

Answer Key

Other (130 Questions)

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

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

## Solutions

### Q1. Solution

**Correct Answer: (C)**



As there is no external force

Linear momentum will be conserved

$$P_1 = P_2 = P$$

Now, de-Broglie wavelength

$$\lambda_1 = \frac{h}{P_1} \text{ or } \lambda_2 = \frac{h}{P_2}$$

$$\Rightarrow \frac{\lambda_1}{\lambda_2} = \frac{P_2}{P_1} = \frac{P}{P} = 1 = \frac{m}{n}$$

$$\Rightarrow m + n = 1 + 1 = 2$$

### Q2. Solution

**Correct Answer: (A)**

If the maximum value of induced EMF is  $V$  then 50% of induced EMF is  $\frac{V}{2}$ . Also, at this moment voltage across resistor will be  $\frac{V}{2}$ .

$$E = \frac{1}{2} Li^2$$

$$E = \frac{1}{2} L \left( \frac{\frac{V}{2}}{R} \right)^2$$

$$E = \frac{1}{2} (5 \times 10^{-3}) \left( \frac{2}{2(1)} \right)^2$$

$$E = 2.5 \text{ mJ}$$

### Q3. Solution

**Correct Answer: (B)**

Force on  $(-q_1)$  due to  $q_2 = \frac{q_1 q_2}{4\pi\epsilon_0 b^2}$

$$\therefore F_1 = \frac{q_1 q_2}{4\pi\epsilon_0 b^2} \text{ along } (q_1 q_2)$$

Force on

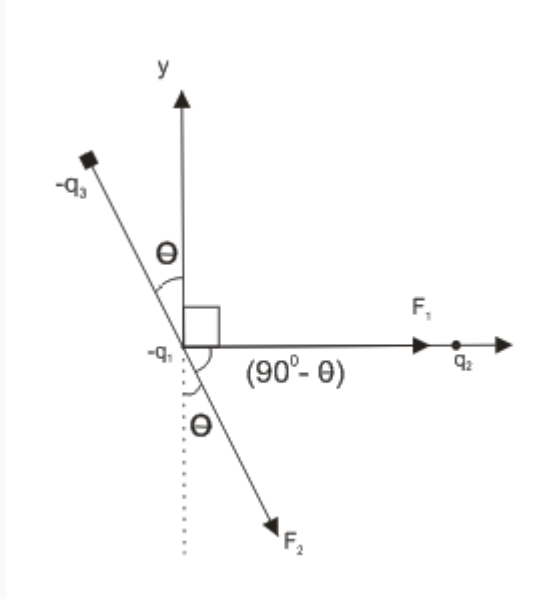
$(-q_1)$

due to

$$(-q_3) = \frac{(q_1)(q_3)}{4\pi\epsilon_0 a^2}$$

$$F_2 = \frac{q_1 q_3}{4\pi\epsilon_0 a^2} \text{ as shown}$$

$F_2$  makes an angle of  $(90^\circ - \theta)$  with  $(q_1 q_2)$



Resolved part of  $F_2$  along  $q_1 q_2$

$$= F_2 \cos(90^\circ - \theta)$$

$$= \frac{q_1 q_3 \sin\theta}{4\pi\epsilon_0 a^2} \text{ along } (q_1 q_2)$$

$\therefore$  Total force on  $(-q_1)$

$$= \left[ \frac{q_1 q_2}{4\pi\epsilon_0 b^2} + \frac{q_1 q_3 \sin\theta}{4\pi\epsilon_0 a^2} \right] \text{ along x-axis}$$

$$\therefore \text{ x-component of force } \propto \left[ \frac{q_2}{b^2} + \frac{q_3}{a^2} \sin\theta \right].$$

**Q4. Solution****Correct Answer: (C)**

$$\Delta U = \frac{f}{2} n R dT$$

$$\Delta Q = \left( \frac{f}{2} + 1 \right) n R dT$$

$$\frac{\Delta U}{\Delta Q} = \frac{f/2}{1 + f/2}$$

$$\frac{\Delta U}{\Delta Q} = \frac{3}{5}$$

$$\frac{\Delta U}{\Delta Q} \times 100 = \frac{3}{5} \times 100 = 60\%$$

Remaining is used in expansion of the gas = 40%

**Q5. Solution****Correct Answer: (B)**

$$\begin{aligned} \text{Voltage gain} &= \frac{V_0}{V_i} = \frac{R_0 \times \Delta I_C}{R_i \times \Delta I_B} \\ &= \frac{2000 \times 1.5 \times 10^{-3}}{150 \times 20 \times 10^{-6}} = \frac{3}{3000 \times 10^{-6}} \\ &= \frac{1}{(1000)^{-1}} = 1000 \end{aligned}$$

**Q6. Solution****Correct Answer: (A)**

Dimensionally

$$F = MLT^{-2}$$

In C.G.S. system

$$1 \text{ dyne} = 1 \text{ g } 1 \text{ cm } (1 \text{ s})^{-2}$$

In the new system

$$1 \text{ x} = (10 \text{ g})(10 \text{ cm})(0.1 \text{ s})^{-2}$$

$$\frac{1 \text{ dyne}}{1 \text{ x}} = \frac{1 \text{ g}}{10 \text{ g}} \times \frac{1 \text{ cm}}{10 \text{ cm}} \left( \frac{10 \text{ s}}{1 \text{ s}} \right)^{-2}$$

$$1 \text{ dyne} = \frac{1}{10,000} \times 1 \text{ x}$$

$$10^4 \text{ dyne} = 1 \text{ x}$$

$$10 \text{ x} = 10^5 \text{ dyne} = 1 \text{ N}$$

$$\text{x} = \frac{1}{10} \text{ N}$$

**Q7. Solution****Correct Answer: (A)**

For stable equilibrium

$$U = -MB$$

$$= - (0.4)(0.16)$$

$$= - 0.064 \text{ J}$$

**Q8. Solution****Correct Answer: (B)**

Let us take  $x$  mg iodine migrated to thyroid gland.

if  $A$  is activity of complete sample of mass  $m$ . Then activity of  $x$  is given by

$$A_x = \frac{A}{m}x$$

$A_x$  is 67.7% of initial total sample at  $t = 4$  days.

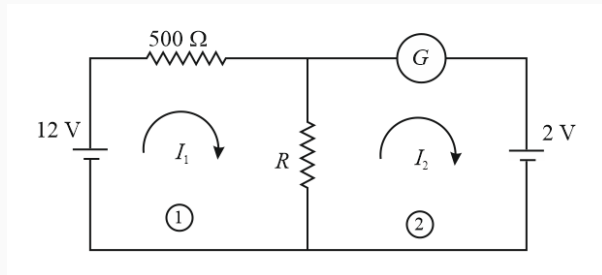
$$A_x = \left(\frac{67.7}{100}\right)A_0 \quad \& \quad A = \frac{A_0}{2^{t/T}}$$

