphuric acid.

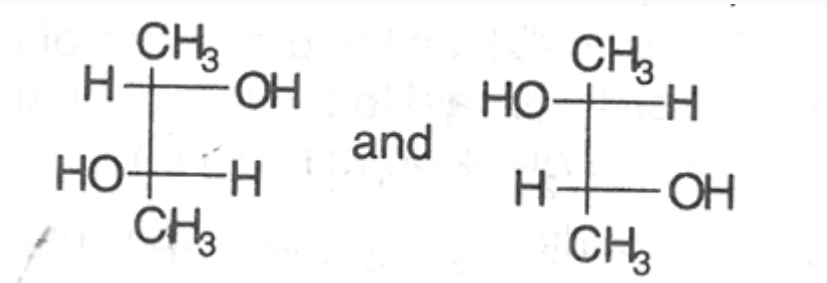
Isopropyl alcohol on oxidation forms acetone.



Q34. Solution

Correct Answer: (D)

A pair of molecule which cannot be super imposed on its mirror image (i.e., asymmetrical) related to each other as an object to its mirror image are knowns as enantiomers, So,



are enantiomers.

Q35. Solution

Correct Answer: (B)

In chelation, ring formation occurs because two atoms from the same ligand coordinate with the metal atom. This cannot happen if the ligand is monodentate. Oxalate is a bidentate ligand hence it forms a chelate. It can coordinate with both of its negatively charged O atoms. Acetate, cyanide and ammonia are monodentate ligands. They do not form chelates.

Q36. Solution
Correct Answer: (B)

Neutral dimethyl glyoxime does not act as ligand.

When Ni^{2+} reacts with dimethyl glyoxime in presence of NH_4OH, it produce dimethyl glyoximate then it form rozy red ppt.

$$Ni^{2+}_{(aq)} + 2\,dmg^- \rightarrow \underset{\text{Rosy red ppt.}}{[Ni(dmg)_2]}$$

Q37. Solution
Correct Answer: (C)

$_{33}As$: 5 electrons in valence shell. It shows $+3$ oxidation state.

$_{17}Cl$: 7 electrons in valence shell.

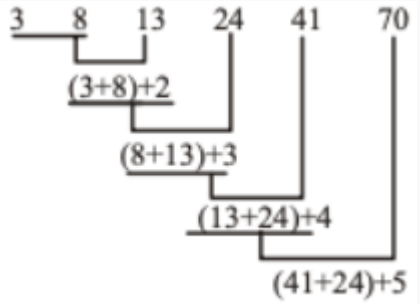
So, molecular formula of a stable compound formed between them is $AsCl_3$ i.e., XY_3.

Q38. Solution
Correct Answer: (B)

$\because$ 8 gm sulphur is present in 100 gm of substance
$\therefore$ 32gm sulphur will present $= \frac{100}{8} \times 32 = 400$

Q39. Solution
Correct Answer: (C)

The sequence in the series is (number + next number) + addition of natural number increasing by 1 at each step, after beginning from 2.



Q40. Solution
Correct Answer: (C)

$H_2S + H_2O_2 \rightarrow S + 2H_2O$ In this reaction H_2O_2 shows oxidising nature.

Q41. Solution
Correct Answer: (D)

The appropriate answer to this question is 729.

As per the given information in the question, the terms of the given series are $3^3+1,\ 3^4-1,\ 3^5+1$.

So, next term$=3^6-1=729-1=728$.

Hence, 729 is the correct answer.

Q42. Solution
Correct Answer: (B)

Bidi smokers is a subset of smokers cancer patient may be a smoker, bidi smoker and non- smoker. Hence third object shares a common relationship with first and second object as well.

Q43. Solution
Correct Answer: (B)

Zinc blend (ZnS) is concentrated by froth flotation method. The method is generally used for sulphide ores. Froth flotation is a process that selectively separates materials based upon whether they are water-repelling (hydrophobic) or have an affinity for water (hydrophilic).

Q44. Solution
Correct Answer: (B)

The topmost figure is stationary and rest of the figure change their size and position (In the group of two figures A & B).

Q45. Solution
Correct Answer: (A)

$$\mathrm{PCl_2} \rightleftharpoons \mathrm{PCl_3} + \mathrm{Cl_2}$$

$$\rightleftharpoons \frac{2\times 40}{100}\ \frac{2\times 40}{100}\ \frac{2\times 60}{100}$$

Volume of container $= 2$ litre . $K_c = \frac{\frac{2\times 40}{100\times 2}\times\frac{2\times 40}{100\times 2}}{\frac{2\times 60}{100\times 2}} = 0.266$

Q46. Solution

Correct Answer: (D)

The logic is $32 \times 41 = (3-2)(4+1) = 15$; $51 \times 34 = (5-1)(3+4) = 47$ etc.
$\therefore 87 \times 53 = (8-7)(5+3) = 18$

Q47. Solution

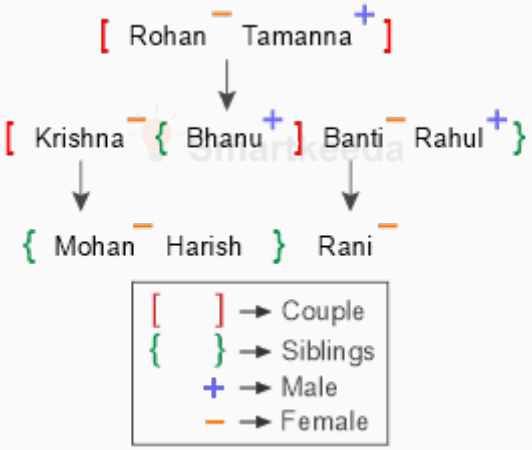
Correct Answer: (C)

If we can observe the statement given, except statement given in option C, all are definitely true.

Only the statement 'Harish is a nephew of Rahul' is possibly false since we are not aware of Harish's gender.

Option C is the correct answer.

Final image:



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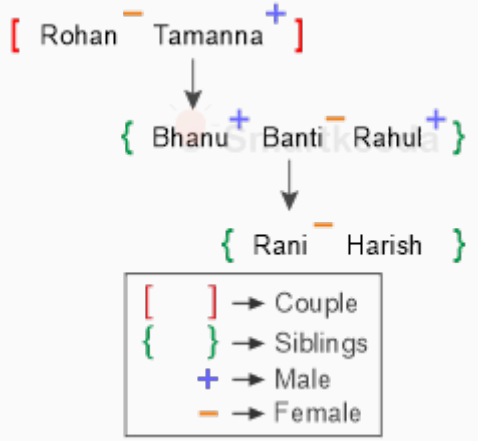

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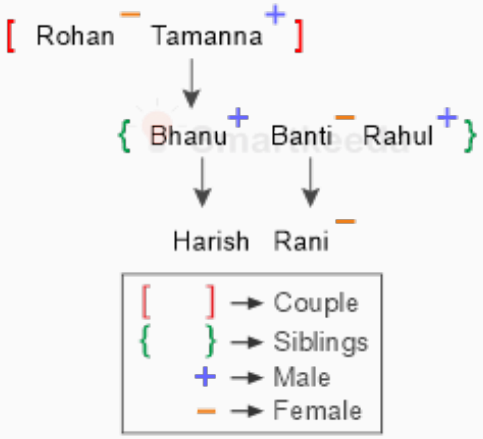

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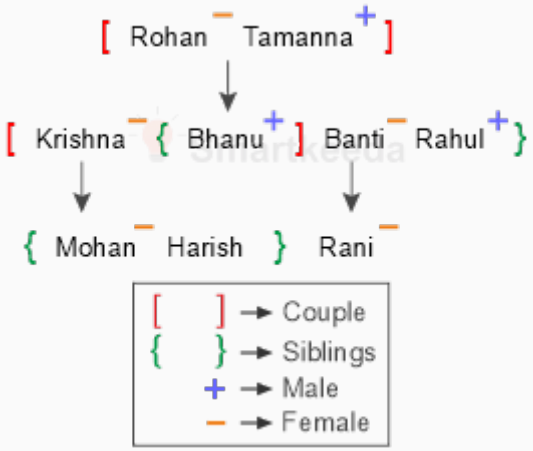
Krishna is the mother of Mohan, who is the only sister of Harish.

As Krishna is the mother of Mohan, who is the only sister of Harish. Thus Harish and Mohan are siblings.

So, Banti can't be mother of Harish, therefore case 1 fails.

Thus Harish is the daughter of Bhanu and Krishna is his wife.



Q48. Solution
Correct Answer: (A)

Position isomers differ in the position of the substituent atom or group or an unsaturated linkage in the same carbon chain. Thus, 2-pentanone and 3 -pentanone (option A) are the position isomers. They differ in the position of the carbonyl group. In Option B, C, and D all are functional isomers. Hence, the correct option is (A).

Q49. Solution
Correct Answer: (C)

By making the interchanges given in (1), we get equations as $2 - 5 + 3 = 4$ or $0 = 4$, which is false. By making the interchanges given in (2), we gets t equations as $3 - 2 + 5 = 4$ or $6 = 4$, which is false. By making the interchanges given in (3), we get t equations as $5 - 3 + 2 = 4$, which is true. So, the answer is (3)

Q50. Solution
Correct Answer: (B)

The order of the letters of the first group is reversed and the middle small letter replaced by a capital letter to obtain the second group.

Q51. Solution
Correct Answer: (D)

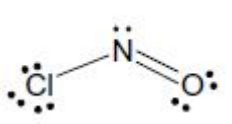
A The passage states that African American troops experienced segregation and other indignities while in the military; these experiences could reasonably be inferred to have dampened their enthusiasm for the armed forces. Regardless, the passage does not suggest an enthusiastic allegiance. B The passage describes African American people's enthusiasm about joining the military. Although they experienced segregation and other indignities while in the military, the passage does not suggest that their opinion about involvement in the war changed. C While African American troops may have joined political organizations, the passage does not provide any actual evidence of this having occurred. D Correct. The fact that, as the passage states, a revitalization movement occurred in the African American community following the First World War suggests that the returning soldiers did become aware of the gap between their expectations of an improved situation with regard to segregation and the reality of continued segregation in the United States.

Q52. Solution
Correct Answer: (A)

It is a simple comparison between dancers and actors and the word 'like' is appropriate. 'same as' is not used because the correct usuage will be 'the same as'.

Q53. Solution

Correct Answer: (A)



Q54. Solution

Correct Answer: (B)

Classical music today is in need of patronage. Earlier, its patrons were the maharajas. Classical musicians were honoured in the royal courts. They were given all the support necessary to let their art flourish.