$T$  = half life time

So using above equation,

$$\frac{67.7}{100}A_0 = \frac{A_0}{2^{4/8}} \left(\frac{x}{m}\right)$$

$$\frac{x}{m} \times 100 = 67.7 \times \sqrt{2} = 95.7\%$$

**Q9. Solution****Correct Answer: (A)**

According to given figure,

Applying KVL in loop (i)

$$500I_1 + R(I_1 - I_2) = 12$$

$$(500 + R)I_1 - RI_2 = 12 \quad \dots Eq(i)$$

Applying KVL in loop (ii), we have

$$R(I_2 - I_1) = -2$$

$$RI_2 = RI_1 - 2 \quad \dots Eq(ii)$$

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

$$(500 + R)I_1 - (RI_1 - 2) = 12$$

$$500I_1 + RI_1 - RI_1 + 2 = 12$$

$$500I_1 = 10$$

$$I_1 = \frac{1}{50}$$

From Eq. (ii),

$$RI_2 = R \times \frac{1}{50} - 2$$

But given that galvanometer G shows zero deflection, hence  $I_2 = 0$ .

$$\therefore 0 = \frac{R}{50} - 2$$

$$\frac{R}{50} = 2$$

$$R = 100 \, \Omega$$

**Correct Answer: (D)**

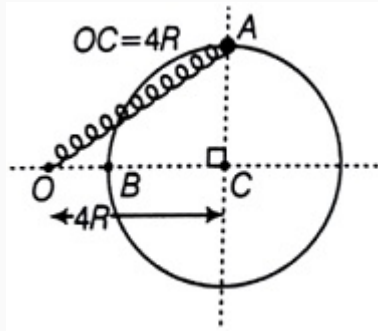
## Wave speed of transverse wave in a stretched string

$$v = \sqrt{\frac{T}{\mu}}$$

$$T = \mu v^2 = \mu \frac{\omega^2}{k^2} = 0.04 \frac{\left(\frac{2\pi}{0.04}\right)^2}{\left(\frac{2\pi}{0.50}\right)^2} = 6.25 \text{ N}$$

### Q11. Solution

**Correct Answer: (C)**



Given,

Mass of bead =  $m$

The radius of circular horizontal ring =  $3R$

The natural length of spring =  $R$

According to the conservation of energy,

$$\text{KE}_i + \text{PE}_i = \text{KE}_f + \text{PE}_f$$

$$\Rightarrow 0 + \frac{1}{2}k[\text{OA} - R]^2 = \text{KE}_f + \frac{1}{2}k[\text{OB} - R]^2$$

$$\Rightarrow 0 + \frac{1}{2}k[5R - R]^2 = \text{KE}_f + \frac{1}{2}k[R - R]^2$$

$$\Rightarrow \text{KE}_f = 8kR^2 \sim$$

### Q12. Solution

**Correct Answer: (A)**

$P_1$  is at central maxima so  $I_1 = 4I_0$

$$\text{For } P_2, \phi = \left(\frac{2\pi}{\beta}\right) \left(\frac{\beta}{4}\right) = \frac{\pi}{2}$$

$$I_2 = I_0 + I_0 + 2\sqrt{I_0 I_0} \cos\left(\frac{\pi}{2}\right) = 2I_0$$

Hence,  $\frac{I_1}{I_2} = 2$ ,

**Q13. Solution****Correct Answer: (B)**

Let  $V_0$  be the speed of object far away from earth. By law of conservation of mechanical energy

$$\Rightarrow \frac{1}{2} m \times 16 \times V^2 - \frac{1}{2} m \times \frac{2GM}{R} = \frac{1}{2} m V_0^2$$

$$\frac{1}{2} m(UV)^2 - \frac{GMm}{R} = \frac{1}{2} m V_0^2 + 0 \Rightarrow \frac{1}{2} m V^2 \times 16 - \frac{1}{2} m V^2 = \frac{1}{2} m V_0^2 \quad ,$$

$$\Rightarrow 15 V^2 = V_0^2$$

$$\Rightarrow V_0 = \sqrt{15} V$$

**Q14. Solution****Correct Answer: (B)**

The circuit shown is a parallel resonant circuit. The frequency is  $f = \frac{1}{2\pi\sqrt{LC}}$  at resonance. Also, at resonance, the capacitive reactance is equal to the inductive reactance. Therefore, equal current will flow through both the bulbs  $b_1$  and  $b_2$ . So, both will glow with same brightness. .

**Q15. Solution****Correct Answer: (C)**

According to Bohr's theory of the H atom, electrons can revolve only in those orbits in which their angular momentum is an integral multiple of  $\frac{h}{2\pi}$ , where  $h$  is Plank's constant.

$$\text{Angular momentum} = mvr = \frac{2h}{2\pi}$$

Hence, angular momentum is quantized.

The energy of an electron in  $n^{th}$  orbit of the hydrogen atom,

$$E = \frac{Rhc}{n^2} \text{ J}$$

Thus, it is obvious that the hydrogen atom has some characteristics of energy state. In fact, this is true for the atom of each element, i.e., each atom has its energy quantized.

Hence, both energy and angular momentum are quantised. ~

**Q16. Solution****Correct Answer: (A)**

As the rods are in series,  $R_{eq} = R_A + R_B + R_C$  with  $R = (L/K_A)$

$$\text{i.e.,} \quad R_{eq} = \frac{L}{2KA} + \frac{L}{KA} + \frac{L}{0.5KA} = \frac{7L}{2KA} \quad \dots(i)$$

Furthermore if  $K_{eq}$  is equivalent thermal conductivity,

$$R_{eq} = \frac{L+L+L}{K_{eq}A} = \frac{7L}{2KA} \quad [\text{from Equation (i)}]$$

$$\text{i.e.,} \Rightarrow \frac{3L}{K_{eq}} = \frac{7L}{2KA}$$

$$\Rightarrow K_{eq} = \frac{6}{7} K$$

**Q17. Solution****Correct Answer: (B)**

$$\frac{P_0 V}{RT_0} + \frac{P_0 V}{RT_0} = \frac{PV}{RT_0} + \frac{PV}{R2T_0}$$

$$2P_0 = P + \frac{P}{2}$$

$$2P_0 = \frac{3P}{2}$$

$$P = \frac{4P_0}{3} \wedge$$

**Q18. Solution****Correct Answer: (B)**Let the minimum mass of B is  $M_B$ .Force applied by it  $F = M_B g$ 

Friction force on block A

$$f = \mu M_A g$$

For motion to start

$$M_B g = \mu M_A g$$

$$M_B = 0.22 \times 10$$

$$= 2.2 \text{ kg !}$$

**Q19. Solution****Correct Answer: (B)**

the magnetic moment is given by

$$\vec{M} = NIA = NI\pi r^2 = 200 \times 4 \times 3.14 \times (15 \times 10^{-2})^2$$

$$= 200 \times 4 \times 3.14 \times 15 \times 15 \times 10^{-4} = 56.5 \text{ A m}^2 ,$$

**Q20. Solution****Correct Answer: (B)**

PE at the surface of earth

$$PE = \frac{-GMm}{R}$$

PE at a height  $3R_e$ 

$$PE = \frac{-GMm}{R+3R} = \frac{-GMm}{4R}$$

$$\Delta PE = PE_f - PE_i = \left( -\frac{GMm}{4R} \right) - \left( \frac{-GMm}{R} \right) = \frac{3}{4} \frac{GMm}{R}$$

$$\Rightarrow \Delta PE = \frac{3}{4} mgR \wedge$$

**Q21. Solution****Correct Answer: (A)**

$$\rho_w \frac{2}{3} V = \rho_b V$$

$$\rho_{oil} \frac{1}{4} V = \rho_b V$$

$$\therefore \frac{2}{3} \rho_w = \frac{1}{4} \rho_{oil}$$

$$\rho_{oil} = \frac{8}{3} \rho_w$$

$$= \frac{8000}{3} = 2666.7$$

**Q22. Solution****Correct Answer: (D)**

Given potential energy is

$$U(x) = U_0(1 - \cos ax)$$

Therefore force on the particle is given by

$$F = -\frac{dU}{dx} = -U_0 a \sin(ax)$$

Using small angle approximation,  $\sin(ax) \approx ax$

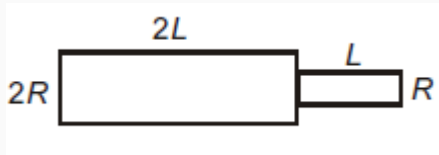
$$\text{Therefore } F = -U_0 a^2 x$$

Time period of SHM is,

$$T = 2\pi \sqrt{\frac{m}{k}} \text{ where } k \text{ is force constant.}$$

Therefore time period for given force is,

$$T = 2\pi \sqrt{\frac{m}{U_0 a^2}}$$

**Q23. Solution****Correct Answer: (A)**

$$\Delta \ell = \frac{FL}{AY}$$

$$\frac{\Delta \ell_1}{\Delta \ell_2} = \frac{L_1}{A_1} \frac{A_2}{L_2} = \frac{2L}{\pi(2R)^2} \times \frac{\pi R^2}{L} = \frac{1}{2}$$

**Q24. Solution****Correct Answer: (A)**

For real inverted image formed by concave mirror.

$$v = -ve, \quad u = -ve, \quad f = -ve$$

$$\Rightarrow \frac{u}{f} \text{ \& \; } \frac{v}{f} \text{ are positive}$$

So graph show be in 1st qudarant

and

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

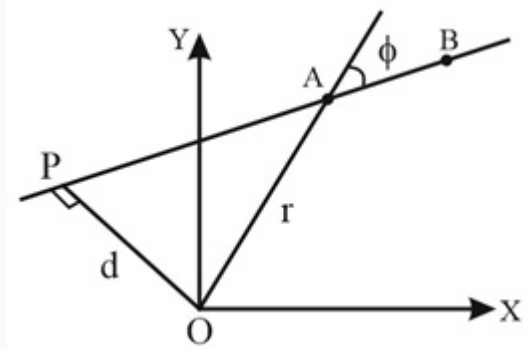
$$\Rightarrow \frac{f}{v} + \frac{f}{u} = 1$$

This graph can also be realized by Newtons formula  $x_1 x_2 = f^2$  where  $x_1$ , and  $x_2$  are distance from focus so graph will be rectangular hyperbola

$\Rightarrow$  (1) is right answer.

**Q25. Solution****Correct Answer: (B)**

From the definition of angular momentum,



$$\mathbf{L} = \mathbf{r} \times \mathbf{p} = rmv \sin \phi \left( -\hat{\mathbf{k}} \right)$$

Therefore, the magnitude of  $L$  is

$$L = mvr \sin \phi = mvd$$

where  $d = r \sin \phi$  is the distance of closest approach of the particle to the origin. As  $d$  is same for both the particles, hence  $L_A = L_B$ .

**Q26. Solution****Correct Answer: (A)**

$$\frac{1}{2}mv^2 = hf - \phi_0 = hf - hf_0$$

The kinetic energy of the emitted photoelectrons is distributed from zero to the maximum value.

minimum kinetic energy of emitted photoelectron is zero.

**Q27. Solution****Correct Answer: (C)**

The correct order of acidity is  $a > d > b > c$  Alkynes > alkenes > alkanes

### Q28. Solution

**Correct Answer: (C)**

In  $\text{C}_2\text{O}_4^{2-} \rightarrow \text{CO}_2$  oxidation number of carbon change from +3 to +4 .

In  $\text{SO}_4^{2-} \rightarrow \text{SO}_3^{2-}$  oxidation number of sulphur change from +6 to +4 .

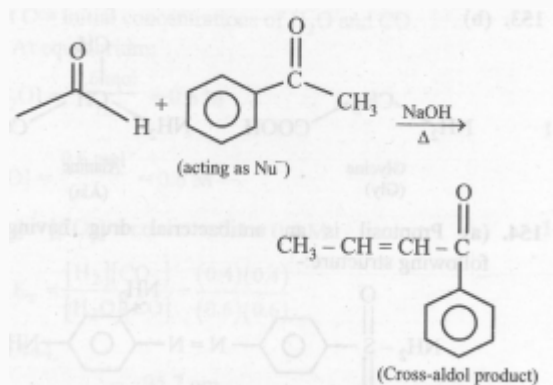
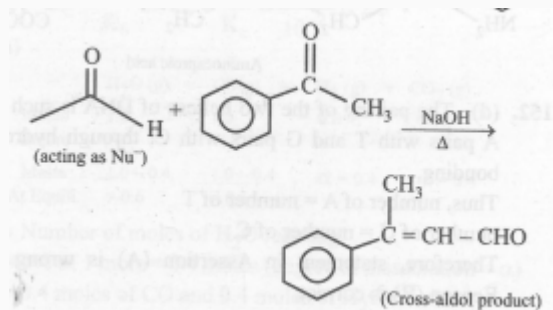
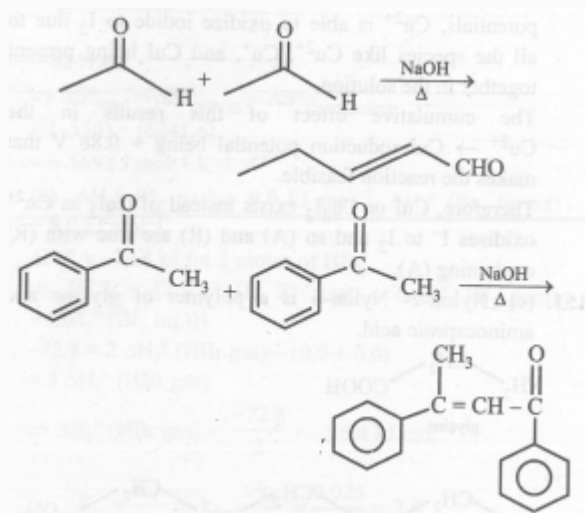
In  $\text{MnO}_4^{2-} \rightarrow \text{MnO}_4^-$  oxidation number of Mn change from +6 to +7 .

In  $\text{Fe}^{3+} \rightarrow \text{Fe}^{2+}$  oxidation number of iron change from +3 to +2.

### Q29. Solution

**Correct Answer: (D)**

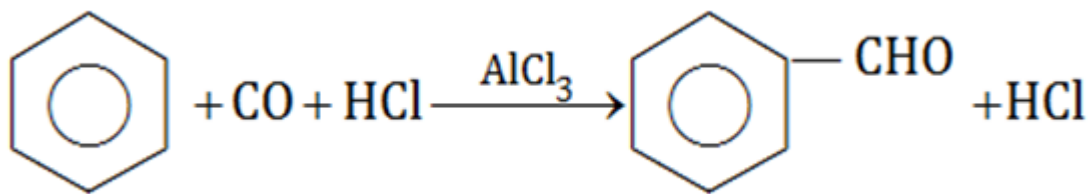
Cross- aldol condensation :



Thus, we get four different products.

**Q30. Solution****Correct Answer: (C)**

The reaction of CO + HCl in the presence of  $\text{AlCl}_3$  with benzene to form benzaldehyde is called Gatterman-Koch reaction.