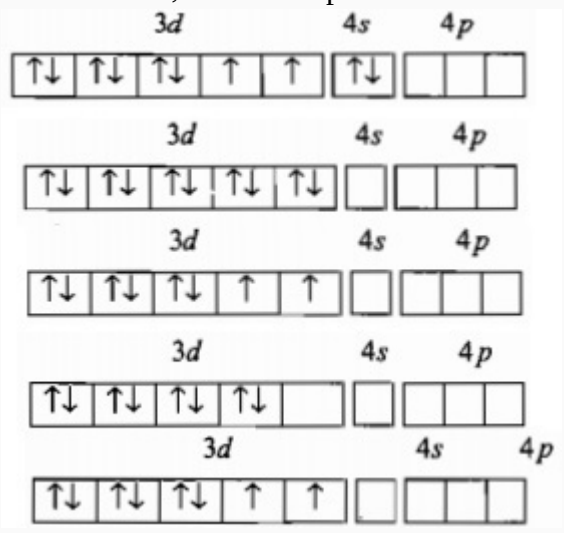
Q55. Solution

Correct Answer: (C)

$[\mathrm{Ni(CO)_4}]$ The oxidation number of Ni is O. Atomic number $= 28$ $\mathrm{Ni} = [\mathrm{Ar}]3\ \mathrm{d}^8 4\ \mathrm{s}^2$ sp^3-Hybridization (tetrahedral) There are no unpaired electrons, so the complex is diamagnetic. Spin magnetic moment $=$ zero

$[\mathrm{Ni(CN)_4}]^{2-}$ The oxidation number of Ni is $+2$. Atomic number $= 28$ $\begin{matrix}\mathrm{Ni} = [\mathrm{Ar}]3\ \mathrm{d}^8 4\ \mathrm{s}^2 \\ \mathrm{Ni}^{2+} = [\mathrm{Ar}]3\ \mathrm{d}^8\end{matrix}$ dsp^2-Hybridization (square planar) There are no unpaired electrons so, the complex is diamagnetic. Spin magnetic moment $=$ zero

$[\mathrm{NiCl_4}]^{2-}$ The oxidation number of Ni is $+2$. Atomic number $= 28$ $\begin{matrix}\mathrm{Ni} = [\mathrm{Ar}]3\ \mathrm{d}^8 4\ \mathrm{s}^2 \\ \mathrm{Ni}^{2+} = [\mathrm{Ar}]3\ \mathrm{d}^8\end{matrix}$ Chlorido is a weak field ligand, no pairing sp^3-Hybridization (tetrahedral) There are two unpaired electrons, so the complex is paramagnetic. Spin magnetic moment $\mu = \sqrt{\mathrm{n(n+2)}}\mathrm{BM}$ $= \sqrt{2(2+2)}\mathrm{BM} = \sqrt{8}\mathrm{BM}$



Q56. Solution

Correct Answer: (A)

Option (1) is logically follows sentence ' A ' because the cultural programme began with an invocation.

Q57. Solution

Correct Answer: (A)

Given equation of curve $y = x^2 - 5x + 6$

$\Rightarrow \frac{\mathrm{dy}}{\mathrm{dx}} = 2\mathrm{x} - 5$

Slope of tangent to the curve at $(2, 0)$ is

$\left(\frac{\mathrm{dy}}{\mathrm{dx}}\right)_{(2,0)} = 2(2) - 5 = -1 = \mathrm{m}_1$

Slope of tangent to the curve at $(3, 0)$ is

$\left(\frac{\mathrm{dy}}{\mathrm{dx}}\right)_{(3,0)} = 2(3) - 5 = 1 = \mathrm{m}_2$

Since $\mathrm{m}_1\ \mathrm{m}_2 = -1$

$\therefore$ Angle between the tangents to the curve at $(2, 0)$ and $(3, 0)$ is $\frac{\pi}{2}$

Q58. Solution

Correct Answer: (C)

Given $|f(x) - f(y)| \leq (x - y)^2$

$\lim\limits_{x \to y} \frac{f(x) - f(y)}{x - y} \leq \lim\limits_{x \to y} |x - y|$

$\Rightarrow\ f^{'}(x)\ \leq 0,\ \Rightarrow f'(\mathrm{x}) = 0$

($f^{'}(x)\ < 0$, not possible)

$\Rightarrow f(x) = k$ (by integration)

$\Rightarrow f(\mathrm{x}) = 0 \forall \mathrm{x} \in \mathrm{R} \quad [\because f(0) = 0]$

$\therefore f(1) = 0$

Q59. Solution

Correct Answer: (A)

Mohan can gets one prize, 2 prizes or 3 prizes and his chance of failure means he get no prize. Number of total ways $= {}^{12}C_3 = 220$ Favourable number of ways to be failure $= {}^{9}C_3 = 84$ Hence required probability $= 1 - \frac{84}{220} = \frac{34}{55}$.

Q60. Solution

Correct Answer: (C)

$\sin^2\alpha + \sin^2\beta + \sin^2\gamma$

$= \frac{\tan^2\alpha}{1+\tan^2\alpha} + \frac{\tan^2\beta}{1+\tan^2\beta} + \frac{\tan^2\gamma}{1+\tan^2\gamma}$

$= \frac{x}{1+x} + \frac{y}{1+y} + \frac{z}{1+z}$

$\left(x = \tan^2\alpha, y = \tan^2\beta, z = \tan^2\gamma\right)$

$= \frac{(x+y+z) + (xy+yz+zx+2xyz) + xy+yz+zx+xyz}{(1+x)(1+y)(1+z)}$

$= \frac{1+x+y+z+xy+yz+zx+xyz}{(1+x)(1+y)(1+z)} = 1$

$(\because xy + yz + zx + 2xyz = 1)$

Q61. Solution

Correct Answer: (D)

$\mathrm{Sr}\ (\mathrm{NO}_3)_2 \xrightarrow{\Delta} \mathrm{SrO} + \mathrm{NO}_2 + \mathrm{O}_2$

Q62. Solution

Correct Answer: (A)

In this complex iron is a central metal atom showing + 1 oxidation state.

$[Fe(H_2O)NO]SO_4$

Brown ring Complex

Q63. Solution

Correct Answer: (C)

Lysine is basic amino acid

Q64. Solution

Correct Answer: (B)

Oxygen is more electronegative than chlorine. With an increase in the number of O atoms attached to Cl, more electrons are pulled away from $O-H$ bond and more weaker becomes the $O-H$ bond. This increases the acid strength. The decreasing order of acidic strength is $HClO_4 > HClO_3 > HClO_2 > HClO$.

Q65. Solution

Correct Answer: (A)

Basic nature $= CaO > MgO > BeO > ZnO$ Solubility order $= LiOH < NaOH < KOH < RbOH$ Melting point order $NaCl > KCl > RbCl > LiCl$ $(I),\ (IV)$

Q66. Solution

Correct Answer: (A)

According to Graham's law of diffusion

$\text{Rate of diffusion (r)} \propto \frac{1}{\sqrt{d}}$

$\text{Molecular weight (M)} = 2 \times \text{vapour density}$

$\frac{r_1}{r_2} = \sqrt{\frac{V.D_2}{V.D_1}}$

$M_A = \left(\frac{100}{2}\right)$

$M_B = \left(\frac{64}{2}\right)$

$r_A = 12 \times 10^{-3}$ and $r_B = ?$

$\frac{r_A}{r_B} = \sqrt{\frac{d_B}{d_A}} = \sqrt{\frac{V.D_B}{V.D_A}}$

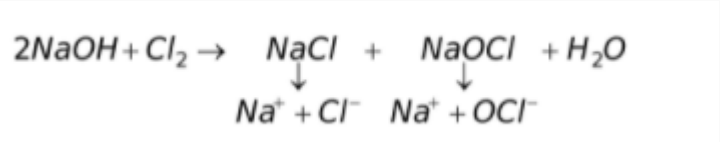
$\frac{12\times10^{-3}}{r_B} = \sqrt{\frac{64/2}{100/2}} = \sqrt{\frac{64}{100}} = \frac{8}{10}$

$r_B = \frac{12\times10^{-3}\times10}{8}$

$= 15 \times 10^{-3}$

Q67. Solution

Correct Answer: (A)



Q68. Solution

Correct Answer: (A)

The size of colloidal particles is of the order $0.1\ \mathrm{m}\mu$ to $0.001\ \mathrm{m}\mu$.

Q69. Solution

Correct Answer: (B)

$V_1 = 10\ \mathrm{m}^3 = 10 \times 10^3 \mathrm{dm}^3$ $T = 300K, W = -5.187\ \mathrm{kJ} = -5187\ \mathrm{J}$ $W = -2.303\mathrm{nRT}\log\frac{V_2}{V_1}$

$V_2 = 20\ \mathrm{m}^3 = 20 \times 10^3 \mathrm{dm}^3$

$\therefore -5187 = -2.303 \times n \times 8.314 \times 300 \times \log_{10}\frac{20\times10^3}{10\times10^3}$ $\therefore n = \frac{5187}{2.303\times8.314\times300\times0.301}$ $\therefore n = 3$ moles

Q70. Solution

Correct Answer: (B)

For face centred cubic structure, the closest approach between two atoms in metallic crystal will be equal to one half the length of the face diagonal. It will be

$\frac{1}{2} \times \mathrm{length\ \ of\ \ face\ \ diagonal}.....(1)$

But the length of a face diagonal $= \sqrt{2}\mathrm{a}.....(2)$

Here, a is the edge of its unit cell.

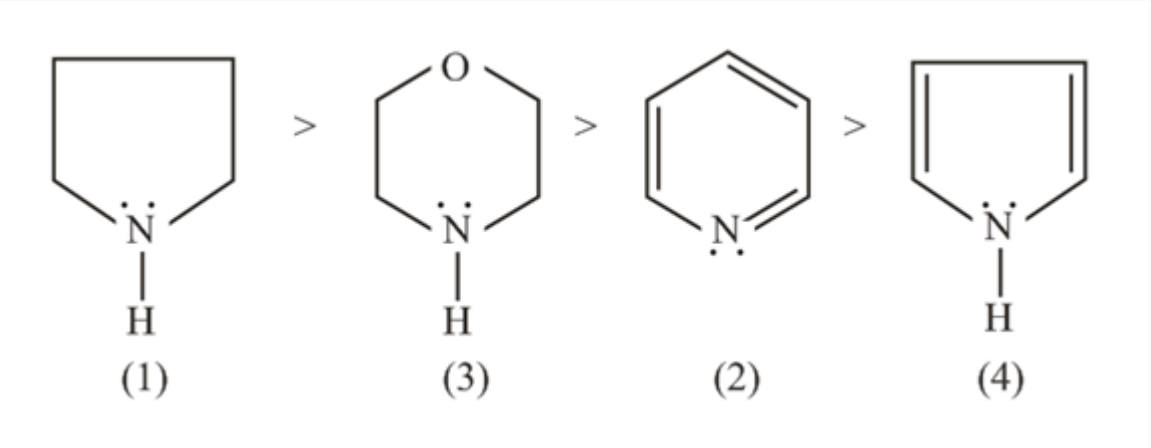
From (1) and (2), the closest approach between two atoms in metallic crystal will be

$(2\mathrm{R}) = \frac{\sqrt{2}\mathrm{a}}{2} = \frac{\mathrm{a}}{\sqrt{2}}$.