**Q31. Solution****Correct Answer: (B)**

If the external force is non-zero then the acceleration of the centre of mass must be non-zero ( $a_0 = \frac{F_{\text{ext}}}{M} \neq 0$ ).

However, at a particular instant of time velocity of the centre of mass may be zero or non-zero. Hence

$$v_0 = 0, a_0 \neq 0$$

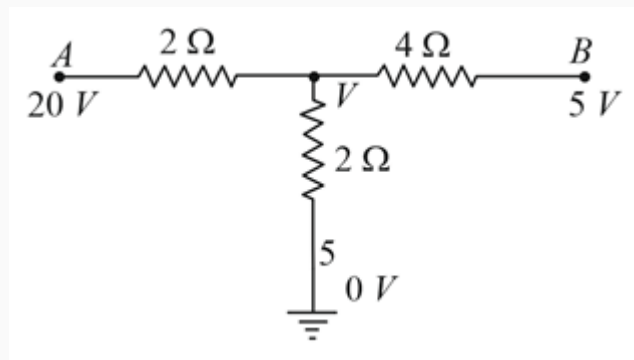
From the equation of velocity is in +ve direction and acceleration is in -ve direction, then at some moment velocity will become 0.

**Q32. Solution****Correct Answer: (B)**

At E, the slope of the curve is negative, *i.e.* for a displacement-time graph the slope represents the velocity and at E, the velocity is -ve as the slope is -ve.

**Q33. Solution****Correct Answer: (B)**

The acceleration vector acts along the radius of the circle. Then given statement is false.

**Q34. Solution****Correct Answer: (A)**When switch  $S$  is closed,Considering potential of junction as  $V$  and using Kirchoff's Current law:

$$\frac{20-V}{2} + \frac{5-V}{4} + \frac{0-V}{2} = 0$$

$$10 + \frac{5}{4} = \frac{5}{4} V$$

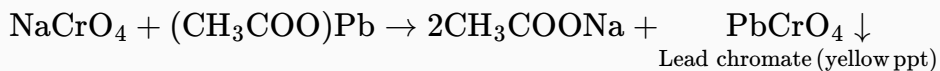
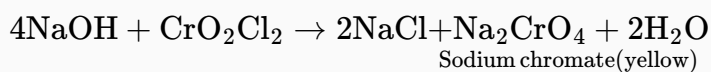
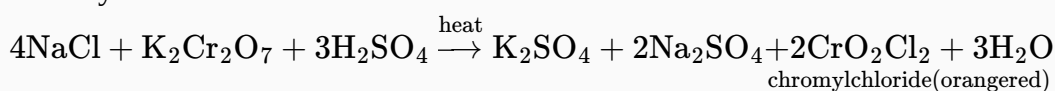
$$V = 9 \text{ V}$$

Current flowing through the switch ' $S$ '

$$i = \frac{9-0}{2} = 4.5 \text{ A towards the ground.}$$

**Q35. Solution****Correct Answer: (B)**

Chromyl chloride test

**Q36. Solution****Correct Answer: (B)**

$$\begin{aligned} \Lambda_m^\circ \text{NH}_4\text{OH} &= \Lambda_m^\circ (\text{NH}_4\text{Cl} + \text{KOH}) - \Lambda_m^\circ (\text{KCl}) \\ &= 152.8 + 272.6 - 149.8 \\ &= 275.6 \text{ S cm}^2 \text{ mol}^{-1} \end{aligned}$$

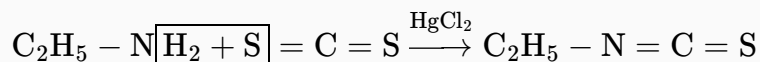
$$\text{Degree of dissociation } (\alpha) = \frac{\Lambda_m}{\Lambda_m^\circ} = \frac{25.1}{275.6}$$

$$= 0.091$$

$$\therefore \% \text{ degree of dissociation} = 9.1\%$$

**Q37. Solution****Correct Answer: (D)**

It is Hoffmann mustard oil reaction

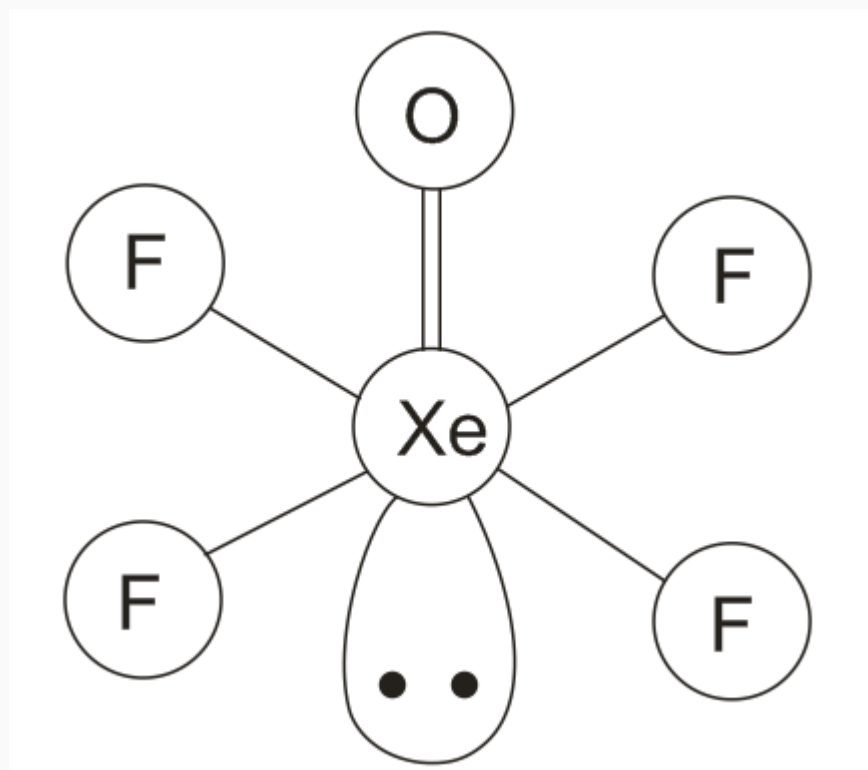
**Q38. Solution****Correct Answer: (D)**

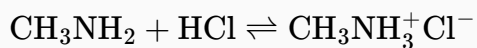
Tertiary structures can usually be destroyed (called denaturation) by heating a protein, treating with high energy radiation, or changing the solvent environment (pH, salt content, organic content, etc.) in which the protein is dissolved. When the characteristic structure of a protein molecule in its physiological environment is lost, the protein's normal function is lost too.

**Q39. Solution****Correct Answer: (B)**

In  $\text{XeOF}_4$ , the central Xe atom is bonded to O atom through a double bond and to F atoms through single bonds. So the total number of bonds formed by Xe atom in the molecule is six. Thus, out of the eight valence electrons in Xenon, two are left unused in bonding and will be present as one lone pair.

The total number of bond pairs is five (double bond is considered as a single super pair). The geometry of the molecules with four bond pairs and one lone pair is square pyramidal as shown below-



**Q40. Solution****Correct Answer: (D)**

Initial moles      0.1          0.08      0

Resulting solution contains [salt] = 0.08

$$[\text{base}] = 0.1 - 0.08 = 0.02$$

$$\text{Applying } \text{pOH} = \text{pK}_b + \log \frac{[\text{salt}]}{[\text{base}]}$$

$$\text{pK}_b = -\log K_b = -\log 5 \times 10^{-4} = 4 - \log 5 = 3.30$$

$$\text{pOH} = 3.30 + \log \frac{0.08}{0.02} = 3.30 + 0.60 = 3.90$$

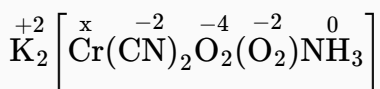
$$\text{pH} + \text{pOH} = 14, \text{pH} = 14 - 3.902 = 10.1$$

$$\text{Applying } \text{pH} = -\log [\text{H}^+]$$

$$10.1 = -\log [\text{H}^+]$$

$$\text{So } \text{H}^+ = 8 \times 10^{-11}$$

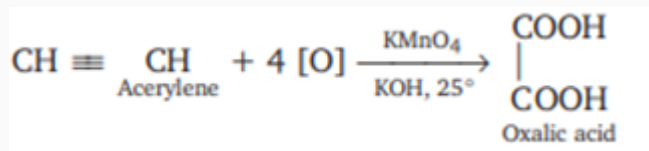
$$[\text{H}^+] \gg 8 \times 10^{-11}$$

**Q41. Solution****Correct Answer: (C)**When activation energy decreases, rate constant increases. As  $k' > k''$ ,  $E_a' < E_a''$ **Q42. Solution****Correct Answer: (D)**

In this complex, oxide and peroxide both ligands are present

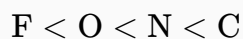
$$\text{So } +2 + x - 8 = 0$$

$$x = +6.$$

**Q43. Solution****Correct Answer: (C)**

**Q44. Solution****Correct Answer: (B)**

Nucleophilicity decreases as we move from left to right in the period. This happens because as we move from left to right, the electronegative nature increases and as a result tendency to attack a positive charge decreases. Hence, the order of nucleophilicity is:



Hence,  ${}^{-}\text{CH}_3$  has highest nucleophilicity.

**Q45. Solution****Correct Answer: (D)**

According to the given question,

This is based on the following pattern:

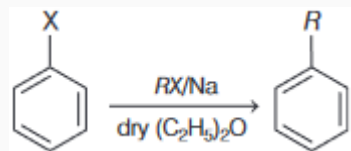
$A = 2, B = 3, \dots, Z = 27$ .

Then,  $\text{FOR} = F + O + R = 7 + 16 + 19 = 42$ .

$\text{FRONT} = F + R + O + N + T = 7 + 19 + 16 + 15 + 21 = 78$ .

Therefore, we can say that

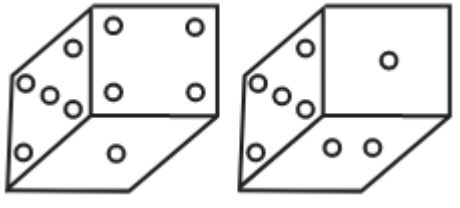
Hence, "78" is the correct answer.

**Q46. Solution****Correct Answer: (B)**

This reaction is known as Wurtz-Fittig reaction where the alkyl halide reacts with aryl halide with sodium in presence of dry ether.

**Q47. Solution****Correct Answer: (A)**

According to the question,



Two surfaces which have 5 and 1 dots in common then, 2 is obtained on the opposite face of 4.

So, 2 is the answer.

Hence, option A is the correct answer.

**Q48. Solution****Correct Answer: (B)**

Given that,

If October 18<sup>th</sup>, 2006 was Wednesday then, (say) 1<sup>st</sup> March 2005 is Tuesday (actually it is) then 1<sup>st</sup> March 2006 is Wednesday.

When 1<sup>st</sup> March 2007 is Thursday then 1<sup>st</sup> March 2008 is Saturday, because 2008 was a Leap Year and 1<sup>st</sup> March is beyond 29<sup>th</sup> February.

October 18<sup>th</sup>, 2006 is Wednesday.

October 18<sup>th</sup>, 2005 is Tuesday (calculated, from 2006).

October 18<sup>th</sup>, 2004 is Monday (calculated, from 2005).

October 18<sup>th</sup>, 2003 is Saturday (because 2004 was a Leap Year).

October 18<sup>th</sup>, 2002 is Friday (calculated, from 2003).

October 18<sup>th</sup>, 2001 is Thursday (calculated, from 2002).

October 18<sup>th</sup>, 2000 is Wednesday (calculated, from 2001).

So finally,

October 17<sup>th</sup>, 2000: Tuesday (calculated, from October 18<sup>th</sup>, 2000).

Hence, this is the correct answer.

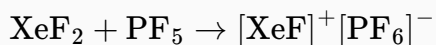
**Q49. Solution****Correct Answer: (D)**

$$[\text{OH}^-] = \frac{0.04}{40} \times \frac{1000}{100} = 10^{-2}$$

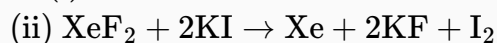
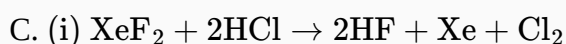
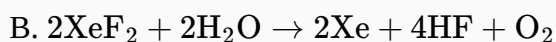
$$\text{pOH} = 2, \text{pH} = 14 - 2 = 12.$$

**Q50. Solution****Correct Answer: (D)**

It acts as a  $\text{F}^-$  donor and forms complexes with covalent fluorides like  $\text{PF}_5$ ,  $\text{AsF}_5$  and  $\text{SbF}_5$ .



A. the five electron pairs form trigonal bipyramid with three lone pairs in equatorial positions. Hence, the structure of  $\text{XeF}_2$  becomes linear in accordance with VSEPR theory.

**Q51. Solution****Correct Answer: (C)**

$$\text{Mol. wt. of } \text{CH}_4 = 16$$

$$\text{Mol. wt. of } \text{C}_2\text{H}_4 = 28$$

$$\therefore 20 = \frac{16x+28y}{x+y}$$

$$\text{or } 16x + 28y = 20x + 20y$$

$$\text{or } 4x = 8y$$

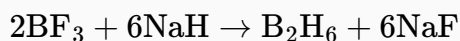
$$\text{or } x = 2y$$

In the gaseous mixture when the mole ratio of  $\text{CH}_4$  and  $\text{C}_2\text{H}_4$  is  $y : x$

$$\begin{aligned} \text{then avg. mol. wt} &= \frac{16y+28x}{x+y} = \frac{16y+56y}{3y} \\ &= \frac{72y}{3y} = 24 \text{ u} \end{aligned}$$

**Q52. Solution****Correct Answer: (D)**

$\text{NH}_3$  has higher value of  $a$ , it means intermolecular forces are stronger and higher critical temperature than oxygen, hence easy to liquefy.

**Q53. Solution****Correct Answer: (D)**

**Q54. Solution**

**Correct Answer: (A)**

1	2	3	4	5	6	7	8	9	10	11	12	13	14
↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
C	O	M	M	U	N	I	C	A	T	I	O	N	S

After rearrangement

O C M M N U C I T A O I S N

10th from right

**Q55. Solution**

**Correct Answer: (A)**

In polar solvent, solvation is maximum for  $\text{Li}^+$ , due to high charge density on small size. Hence size of solvated cation is in the order  $\text{Li}^+ > \text{Na}^+ > \text{K}^+ > \text{Rb}^+$

**Q56. Solution**

**Correct Answer: (A)**

ZnS shows Frenkel defect due to the smaller ion (usually the cation) is dislocated does not show Schottky defect.