Q71. Solution

Correct Answer: (D)

Basicity decreases as in the following order 1 > 3 > 2 > 4.



Here (1) is more basic than (3) as in (3) oxygen atom is electron withdrawing. (2) is more basic than (4) as in (4) lone pair is delocalized. (3) and (4) are less basic than (1) and (2) due to more s%.

Q72. Solution

Correct Answer: (A)

$$\frac{\alpha_1}{\alpha_2} = \sqrt{\frac{k_{a_1}}{k_{a_2}}}$$

$$\frac{1}{2} = \sqrt{\frac{2\times10^{-4}}{k_{a_2}}}$$

$$\frac{1}{4} = \frac{2\times10^{-4}}{k_{a_2}}$$

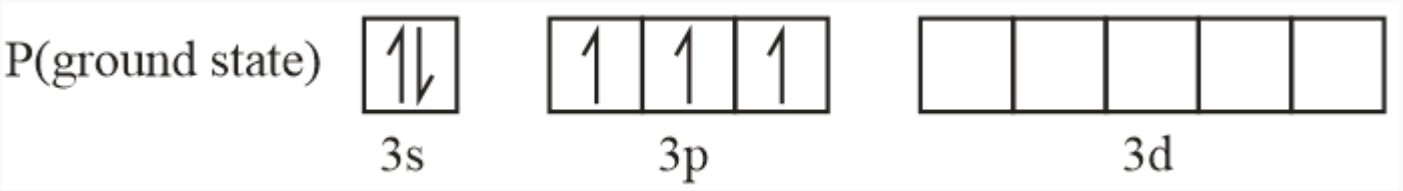
$$k_{a_2} = 8 \times 10^{-4}$$

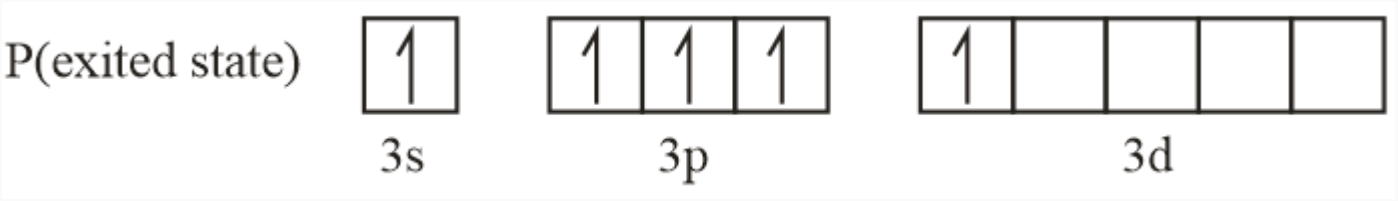
Q73. Solution

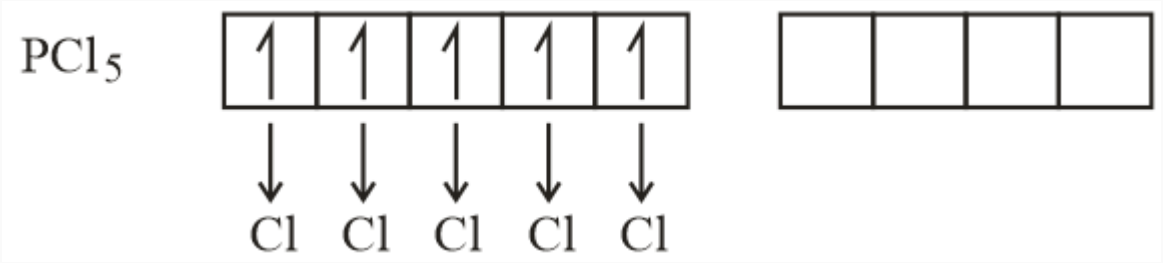
Correct Answer: (A)

$_{7}\mathrm{N} = 1\mathrm{s}^2 2\mathrm{s}^2 2\mathrm{p}^3$ $_{15}\mathrm{P} = 1\mathrm{s}^2 2\mathrm{s}^2 2\mathrm{p}^6 3\mathrm{s}^2 3\mathrm{p}^3 3\mathrm{d}^0$

In phosphorous, the $3\mathrm{d}-$orbitals are available for the hybridisation.







Hence, the phosphorus can form pentahalides also, but the nitrogen cannot form pentahalides since there are no $\mathrm{d}-$orbitals for the hybridisation.

Q74. Solution

Correct Answer: (B)

$\mathrm{Fe}_2(\mathrm{SO}_4)_3 \rightarrow \mathrm{Fe}^{3+} - [\mathrm{Ar}]3\ \mathrm{d}^5 - 5$ electrons are unpaired. So, Fe will be attracted in the magnetic field so it will show an increase in weight.

Q75. Solution

Correct Answer: (D)

Consider pair of numbers $\begin{array}{l}(1,1)=\left(1,1^3\right)\\(2,4)=\left(2,2^2\right)\\(3,27)=\left(3,3^3\right)\\(4,16)=\left(4,4^2\right)\end{array}$ Next number will be 5.

Q76. Solution

Correct Answer: (C)

The words are jumbled. The actual words are ROSE, LOTUS, ORANGE, JASMINE and LILLY. All, except ORANGE, are flowers whereas ORANGE is a fruit.

Q77. Solution

Correct Answer: (A)

From the relationship given in the question, we observe that each of the objects carries something in common to one another. A Tennis fan can be a cricket player as well as student. Hence Diagram (1) represents this relationship.

Q78. Solution

Correct Answer: (B)

There are two alternate sequences in which a larger circle is added at each stage.

Q79. Solution

Correct Answer: (B)

The triangle folds into the hexagon and changes from white to black.

Q80. Solution

Correct Answer: (C)

The figure is replaced by a figure with two sides move and the new figure is shaded. Similar relationship of (C) is thus figure (3)

Q81. Solution

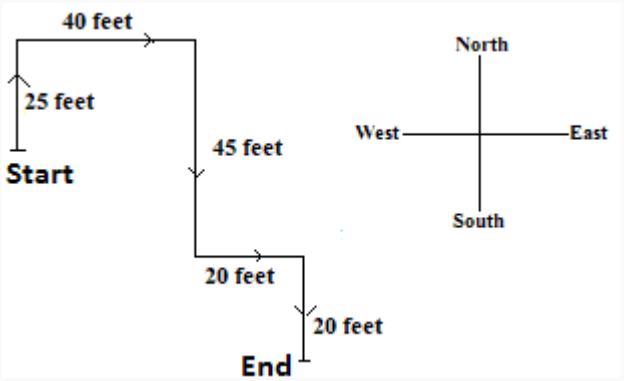
Correct Answer: (A)

Since the total number of dots on opposite faces is always 7, therefore 1 dot must lie opposite 6 dots, 2 dots must lie opposite 5 dots and 3 dots must lie opposite 4 dots. In the figures (2) and (4), 2 dots appear adjacent to 5 dots, and in fig. (3), 3 dots appear adjacent to 4 dots. Hence, figures are incorrect. Therefore, only fig. (1) is correct.

Q82. Solution

Correct Answer: (D)

The child started walking 25 Feet in the north direction. Let's understand this problem with the help of pictorial representation as shown here by tracing his complete path as per the information given in the question.



Clearly, with respect to the starting point, the child is in a South-East direction.

Q83. Solution

Correct Answer: (A)

When the sheet shown in fig.(X) is folded to from a box (cuboid), then the two rectangular-shaded faces lie opposite to each other, the two rectangular white faces lie opposite to each other and the two square shaped faces (one shaded and one white) lie opposite to each other. Clearly, the cuboids shown in fig. (2) and (4) cannot be formed as in each of the two cuboids the two shaded rectangular faces appear adjacent to each other. So, only the cuboids in figures (1) and (3) can be formed.

Q84. Solution

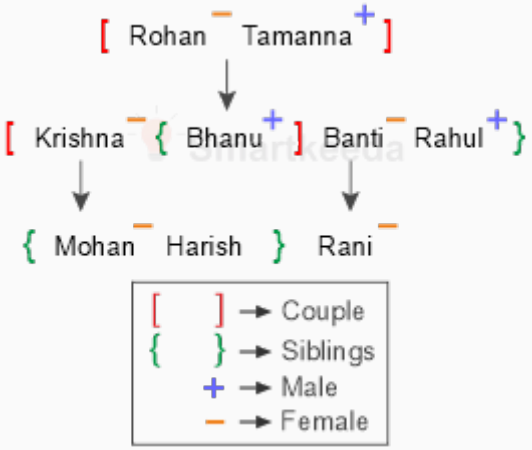
Correct Answer: (C)

From common explanation, we have

Clearly, Krishna is the wife of Bhanu who is brother in law of Sanjay.

Hence, option C is the correct answer.

Final image:



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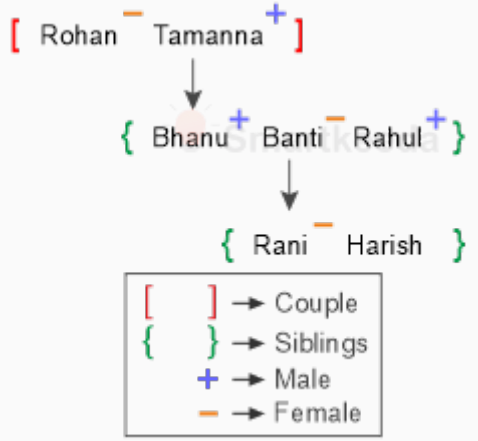

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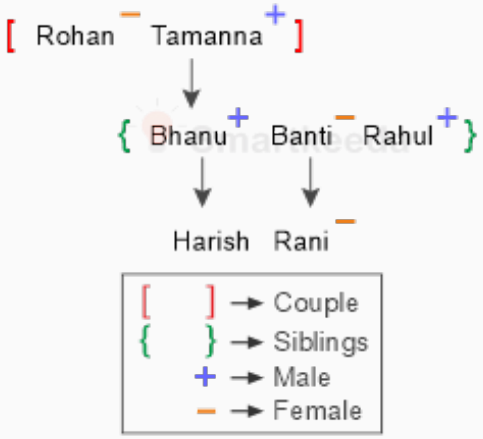

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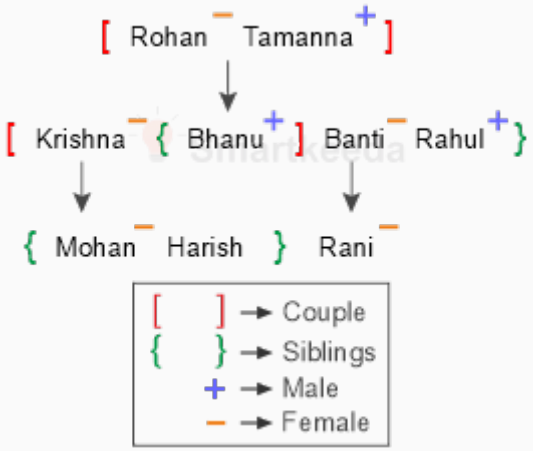


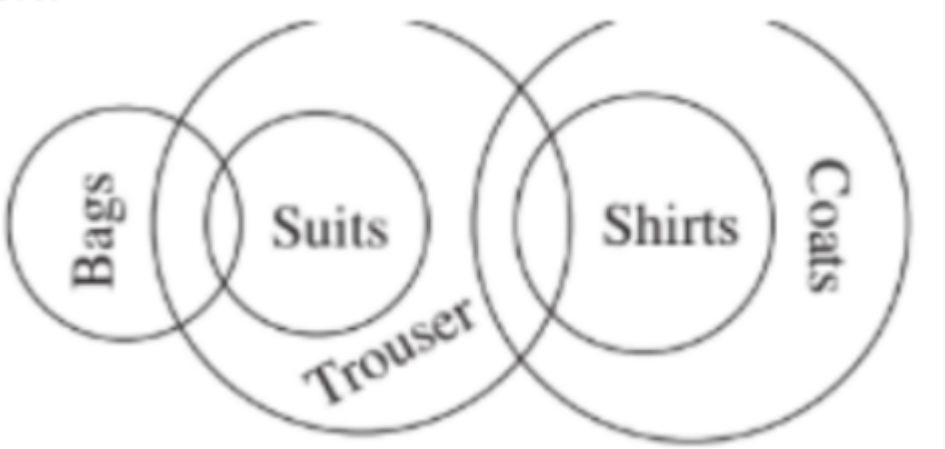
Q85. Solution

Correct Answer: (A)

There cannot be a subject in the first part of the sentence as the same subject is given on the second part so (3) and (4) are eliminated. To study is the infinitive verb which will not be used here, because it suggests the action which is the affect and not the cause. e.g. 'To gain something you have to lose something else'. By studying is the right answer because this gives the cause for the verb in the latter part of the sentence.

Q86. Solution

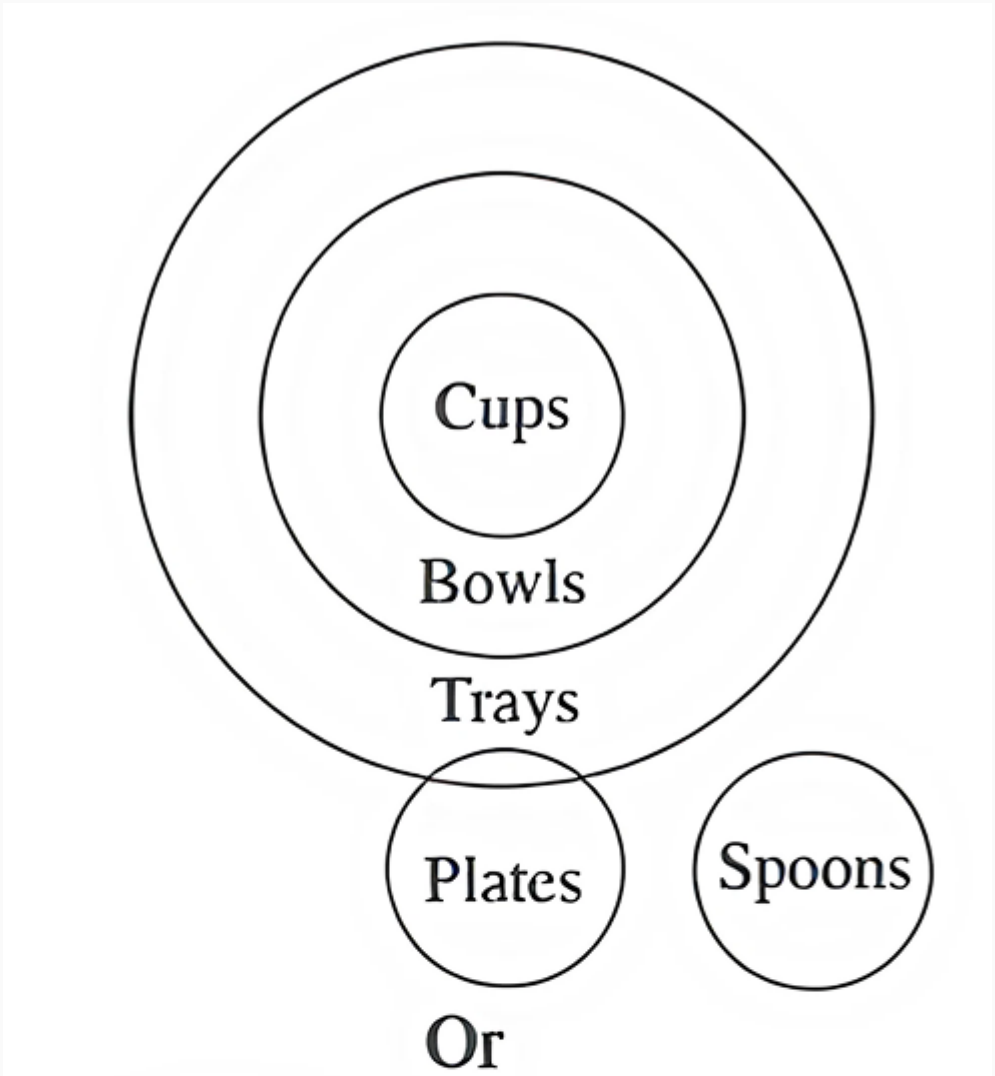
Correct Answer: (A)



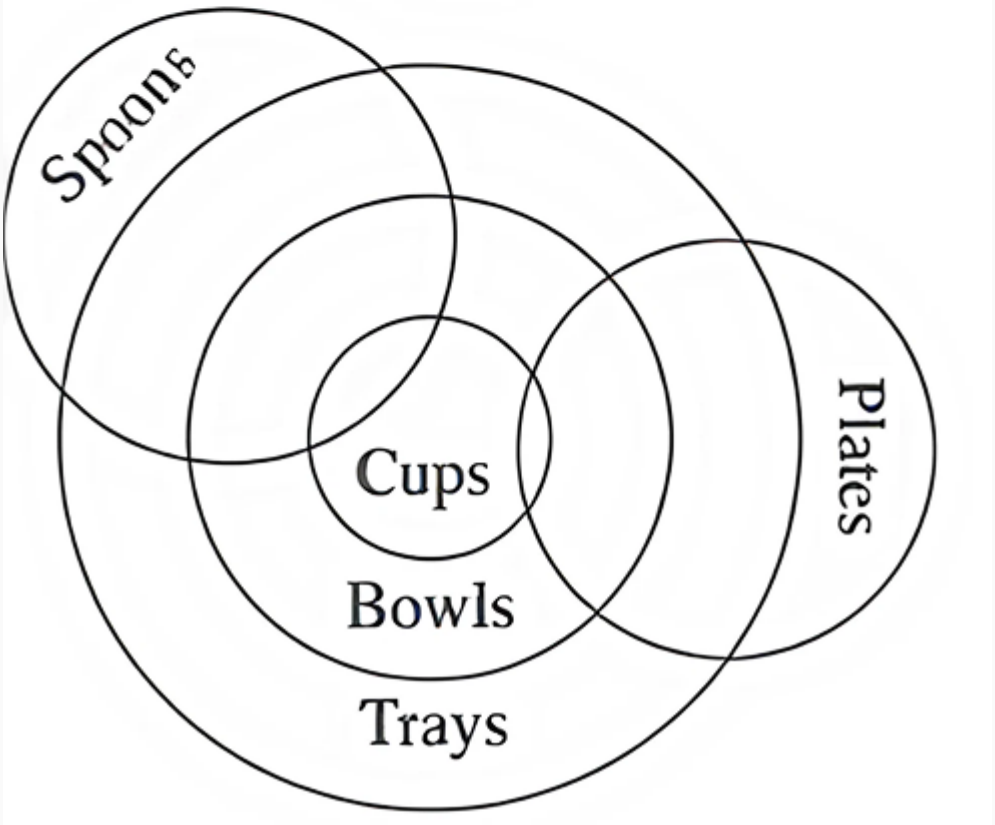
Only I and II follow

Q87. Solution

Correct Answer: (C)



Or



Only II and III follow

Q88. Solution
Correct Answer: (C)

To answer this question, find what the passage states explicitly about how Marcus Garvey achieved his success. The passage begins by stating that Garvey arrived at the right time: that returning African American soldiers were primed to receive what he had to say about the African American community. These soldiers already held strong beliefs about their rights to opportunities for success; the passage concludes that the divide between the soldiers' expectations and their experiences led to Garvey's success. A The passage states that African American people were in possession of a strong cultural and historical consciousness prior to Garvey's arrival in the United States. B The passage attributes belief in the traditional American success ethos to African American people who joined the armed forces; it does not mention Garvey's beliefs on this subject. C Correct. African American soldiers who had experienced segregation during the First World War were ready to hear what Garvey had to say. D Critics of African American support for United States involvement in the First World War are not mentioned in the passage.

Q89. Solution
Correct Answer: (C)

Verbose means using or containing more words than are needed, ambiguous means having more than one meaning.

Q90. Solution
Correct Answer: (B)

Sumptuous means sufficient or more in quantity meagre means very little.

Q91. Solution
Correct Answer: (C)

What do you do if your mom asks you to have a meal just when you are planning to go out? You hastily finish your meal and run away. That is, you do not devote much time to it. Now, imagine a dinner-table full of guests. You can't hurry. Everyone goes at an easy pace. In other words, you leisurely have the dinner.