**Q57. Solution**

**Correct Answer: (D)**

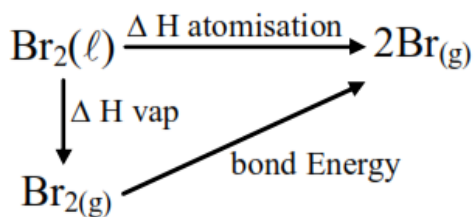
Radius in nth orbit = Bohr radius  $\times n^2$

$$r_3 = x \times n^2 = x \times 3^2$$

$$= (9 \times x) \text{pm}$$

**Q58. Solution****Correct Answer: (B)**

Based on Hess's law it can be given as



As  $\Delta H_{\text{atomisation}} = \Delta H_{\text{vap}} + \text{Bond Energy}$

Hence  $x > y$

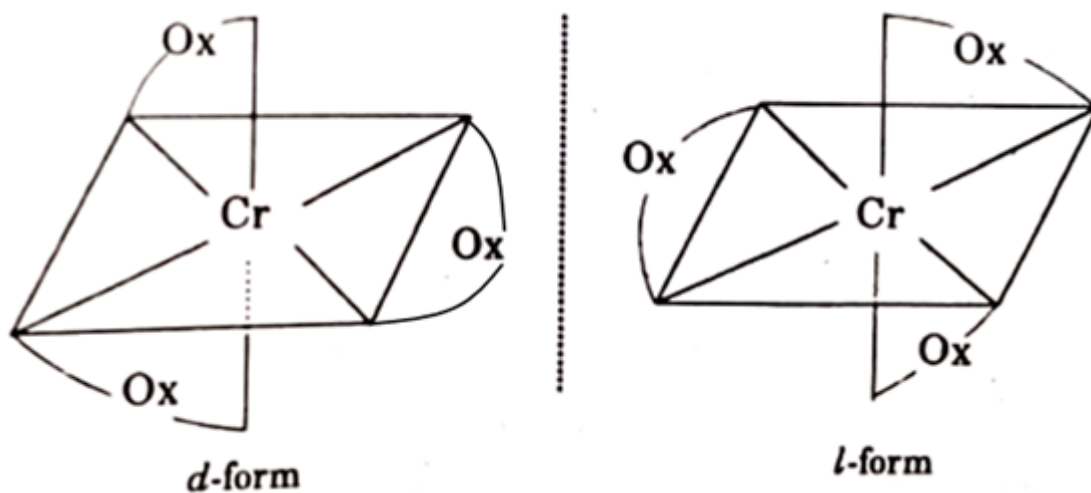
**Q59. Solution****Correct Answer: (B)**

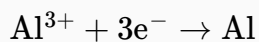
Nylon-6,6 is made from adipic acid.

Nylon 6,6 is synthesized by polycondensation of hexamethylenediamine and adipic acid. Equivalent amounts of hexamethylenediamine and adipic acid are combined with water in a reactor.

**Q60. Solution****Correct Answer: (B)**

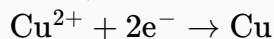
The anion of the compound B is  $[\text{Cr}(\text{C}_2\text{O}_4)_3]^{3-}$  or  $[\text{Cr}(\text{Ox})_3]^{3-}$ , where  $\text{Ox} \equiv \text{C}_2\text{O}_4^{2-}$ . Since such octahedral complexes have non-super-imposable mirror images, so they show optical isomerism.



**Q61. Solution****Correct Answer: (A)**

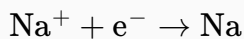
$$3F = 1 \text{ mol}$$

$$1F = 1/3 \text{ mol}$$



$$2F = 1 \text{ mol}$$

$$1F = 1/2 \text{ mol}$$



$$1F = 1 \text{ mol}$$

The mole ratio of Al, Cu and Na deposited at the respective cathode is  $\frac{1}{3} : \frac{1}{2} : 1$  or 2: 3: 6

**Q62. Solution****Correct Answer: (D)**

The electrovalent bond is favoured with a metal having low ionization energy and non-metal with high electron affinity.

The amount of energy released when one mole of an ionic compound is formed is called lattice energy. Higher the lattice energy more the stability of the ionic compound.

**Q63. Solution****Correct Answer: (A)**

For a spontaneous reaction,  $\Delta G < 0$ .

As per the Gibbs-Helmholtz equation,

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

When  $\Delta H$  is negative, i.e., the reaction is exothermic and  $\Delta S$  is positive, i.e., the disorder is increasing, the value of  $\Delta G$  will definitely be negative and the process will be spontaneous for all temperatures.

**Q64. Solution****Correct Answer: (A)**

$$\% \text{ N} = \frac{28}{22400} \times \frac{\text{Volume of N}_2 \text{ at STP (ml)}}{\text{Weight of organic compound}} \times 100$$

$$\% \text{ N} = \frac{28}{22400} \times \frac{112}{0.5} \text{ ml} \times 100 = 28 \%$$

**Q65. Solution****Correct Answer: (C)**

$$15 - 8 = 7$$

$$24 - 15 = 9$$

$8 - 3 = 5$   $34 - 24 = 10$  Obviously difference should be 11 & 13 instead of 10 & 14 . Therefore, 34 is the

$$48 - 34 = 14$$

$$63 - 48 = 15$$

wrong term.

**Q66. Solution****Correct Answer: (D)**

Gum is used to stick and needle is used to stitch.

**Q67. Solution****Correct Answer: (C)**

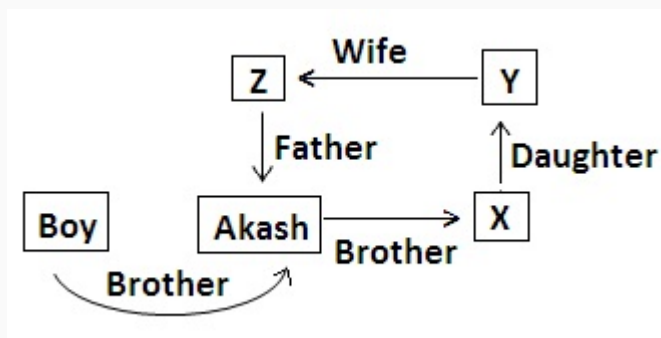
Socks are worn on feet, similarly gloves are worn on hands.

**Q68. Solution****Correct Answer: (A)**

$P + Q - R$  means  $P$  is the daughter of  $Q$  who is the husband of  $R$  i.e,  $R$  is the mother of  $P$ .

**Q69. Solution****Correct Answer: (C)**

According to the given question,



Father's wife of Akash is his mother. The daughter of his mother is his sister. His sister has two brothers one of whom is Akash and the other is the man he is referring to as the boy in the blue shirt.

Hence, the boy in the blue shirt is the younger brother of Akash.

So, the correct answer is an option (C).

**Q70. Solution****Correct Answer: (C)**

As per the given figure,

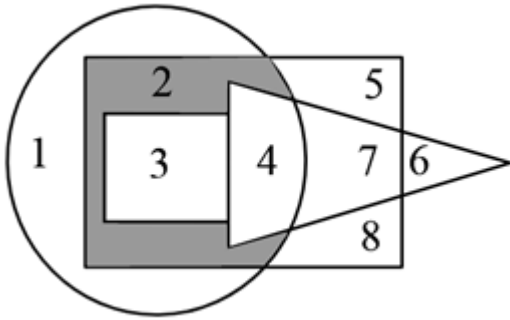
1, 2, 3, 4 is represented by rich persons.