Q92. Solution
Correct Answer: (B)

'Are' is a verb that is referred to address more than one places/people. 'Is' is a verb that is used to refer a single person/place. Therefore, correct answer in the current sentence should be 'Sri Lanka is' because Sri Lanka is a single country and not a combination of countries. The rest of the options are grammatically correct.

Q93. Solution

Correct Answer: (A)

Given,

$\log_e\left(\frac{dy}{dx}\right) = 3x + 4y$

$\Rightarrow \frac{dy}{dx} = e^{3x} \cdot e^{4y}$

$\Rightarrow \int e^{-4y} dy = \int e^{3x} dx$

$\Rightarrow \frac{\mathrm{e}^{-4\mathrm{y}}}{-4} = \frac{\mathrm{e}^{3\mathrm{x}}}{3} + \mathrm{C}$

Given,

$y(0) = 0$

So,

$-\frac{1}{4} - \frac{1}{3} = \mathrm{C} \Rightarrow \mathrm{C} = -\frac{7}{12}$

So, the particular solution is

$\frac{e^{-4y}}{-4} = \frac{e^{3x}}{3} - \frac{7}{12}$

$\Rightarrow e^{-4y} = \frac{4e^{3x} - 7}{-3}$

$\Rightarrow \mathrm{e}^{4\mathrm{y}} = \frac{3}{7 - 4\mathrm{e}^{3\mathrm{x}}} \Rightarrow 4\mathrm{y} = \ln\left(\frac{3}{7 - 4\mathrm{e}^{3\mathrm{x}}}\right)$

$4\mathrm{y} = \ell\mathrm{n}\left(\frac{3}{6}\right)$ when $\mathrm{x} = -\frac{2}{3}\ell\mathrm{n}2$

$\Rightarrow \mathrm{y} = \frac{1}{4}\ell\mathrm{n}\left(\frac{1}{2}\right)$

$\Rightarrow y = -\frac{1}{4}\ell\mathrm{n}2$

So, $\alpha = -\frac{1}{4}$

Q94. Solution

Correct Answer: (A)

$4^{1/3} \cdot 4^{1/9} \cdot 4^{1/27} \ldots\ldots \infty$

$\therefore S = 4^{1/3 + 1/9 + 1/27} \ldots . \infty$

$\Rightarrow S = 4^{\left(\frac{1/3}{1 - 1/3}\right)} = 4^{\frac{1/3}{2/3}} \Rightarrow S = 4^{1/2} \Rightarrow S = 2$

Q95. Solution

Correct Answer: (B)

$$|z_1+z_2|^2=|z_1|^2+|z_2|^2+2\,\mathrm{Re}\,(z_1\bar{z}_2)$$

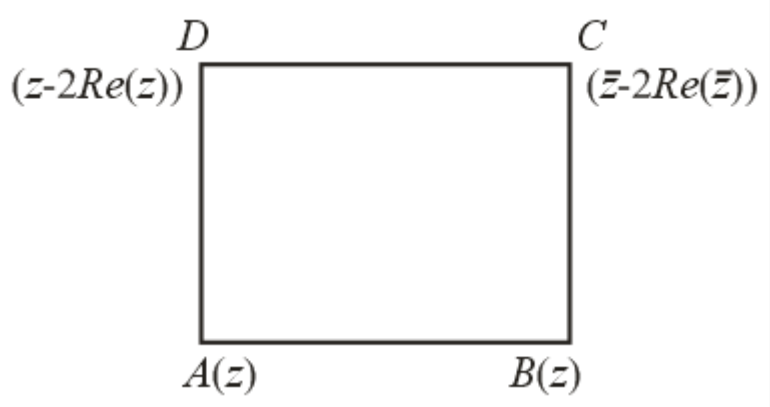
We know, $|z_1-z_2|^2=|z_1|^2+|z_2|^2-2\,\mathrm{Re}\,(z_1\bar{z}_2)$

$$\Rightarrow |z_1+z_2|^2+|z_1-z_2|^2=2\left(|z_1|^2+|z_2|^2\right)$$

Q96. Solution

Correct Answer: (C)

Let $z=x+iy$



$\therefore$ length of side $=4$

then $|z-\bar{z}|=4$

$|2iy|=4$

$|y|=2$

also $|z-(z-2\ \mathrm{Re}\ (z))|=4$

$|2x|=4\Rightarrow|x|=2$

$|z|=\sqrt{x^2+y^2}=2\sqrt{2}$

Q97. Solution

Correct Answer: (C)

The given circle is $x^2+y^2-2x=0$. Let (x_1,y_1) be the middle point of any chord of this circle, than its equation is $S_1=T$. or $x_1^2+y_1^2-2x_1=xx_1+yy_1-(x+x_1)$ If it passes through $(0,0)$, then $x_1^2+y_1^2-2x_1=-x_1\Rightarrow x_1^2+y_1^2-x_1=0$ Hence the required locus of the given point (x_1,y_1) is $x^2+y^2-x=0$.

Q98. Solution

Correct Answer: (A)

We have, $\frac{x^2}{9}+\frac{y^2}{5}=1$

$\Rightarrow \quad a=3$ and $b=\sqrt{5}$

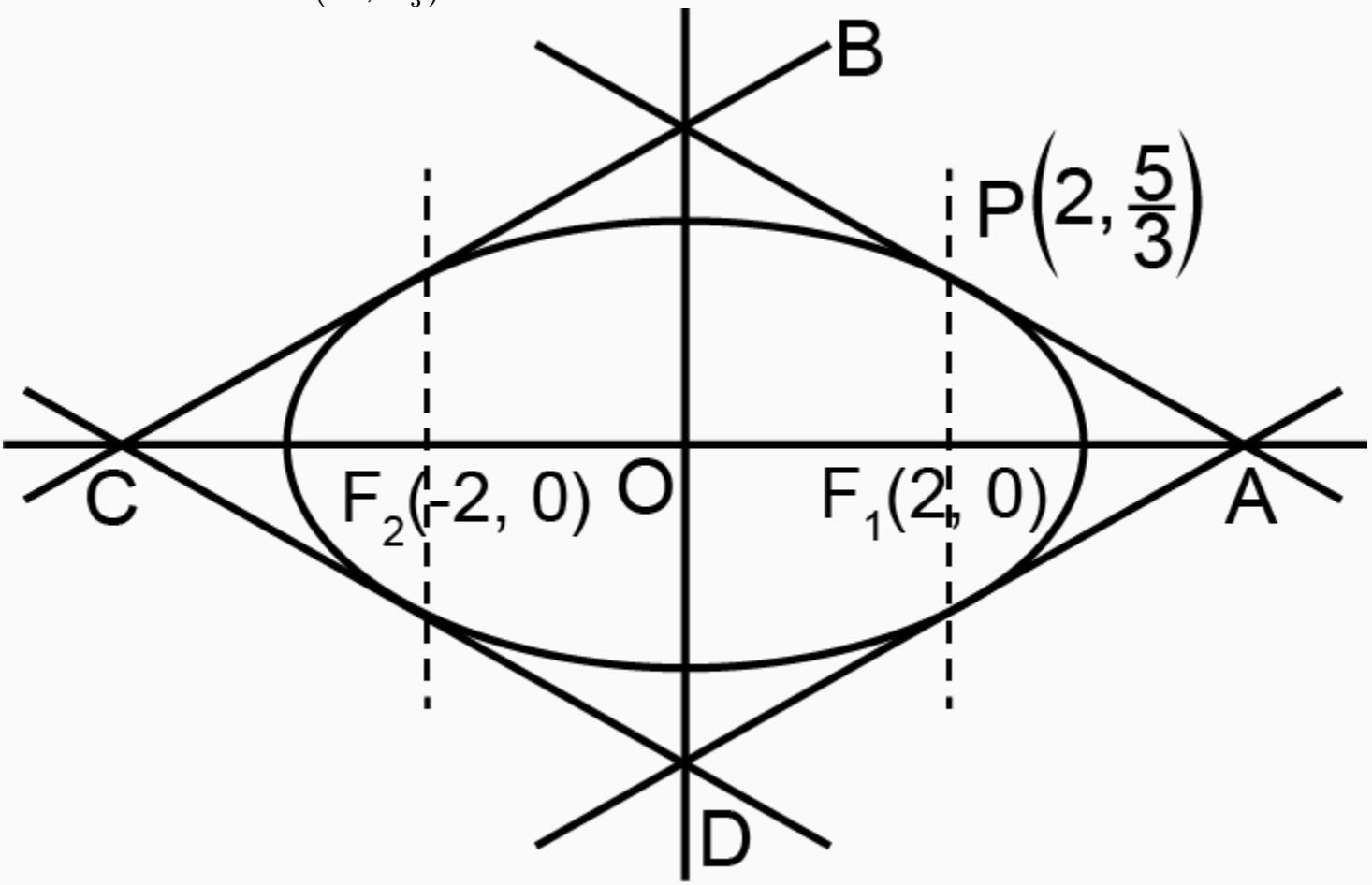
$\therefore \quad e=\sqrt{1-\frac{b^2}{a^2}}$

$=\sqrt{1-\frac{5}{9}}=\frac{2}{3}$

$\therefore$ Foci $=(\pm ae, 0)$

$=\left(\pm 3 \times \frac{2}{3}, 0\right)=(\pm 2, 0)$

$\therefore$ Ends of latusrectum $=\left(\pm 2, \pm \frac{5}{3}\right)$



Equation of tangent at the end of latusrectum P is

$\frac{x \times 2}{9}+\frac{y \times 5/3}{5}=1$

$\frac{2}{9}x+\frac{1}{3}y=1$

$2x+3y=9$

$OA=\frac{9}{2}$ and $OB=3$

$\therefore$ Area of quadrilateral $ABCD$

$=4 \times$ Area of ΔOAB

$=4 \times \frac{1}{2} \times OA \times OB$

$=4 \times \frac{1}{2} \times \frac{9}{2} \times 3$

$=27$sq units.

Q99. Solution

Correct Answer: (C)

$$\lim_{x\to 0} 2\sin a \cdot \frac{(\cos x-1)}{x\sin x} = -2\sin a \cdot \frac{(1-\cos x)}{x^2}\cdot\left(\frac{x}{\sin x}\right)$$

$$= \lim_{x\to 0} -2\sin a \cdot \frac{2\sin^2(x/2)}{4\left(\frac{x}{2}\right)^2\left(\frac{\sin x}{x}\right)} = -\sin a$$

Q100. Solution

Correct Answer: (A)

$\sin^3 x\cos x + \sin^2 x\cos^2 x + \sin x\cos^3 x = 1$

$\Rightarrow \sin x\cos x\left(\sin^2 x + \sin x\cos x + \cos^2 x\right) = 1$

$\Rightarrow \frac{\sin 2x}{2}\left(1+\frac{\sin 2x}{2}\right) = 1$

$\Rightarrow \sin 2x(2+\sin\ 2x) = 4$

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

$\Rightarrow \sin 2x = \frac{-2\pm\sqrt{4+16}}{2}$

$\Rightarrow \sin 2x = -1\pm\sqrt{5}$

This is not possible. $(\text{Since } -1\le\sin 2x\le 1)$

Hence the given equation has no solution.

Q101. Solution

Correct Answer: (C)

We know that, the equation of normal to parabola $y^2 = -4ax$ is

$y = mx + 2am + am^3 \quad \ldots (1)$

For the parabola $y^2 = -8x$, $a = 2$.

Given the equation of normal is

$2x + y + k = 0$,

$\Rightarrow y = -2x - k \quad \ldots (2)$

On comparing Equations (1) and (2), we get

$m = -2$ and $-k = 2am + am^3$

$\Rightarrow -k = 2(2)(-2) + 2(-2)^3$

$\Rightarrow -k = -8 - 16$

$\therefore\ k = 24$

Q102. Solution

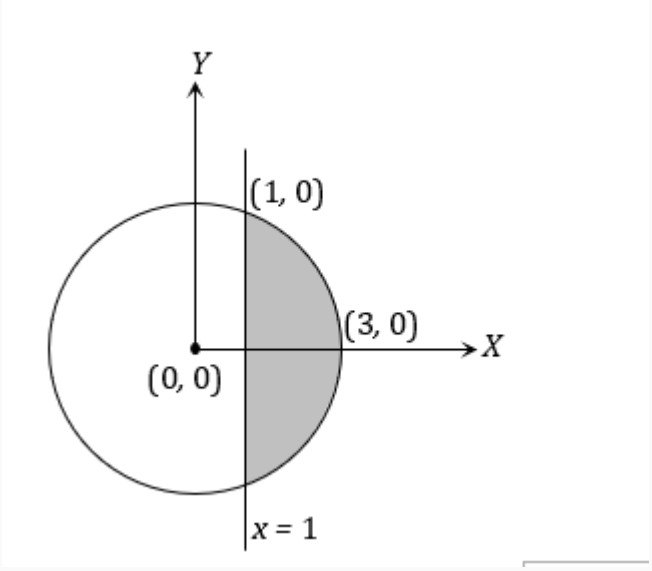
Correct Answer: (B)

Area of smaller part $I = 2\int_1^3 \sqrt{9 - x^2}dx$

$= 2 \cdot \frac{1}{2}\left[x\sqrt{9 - x^2} + 9\sin^{-1}\frac{x}{3}\right]_1^3 = \left[9\frac{\pi}{2} - \sqrt{8} - 9\sin^{-1}\left(\frac{1}{3}\right)\right]$

$= \left[9\left(\frac{\pi}{2} - \sin^{-1}\left(\frac{1}{3}\right)\right) - \sqrt{8}\right] = \left[9\cos^{-1}\left(\frac{1}{3}\right) - \sqrt{8}\right]$

$= \left[9\sec^{-1}(3) - \sqrt{8}\right].$



Q103. Solution

Correct Answer: (C)

The coefficient of the middle term in power of $x(1+\alpha x)^4 = {}^4C_2\alpha^2$

The coefficient of the middle term in power of $x(1-\alpha x)^6 = {}^6C_3(-\alpha)^3$

$$\begin{aligned} & & {}^4C_2\alpha^2 &= {}^6C_3(-\alpha)^3 \\ & \Rightarrow & \tfrac{4!}{2!2!}\alpha^2 &= -\tfrac{6!}{3!3!}\alpha^3 \\ \text{According to given condition, } & \Rightarrow & 6\alpha^2 &= -20\alpha^3 \\ & \Rightarrow & \alpha &= -\tfrac{6}{20} \\ & \therefore & \alpha &= -\tfrac{3}{10} \end{aligned}$$

Q104. Solution

Correct Answer: (C)

For non-trivial solution, We have, $\begin{vmatrix} 1 & 4a & a \\ 1 & 3b & b \\ 1 & 2c & c \end{vmatrix} = 0$

$\Rightarrow \quad 1(3bc-2bc)-(4ac-2ac)+1(4ab-3ab)=0$

$\Rightarrow bc-2ac+ab=0$

$\Rightarrow bc+ab=2ac$

$\Rightarrow b(a+c)=2ac$

$\Rightarrow b=\frac{2ac}{a+c}$

$\Rightarrow a, b, c$ are in HP

Q105. Solution

Correct Answer: (A)

$g(x)=\int_0^x \cos^4 t \, \mathrm{d}t$

$\Rightarrow g(x+\pi)=\int_0^{x+\pi}\cos^4 t\,\mathrm{d}t=\int_0^x \cos^4 t\,\mathrm{d}t+\int_x^{x+\pi}\cos^4 t\,\mathrm{d}t$

$=g(x)+\int_x^{x+\pi}\cos^4 t\,\mathrm{d}t$ [as $\cos^4 t$ is a periodic function with period π]

$=g(x)+\int_0^{\pi}\cos^4 t\,\mathrm{d}t$

$=g(x)+g(\pi)$

Q106. Solution

Correct Answer: (B)

$$(f \circ f)(x) = \frac{a - \frac{a-x}{a+x}}{a + \frac{a-x}{a+x}} = x$$

$$\Rightarrow \frac{a^2 + ax - a + x}{a^2 + ax + a - x} = x$$

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

$$\Rightarrow a + 1 = a^2 + a, a^2 - a = 0, a - 1 = 0$$

$$\Rightarrow a = 1$$

$$\Rightarrow f(x) = \frac{1-x}{1+x}$$

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

Q107. Solution

Correct Answer: (A)

At yz plane $x-$coordinate of any point is zero.

So, let the ratio is $\lambda : 1$.

The $x-$coordinate of the point is $\lambda(-2) + 1 \times 3 = 0, \quad \Rightarrow \ \lambda = \frac{3}{2}$

Ratio $= \frac{3}{2}$

$\therefore$ Required co-ordinates of the points are,

$\left[\frac{6-6}{5}, \frac{10+3}{5}, \frac{-14+24}{5}\right] = \left(0, \frac{13}{5}, \ 2\right).$

Q108. Solution

Correct Answer: (A)

$$\bar{b} \times \bar{d} = \begin{matrix} \hat{i} & \hat{j} & \hat{k} \\ 2 & 0 & 3 \\ 1 & -1 & 0 \end{matrix} = \hat{i}(3) - \hat{j}(0-3) + \hat{k}(-2)$$

$$\bar{b} \times \bar{d} = 3\hat{i} + 3\hat{j} - 2\hat{k}$$

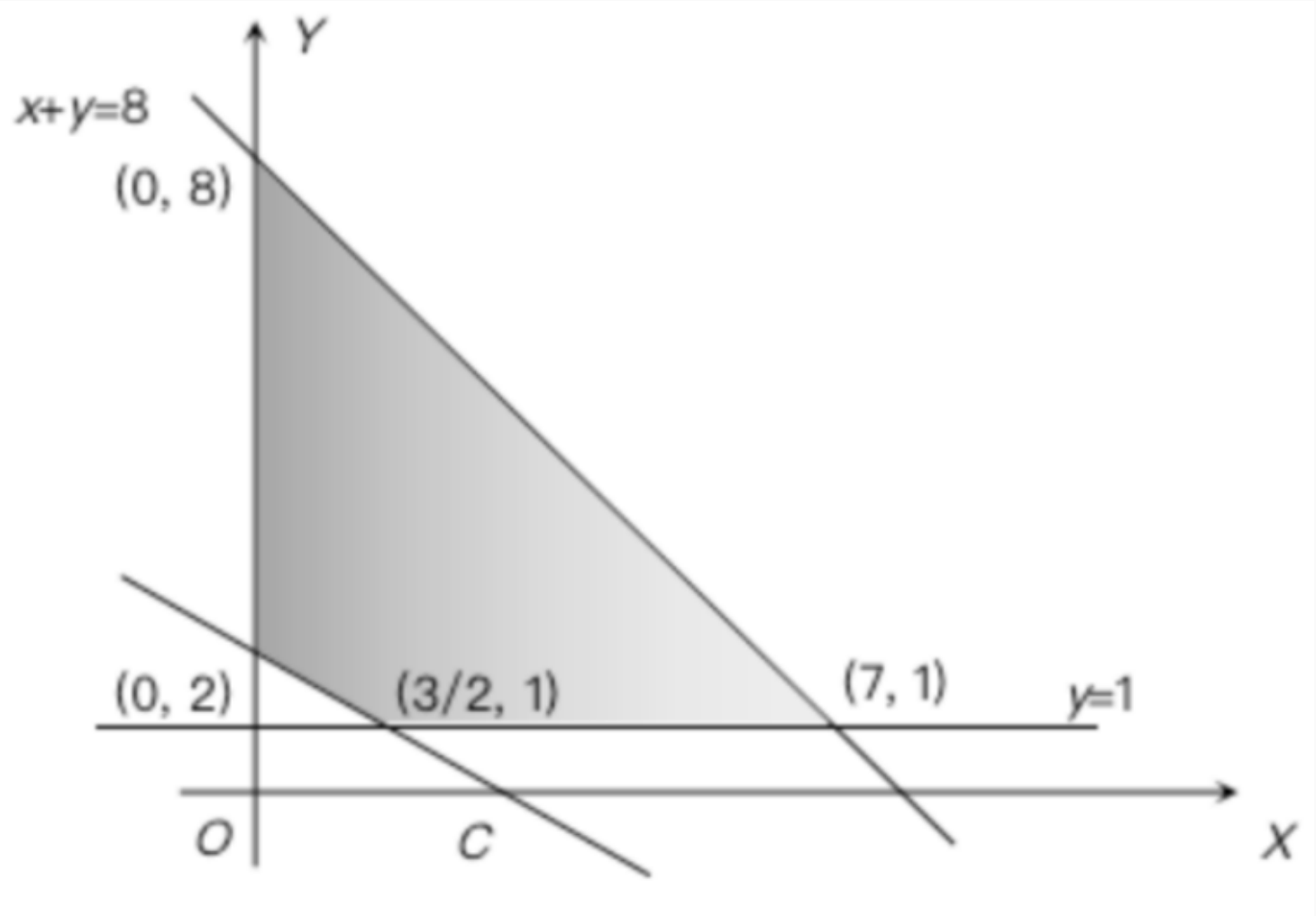
and $\bar{c} - \bar{a} = 3\hat{i} - \hat{j} - 3\hat{k}$

then $(\bar{c} - \bar{a}) \cdot (\bar{b} \times \bar{d}) = 3(3) + (-1)(3) + (-3)(-2)$

$= 9 - 3 + 6 = 12$

Q109. Solution

Correct Answer: (B)



Obviously, at $\left(\frac{3}{2}, 1\right)$ and $(0, 2)$, Min $z = 4x + 6y = 12$.