3 is represented by researchers.

2, 3, 4, 5, 7, 8 is represented by surgeons.

4, 6, 7 is represented by engineers.

So, region 2 represents some surgeons who are neither engineers nor researchers.



Hence, 2 is the correct answer.

**Q71. Solution****Correct Answer: (B)**

The member is elected by the people of that particular constituency and represents those people in the legislative assembly and debates on issues related to his or her constituency. The MLA's position is like an MP, but the difference is only that MLA is at the state level and the MP is at the national level. All MPs and MLAs are in the elected house.

**Q72. Solution****Correct Answer: (A)**

According to the question,

$$A = 4B$$

$$B = \frac{C}{2}$$

$$C = 2.5 \times D$$

$$D = \frac{1}{4} \times E$$

$$A : B = 4 : 1 = 20 : 5$$

$$B : C = 1 : 2 = 5 : 10$$

$$C : D = 5 : 2 = 10 : 4$$

$$D : E = 1 : 4 = 4 : 16$$

So,

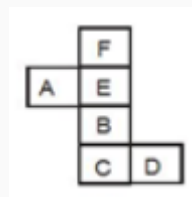
$$A : B : C : D : E = 20 : 5 : 10 : 4 : 16$$

From this ratio, it is clear that A is the heaviest.

**Q73. Solution**

**Correct Answer: (B)**

The given figure is



As per the given information, we have to find the box that forms a similar sequence as we will get after folding the given sheet of paper.

Here, in the given figure, the adjacent faces are not opposite, and mostly alternate faces are opposite to each other.

We can see that A, F, and B are adjacent to E.

Therefore,

C is opposite to E.

B is opposite to F.

A is opposite to D.

From the given figures:

As per dice 1: F and B cannot be adjacent to each other because B is opposite to F. So, the given dice is not correct.

As per dice 2: E, F, and D are adjacent to each other. So, the given dice is correct.

As per dice 3: E and C cannot be adjacent to each other because E is opposite to C. So, the given dice is not correct.

As per dice 4: D and A cannot be adjacent to each other because D is opposite to A. So, the given dice is not correct.

Therefore, only 2 is the correct dice.

So, option (B) is the correct answer.

Hence, this is the correct answer.

**Q74. Solution****Correct Answer: (B)**

According to the question:

The doctor goes to see the patient after every 3.30 hours.

The next visit is at 1.40 p.m. = 13.40.

The last visit before 13.40 =  $13.40 - 3.30 = 10.10$

But it's been 1.20 hours already. Hence, the present time at which information is given to the doctor is  $10.10 + 1.20 = 11.30$ .

Hence, the correct answer is 11.30.

**Q75. Solution****Correct Answer: (D)**

From the graph, it is clear that the ratio of import ( $I$ ) and export ( $E$ ) in the year 2001 is 6.5 i.e.

$$\frac{I}{E} = 6.5 \quad \text{--- (1)}$$

$$\text{Increased export, } E_1 = E + \frac{10}{100} E = \frac{11}{10} E$$

$$\text{Increased import, } I_1 = I + \frac{20}{100} I = \frac{12}{10} I$$

$$\text{Increased export, } E_1 = ₹ 50000$$

So,

$$\frac{11}{10} E = 50000$$

$$E = \frac{50000 \times 10}{11}$$

$$E = ₹ 45454.55$$

Using the given ratio of import and export and the increased import we get,

$$\frac{\frac{12}{10} I_1}{45454.55} = 6.5$$

$$I_1 = \frac{6.5 \times 45454.55 \times 10}{12}$$

$$I_1 = ₹ 246212.15$$

Hence, the required import = ₹ 246212.15

**Q76. Solution****Correct Answer: (B)**

According to II statement, the number of all the students 
$$= (10 + 49) - 1$$
  

$$= 58$$

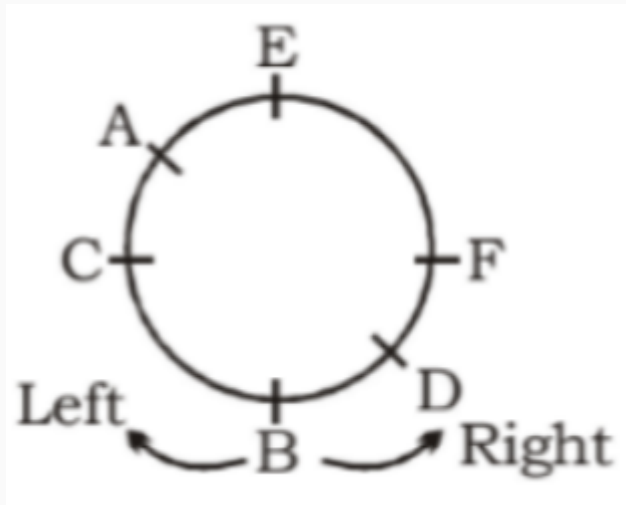
**Q77. Solution****Correct Answer: (A)**

To find the alphanumeric relationship in the given question, you have to know the place value of each of the given alphabets. The place value of C is 3, and it is one for A. Similarly, 7 is for G and 5 is for E. As we can see, the given numbers are nothing but the place values of the given alphabets.

$$31 = CA \quad GE = 75$$

$$89 = HI \quad DE = 45$$

Hence, HIDE is the correct answer to the given question.

**Q78. Solution****Correct Answer: (D)**

First we have to arrange B in between D and C then F is to the right of D then A between E and C.

**Q79. Solution****Correct Answer: (D)**

Kavya's birthday is on Tuesday 4th July. On the day of the week will be Anika's birthday in the same year, if Anika was born of 15th August?

4th July is Tuesday (Kavya's birthday)

Now, after every 7 days, Tuesday is on 11 July, 18 July, 25 July, 1 August, 8 August, and 15 August.

Therefore, Anika's birthday is on Tuesday 15 August.

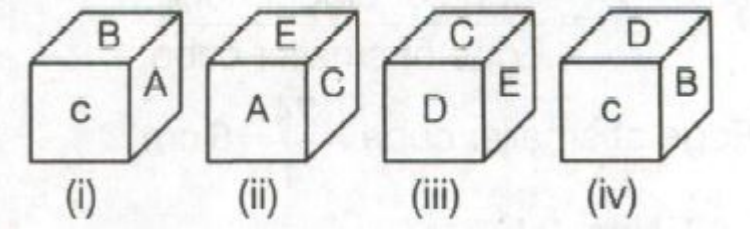
So, the required day is Tuesday.

Hence, this is the correct answer.

**Q80. Solution**

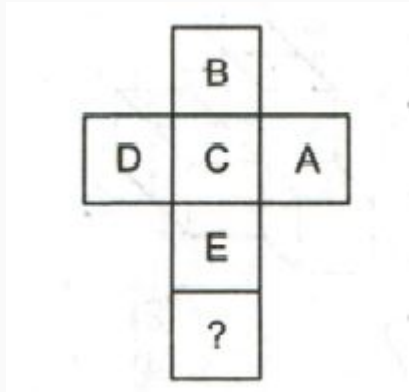
**Correct Answer: (C)**

The given question is



According to the given question, we have to find the letter opposite to D.