Q110. Solution

Correct Answer: (C)

We have A = {10, 11, 12, 14, 26} and

f : A → n, where f(a) = Highest prime factor of a, when a ∈ A.

Now $10 = 2 \times 5 \Rightarrow$ Highest prime factor is 5

$11 = 1 \times 11 \Rightarrow$ Highest prime factor is 11

$12 = 2 \times 2 \times 3 \Rightarrow$ Highest prime factor is 3

$14 = 2 \times 7 \Rightarrow$ Highest prime factor is 7

$26 = 2 \times 13 \Rightarrow$ Highest prime factor is 13

$\therefore$ f = {3, 5, 7, 11, 13}

Q111. Solution

Correct Answer: (A)

Number of ways = coefficient of x^{15} in the expansion

$\left(1+x+x^2+x^3+x^4+x^5\right)\left(1+x+x^2+\ldots\ldots+x^{10}\right)\left(1+x+x^2+\ldots\ldots+x^{15}\right)$

$\left(1+x+x^2+x^3+x^4+x^5\right)\left(1+x+x^2+\ldots\ldots+x^{10}\right)$

$\left(1+x+x^2+\ldots+x^{15}\right)=\left(1-x^6-x^{11}\right)\left(1+{}^3C_1x+{}^4C_2x^2\right.$

$\left.+\ldots\ldots+{}^6C_4x^4+{}^{11}C_9x^9+{}^{17}C_{15}x^{15}+\ldots\ldots\ldots\ldots\right)$

$=\ldots\ldots\ldots+\ldots\ldots\ldots+x^{15}\left(-{}^{11}C_9-{}^6C_4+{}^{17}C_{15}\right)$

$=\ldots\ldots\ldots+\ldots\ldots+x^{15}(-55-15+136)=x^{15}\times 66$

Q112. Solution

Correct Answer: (D)

We have,

$P(A \cap B) \leq \min\{P(A), P(B)\}$

$= \min\{0 \cdot 65, 0 \cdot 80\} = 0 \cdot 65$

$\Rightarrow P(A \cap B) \leq 0 \cdot 65.$

Also,

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

$\geq 0 \cdot 65 + 0 \cdot 80 - 1 = 0 \cdot 45$

$\therefore\ 0 \cdot 45 \leq P(A \cap B) \leq 0 \cdot 65.$

Q113. 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 $n_2 = 100 - n_1$

$$500 = \frac{510n_1 + (100 - n_1)460}{100}$$
$$\Rightarrow 50000 = 510n_1 + 46000 - 460n_1$$
$$\Rightarrow 50000 - 46000 = 50n_1$$
$$\Rightarrow 4000 = 50n_1$$
$$\Rightarrow n_1 = \frac{4000}{50} = 80.$$

Q114. 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,

$$2yy_1 = 4a, y^2 = 2yy_1\left(x + \frac{yy_1}{2}\right)$$
$$y = 2xy_1 + yy_1^2 \Rightarrow y\left(\frac{dy}{dx}\right)^2 + 2x\frac{dy}{dx} = y.$$

Q115. Solution

Correct Answer: (B)

Given, $2f(x) + f(1-x) = x^2$

Replacing x by $(1-x)$, we get

$2f(1-x) + f(x) = (1-x)^2 \Rightarrow \quad 2f(1-x) + f(x) = 1 + x^2 - 2x$ Multiplying Eq. (i) by 2 and subtracting Eq. (ii) from Eq. (i), we get

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

Eq. (i), we get

Q116. Solution

Correct Answer: (A)

$I = \int \frac{bx\cos 4x - a\sin 4x}{x^2} dx$

By integration by parts

$= (bx\cos 4x - a\sin 4x) \times \left(-\frac{1}{x}\right) + \int \frac{b\cos 4x - 4bx\sin 4x - 4a\cos 4x}{x} dx + k$

$= -\frac{bx\cos 4x - a\sin 4x}{x} + \int \left[\left(\frac{b-4a}{x}\right)\cos 4x - 4b\sin 4x\right] dx + k$

$= -b\cos 4x + \frac{a\sin 4x}{x} + b\cos 4x + \int \left(\frac{b-4a}{x}\right)\cos 4x dx + c$

Given,

$I = \frac{a\sin 4x}{x} + c$

By comparing we can say, $b - 4a = 0 \Rightarrow b = 4a$

Hence, we can write $a = 1$ & $b = 4$

Q117. Solution

Correct Answer: (B)

Given series is $\frac{4}{3} + \frac{10}{9} + \frac{28}{27} + \ldots$ The sum of the given series upto n-terms

$\frac{4}{3} + \frac{10}{9} + \frac{28}{27} + \ldots.$ upto n-terms

$= \left(1 + \frac{1}{3}\right) + \left(1 + \frac{1}{9}\right) + \left(1 + \frac{1}{27}\right) + \ldots$ upto n-terms

$= (1 + 1 + 1 + \ldots$ upto n-terms $)$

$+ \left(\frac{1}{3} + \frac{1}{3^2} + \frac{1}{3^3} + \ldots \text{ upto } n \text{ - terms}\right)$

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

Q118. Solution

Correct Answer: (D)

Given $f(x, y) = x^2 + y^2 + 2ax + 2by + c = 0$

Now, $f(x, 0) = 0$ has two repeated roots equal to 2.

$\Rightarrow x^2 + 2ax + c = (x - 2)^2$

$\Rightarrow x^2 + 2ax + c = x^2 - 4x + 4$

On comparison, we get

$2a = -4$ & $c = 4$

$\Rightarrow a = -2$ & $c = 4$

Also, given $f(0,\ y) = 0$ has two roots i.e., 2 & 3.

$\Rightarrow y^2 + 2by + c = (y - 2)(y - 3)$

$\Rightarrow y^2 + 2by + c = y^2 - 5y + 6$

On comparison, we get

$2b = -5$ & $c = 6$

$\Rightarrow \mathrm{b} = -\frac{5}{2}$ & $\mathrm{c} = 6$.

Clearly, the data is not consistent.

Q119. Solution

Correct Answer: (C)

(C)
The dr's of PA are $x_1 - 1, y_1 - 3, z_1 - 4$
The dr's n are $2, -1, 1$
The dr's of PA and n are parallel
$\therefore \frac{x_1-1}{2} = \frac{y_1-3}{-1} = \frac{z_1-4}{1} = \lambda$
$x_1 = 2\lambda + 1, y_1 = -\lambda + 3, z_1 = \lambda + 4$
$A = (2\lambda + 1, -\lambda + 3, \lambda + 4)$ lies on $2x - y + z + 3 = 0$
$\Rightarrow -4\lambda + 2 - \lambda - 3 - \lambda + 4 + 3 = 0$
$\Rightarrow 6\lambda = -6$
$\Rightarrow \lambda = -1$
$\therefore P = (-1, 4, 3)$

Q120. Solution

Correct Answer: (B)

Given: $\mathrm{f}'(x)=\mathrm{f}(x)$ for all $x \in \mathrm{R}' \Rightarrow \frac{\mathrm{f}'(x)}{\mathrm{f}(x)}=1$ Integrating on both sides, wwe get $\log|\mathrm{f}(x)|=x+\mathrm{c}$

$\Rightarrow \mathrm{f}(x)=\mathrm{e}^{x+c} \Rightarrow \mathrm{f}(x)=\mathrm{e}^{x} \cdot \mathrm{e}^{\mathrm{c}} \Rightarrow \mathrm{f}(x)=\mathrm{e}^{x} \cdot \mathrm{c}_1 \ldots$ (i)$[\mathrm{e}^{\mathrm{c}}=\mathrm{c}_1]$ As $f(1)=2$ $\therefore \quad \mathrm{c}_1 \cdot \mathrm{e}=2$ $\Rightarrow \mathrm{c}_1=\frac{2}{\mathrm{e}}$ Equation (i) becomes $\mathrm{f}(x)=\mathrm{e}^{x} \cdot \frac{2}{\mathrm{e}}$ Now, $\mathrm{h}(x)=\mathrm{f}(\mathrm{f}(x))$

$$\begin{aligned}
\therefore \quad \mathrm{h}'(x) &= \mathrm{f}'(\mathrm{f}(x)) \times \mathrm{f}'(x) \\
\therefore \quad \mathrm{h}'(1) &= \mathrm{f}'(\mathrm{f}(1)) \times \mathrm{f}'(1) \\
\Rightarrow \mathrm{h}'(1) &= \mathrm{f}'(2) \times \mathrm{f}'(1) \\
\Rightarrow \mathrm{h}'(1) &= \mathrm{e}^{2} \times \tfrac{2}{\mathrm{e}} \times 2 \\
\Rightarrow \mathrm{h}'(1) &= 4\mathrm{e}
\end{aligned}$$

Q121. Solution

Correct Answer: (C)

Let r be the radius of the circular disc and A be the area of the circular disc at any instant of time. we know that $A=\pi r^2$

$\frac{dA}{dt}=2\pi r\frac{dr}{dt}$ According to the question, the circular disc expands on heating with the rate of change of radius is $0.05\ \mathrm{cm/s}$ $\frac{dr}{dt}=0.05\ \mathrm{cm/s}$ So, the rate at which its area is increasing, when radius is $5.2\ \mathrm{cm}$ is $0.05\ \mathrm{cm/s}$

$$\Rightarrow \quad \frac{dA}{dt}=2\times\pi\times5.2\times0.05$$

$$\Rightarrow \quad \frac{dA}{dt}=0.52\pi \mathrm{cm}^2/\mathrm{s}$$

is $0.52\pi \mathrm{cm}^2/\mathrm{s}$.

Q122. Solution

Correct Answer: (C)

$|\vec{A}-\vec{B}|+|\vec{A}+\vec{B}|=\sqrt{2-2\cos\theta}+\sqrt{2+2\cos\theta}$

$=\sqrt{2}(\sqrt{1-\cos\theta}+\sqrt{1+\cos\theta})$

$=\sqrt{2}.\ \left\{\sqrt{2}\sin\frac{\theta}{2}+2\cos\frac{\theta}{2}\right\}=2\left(\sin\frac{\theta}{2}+\cos\frac{\theta}{2}\right)$ Greatest value is $2\sqrt{2}$

Q123. Solution

Correct Answer: (A)

Given $np=6, npq=4$ $\therefore \frac{npq}{np}=\frac{4}{6} \Rightarrow q=\frac{2}{3}$ and $p=\frac{1}{3}$

$\because np=6 \Rightarrow n\times\frac{1}{3}=6 \Rightarrow n=18.$

Q124. Solution

Correct Answer: (C)

We know the domain of $\sin^{-1} x$ & $\cos^{-1} x$ is $[-1, 1]$, the domain of $\tan^{-1} x$ & $\cot^{-1} x$ is $(-\infty, \infty)$ and domain of $\text{cosec}^{-1} x$ & $\sec^{-1} x$ is $(-\infty, -1] \cup [1, \infty)$

$\therefore$ Domain of $f(x) \in \{-1, 1\}$

$f\left(-1\right) = f\left(1\right) = \frac{3\pi}{2} = \frac{3\pi}{\mu}$

$\Rightarrow \quad \mu = 2$

Q125. Solution

Correct Answer: (A)

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

Q126. Solution

Correct Answer: (A)

Perpendicular to $\sqrt{3}\sin\theta + 2\cos\theta = \frac{4}{r}$ is $\sqrt{3}\sin\left(\frac{\pi}{2} + \theta\right) + 2\cos\left(\frac{\pi}{2} + \theta\right) = \frac{k}{r}$ It is passing through $(-1, \pi/2)$

$\sqrt{3}\sin\pi + 2\cos\pi = \frac{k}{-1} \Rightarrow k = 2$

$\therefore \sqrt{3}\cos\theta - 2\sin\theta = \frac{2}{r} \Rightarrow 2 = \sqrt{3}r\cos\theta - 2r\sin\theta.$

Q127. Solution

Correct Answer: (A)

$f(x) = x^p \sin\frac{1}{x}, x \neq 0$ and $f(x) = 0, x = 0$ Since at $x = 0$, $f(x)$ is a continuous function
$\therefore \lim_{x\to 0} f(x) = f(0) = 0 \Rightarrow \lim_{x\to 0} x^p \sin\frac{1}{x} = 0 \Rightarrow p > 0$. $f(x)$ is differentiable at $x = 0$, if
$\lim_{x\to 0} \frac{f(x) - f(0)}{x - 0}$ exists $\Rightarrow \lim_{x\to 0} \frac{x^p \sin\frac{1}{x} - 0}{x - 0}$ exists $\Rightarrow \lim_{x\to 0} x^{p-1}\sin\frac{1}{x}$ exists $\Rightarrow p - 1 > 0$ or $p > 1$ If $p \leq 1$, then
$\lim_{x\to 0} x^{p-1}\sin\left(\frac{1}{x}\right)$ does not exist and at $x = 0 \quad f(x)$ is not differentiable. $\therefore$ for $0 < p \leq 1 f(x)$ is a continuous function at $x = 0$ but not differentiable.

Q128. Solution

Correct Answer: (C)

Let $z = x + iy$

$\therefore |z|^2 + |z-3|^2 + |z-i|^2$

$= |x+iy|^2 + |\,|x-3) + iy|^2$

$\quad + |x + i(y-1)|^2$

$= x^2 + y^2 + (x-3)^2 + y^2 + x^2 + (y-1)^2$

$= x^2 + y^2 + x^2 - 6x + 9 + y^2 + x^2 + y^2$

$= 3x^2 + 3y^2 - 6x - 2y + 10$

$= 3\left(x^2 - 2x + 1\right) + 3\left(y^2 - \frac{2}{3}y + \frac{1}{9}\right)$

$= 3(x-1)^2 + 3\left(y - \frac{1}{3}\right)^2 + \frac{20}{3}$

It is minimum, when $x - 1 = 0$ and $y - \frac{1}{3} = 0$

$\therefore \quad x = 1 \quad$ and $\quad y = \frac{1}{3}$

$\therefore \quad z = 1 + \frac{1}{3}i$

Q129. Solution

Correct Answer: (D)

$\mathrm{x} = \frac{B}{\mathrm{M}} = \left(\frac{\mu_0 i}{2r}\right)\left(\frac{1}{i\pi r^2}\right)$ or $\mathrm{x} \propto \frac{1}{r^3}$

i.e., x will become $\frac{\mathrm{x}}{8}$ when radius and current both are doubled.

Q130. Solution

Correct Answer: (C)

$\eta = 1 - \frac{\mathrm{T}_2}{\mathrm{T}_1}$

$0.8 = 1 - \frac{T_2}{T_1}$

$\frac{\mathrm{T}_2}{\mathrm{T}_1} = 0.2$

$\mathrm{T}_2\mathrm{V}_2^{\gamma-1} = \mathrm{T}_1\mathrm{V}_1^{\gamma-1}$

$\left(\frac{\mathrm{V}_2}{\mathrm{V}_1}\right)^{\gamma-1} = \frac{\mathrm{T}_1}{\mathrm{T}_2} = 5$

$\frac{\mathrm{V}_1}{\mathrm{V}_2} = \left(\frac{1}{5}\right)^{\frac{5}{2}}$

Q131. Solution
Correct Answer: (D)

Let the radius of the bigger drop be $'R'$.

As total volume remains constant, so

$2 \times \frac{4}{3}\pi r^3 = \frac{4}{3}\pi R^3$

$\Rightarrow R = 2^{\frac{1}{3}} r$

Surface energy of a sphere of surface area A & surface tension T is given by

$U = AT$

$\Rightarrow U = 4\pi R^2 T$

$\Rightarrow U = 4\pi\left(2^{\frac{1}{3}} r\right)^2 T$

$\Rightarrow U = 4\pi 2^{\frac{2}{3}} r^2 T$

$\Rightarrow U = 2^{\frac{8}{3}} \pi r^2 T.$

Q132. Solution
Correct Answer: (A)

As NCS^- is an ambidentate ligand and it can be linked through N or S so it is capable of showing linkage isomerism so $[\mathrm{Pd(PPh_3)_2(NCS)_2}]$ and $[\mathrm{Pd(PPh_3)_2(SCN)_2}]$ are linkage isomers.

Q133. Solution
Correct Answer: (B)

Cubic unit cell has $\mathrm{a = b = c}$ and $\alpha = \beta = \gamma = 90^{\circ}$.
So, it is considered as most organised crystal system.

Q134. Solution
Correct Answer: (C)

$\mathrm{PH_3 + 4Cl_2 \rightarrow PCl_5 + 3HCl}$

Q135. Solution
Correct Answer: (D)

Rule is $\mathrm{a * b = (a + b)^2}, \quad \therefore 5 * 6 = (5 + 6)^2 = 121.$

Q136. Solution

Correct Answer: (B)

According to the formula of square,

Area of square$= a^2$

Where a is equal to side length,

It means area of a square is directly proportional to its side length,

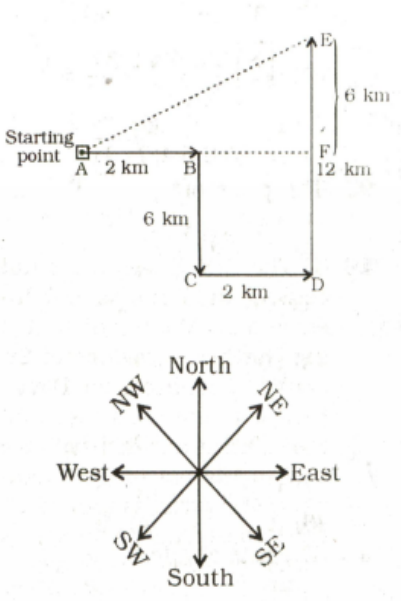
$Area\ of\ square\ \alpha\ (length)^2$

It means if the length is zero, the area will also be zero as the curve will be reprsented by, $y = x^2$.

So the curve will start from the origin. Hence, the correct answer is option 2.

Q137. Solution

Correct Answer: (B)



From above diagram representation,

We have to find the Length of AF,

AE=FD−ED

$= 12 - 6 = 6\ km$(Since ED=BC)

$AE = \sqrt{(AF)^2 + (FE)^2} = \sqrt{(4)^2 + (6)^2} = \sqrt{16 + 36} = \sqrt{52} = 7.2\ km$

Q138. Solution

Correct Answer: (A)

$(p \Rightarrow \sim q) \wedge (q \Rightarrow \sim p)$

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

$[\because (p \Rightarrow q) = (\sim p) \vee q]$

$= (p \wedge q) \vee (q \wedge p)$ (Demorgan law)

$= p \wedge q$

Q139. Solution

Correct Answer: (A)

Let $A = \begin{bmatrix} \cos\theta & \sin\theta \\ -\sin\theta & \cos\theta \end{bmatrix}$

$\therefore \quad \text{adj(A)} = \begin{bmatrix} \cos\theta & -\sin\theta \\ \sin\theta & \cos\theta \end{bmatrix}$

Q140. Solution

Correct Answer: (D)

$$\text{Given lines } y = kx + 1 \quad \text{--- (1)}$$
$$3x + 4y = 9 \quad \text{--- (2)}$$
$$\text{Put (1) in (2):}$$
$$\Rightarrow 3x + 4(kx + 1) = 9$$
$$\Rightarrow 3x + 4kx + 4 = 9$$
$$\Rightarrow x(3 + 4k) = 5$$
$$\Rightarrow x = \frac{5}{3 + 4k}$$

For x to be an integer, $3 + 4k$ should divide 5

$$\therefore \text{Divisors of 5 are } \{1, 5, -1, -5\}$$
$$\text{If } 3 + 4k = 1 \Rightarrow k = -\frac{1}{2}$$
$$\text{If } 3 + 4k = 5 \Rightarrow k = \frac{1}{2}$$
$$\text{If } 3 + 4k = -1 \Rightarrow k = -1$$
$$\text{If } 3 + 4k = -5 \Rightarrow k = -2$$
$$\because x \text{ is an integer} \Rightarrow k = -1, -2$$
$$\therefore \text{From (1), the lines:}$$
$$y = -x + 1 \Rightarrow x + y - 1 = 0$$
$$y = -2x + 1 \Rightarrow 2x + y - 1 = 0$$
$$\text{Combined equation is: } (x + y - 1)(2x + y - 1) = 0$$