Dice can be shown as,



So, from the unfolded dice, it is clear that the letter opposite to

$D \leftrightarrow A$

$B \leftrightarrow E$

$C \leftrightarrow F$

So, the correct answer is A.

Hence, this is the correct answer.

**Q81. Solution****Correct Answer: (C)**

When two sentences are related to each other then we use a relative pronoun. Relative pronouns are used to avoid repetition. 'Who', 'whose', 'whom', and 'which' are examples of relative pronouns. The word 'which' is used to refer to things and the word 'who' is used to refer to people. Also, 'who' is used for nominative and accusative cases, 'whose' is used for genitive cases, and 'whom' is used for accusative cases.

Here, in the sentence the blank is referring to the subject so, we have to use such a pronoun that shows the subject hence, the use of the nominative case 'who' would be correct because 'who' is used as a subject in the sentence and 'whom' is an objective case pronoun.

**Q82. Solution****Correct Answer: (D)**

The phrase 'done to death' means 'killed or executed deliberately'. Another meaning of the same phrase is 'to do or repeat something so often that it becomes boring or unappealing'.

Thus, out of the given alternatives, we can conclude that the word 'murdered' is the most appropriate meaning of the given phrase. Hence, the correct answer is 'murdered'.

**Q83. Solution****Correct Answer: (B)**

The idiom, 'face the music' means to be confronted with the unpleasant consequences of one's own actions. From the given options 'get reprimanded' means to get rebuked or criticized. Therefore, the correct answer is to 'get reprimanded'.

**Q84. Solution****Correct Answer: (B)**

‘Vehement’ is an adjective which means to show a strong or intense feeling. Hence, this is the correct option. The word ‘Meek’ refers to a person who is quiet or gentle, and when someone gives no interest in someone then he is said to be ‘apathetic’. ‘Impotent’ refers to a feeling of helplessness.

**Q85. Solution****Correct Answer: (D)**

The most appropriate filler for the given blank is 'industrialised'.

Industries release chemicals in to our air, land and water which contaminate the earth causing acid rain. The other options 'cosmopolitan', 'growing' and 'developing' are related to growth and development but do not relate to pollution. So, the correct option is 'industrialised'.

**Q86. Solution****Correct Answer: (D)**

Fatal means causing death. Example: It was a fatal accident. In the given sentence, that was a fatal illness that raises concern among dog owners.

Hence, the correct answer is 'Dozens of dogs in Norway have recently been hit by a mysterious and at times, fatal illness, raising concerns among dog owners'.

**Q87. Solution****Correct Answer: (A)**

The first part of the given sentence contains an error.

The sentence is in the present perfect tense. The first part is in the simple present tense. So, the helping verb 'is' must be changed to 'has' to frame a correct sentence from the grammatical point of view.

Hence, this is the correct alternative.

**Q88. Solution****Correct Answer: (D)**

The correct word to be used is 'growth' which means an increase in size, number, value or strength. The word 'grow' means to become bigger.

For example: Children grow quickly.

**Q89. Solution****Correct Answer: (B)**

The error lies in the second part.

The subject of the sentence is 'a new wave high definition home decor products' which is singular, and so the verb must also be singular. However, the sentence uses 'include' which is a plural verb.

Therefore, we must replace 'include' with 'includes'.

Hence, the complete sentence is "A new wave of high definition home decor products has swept the market that includes products such as high definition paints and tiles".

**Q90. Solution****Correct Answer: (B)**

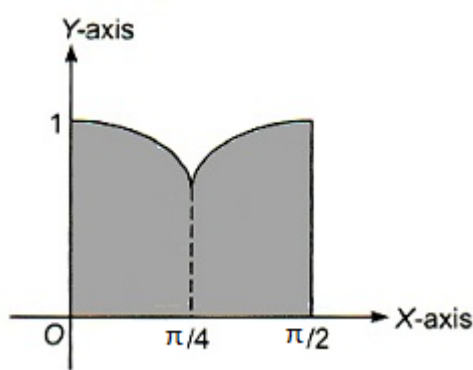
The only option word which cannot be made using the letters of the word 'RINTHEREOUT' is option (B), i.e. 'URBANE'. There is no 'B' or 'A' in the word 'RINTHEREOUT' but can be seen in 'URBANE'.

**Q91. Solution****Correct Answer: (C)**

$$f(x) = \begin{cases} \cos x & \text{for } 0 \leq x \leq \pi/4 \\ \sin x & \text{for } \pi/4 < x \leq \pi/2 \end{cases}$$

$$\therefore \text{ Required Area} = 2 \int_0^{\pi/4} \cos x dx = 2[\sin x]_0^{\pi/4}$$

$$; \quad = \sqrt{2} \text{ sq units}$$



$$\Rightarrow k = \sqrt{2}$$

$$\Rightarrow [k + 3] = [\sqrt{2} + 3] = 4$$

**Q92. Solution****Correct Answer: (B)**General Term of the expansion of  $(a - 2b)^n$ 

$$T_{r+1} = {}^nC_r(a)^{n-r}(-2b)^r$$

$$\text{hence } T_4 = {}^nC_3(a)^{n-3}(-2b)^3$$

$$\text{and } T_5 = {}^nC_4(a)^{n-4}(-2b)^4$$

$$\text{Since } T_4 + T_5 = 0$$

$$\Rightarrow {}^nC_3(a)^{n-3}(-2b)^3 + {}^nC_4(a)^{n-4}(-2b)^4 = 0$$

$$\Rightarrow (a)^{n-4}(-2b)^3[a {}^nC_3 + {}^nC_4(-2b)] = 0$$

$$\Rightarrow \frac{a}{b} = \frac{2 {}^nC_4}{{}^nC_3}$$

Using standard result

$$\frac{{}^nC_r}{{}^nC_{r-1}} = \frac{n-r+1}{r}$$

$$\Rightarrow \frac{a}{b} = \frac{2(n-4+1)}{4}$$

$$\Rightarrow \frac{a}{b} = \frac{(n-3)}{2}$$

**Q93. Solution****Correct Answer: (A)**

The general equation of a second degree

$$ax^2 + 2hxy + by^2 + 2gx + 2fy + c = 0,$$

represents a circle, if  $h = 0$ ,  $a = b$  and  $a(g^2 + f^2 - c) > 0$ 

Hence, for the equation

$$px^2 + (2 - q)xy + 3y^2 - 6qx + 30y + 6 = 0,$$

we have

$$h = 2 - q = 0 \Rightarrow q = 2 \text{ and } a = b \Rightarrow p = 3.$$

Also, for the values of  $p$  and  $q$  the circle

$$3x^2 + 3y^2 - 12x + 30y + 6 = 0$$

$$\Rightarrow x^2 + y^2 - 4x + 10y + 2 = 0$$

$$g^2 + f^2 - c = (-2)^2 + 5^2 - 2 = 4 + 25 - 2 = 27 > 0$$

For which

$$\therefore p + q = 3 + 2 = 5$$

**Q94. Solution****Correct Answer: (C)**

Given lines are  $x + y - 1 = 0$ ,  $x - y - 1 = 0$  and  $y + 1 = 0$  These lines form a triangle the total number of circles that touches all the three sides of a triangle are 4. [ $\because$  One is incircle of a triangle and when we extend the sides of a triangle we will get the three ex-circle which touches all sides of a triangle]

**Q95. Solution****Correct Answer: (C)**

Let  $z = x + iy$ .

Then

$$z + iz = x + iy + i(x + iy) = (x - y) + i(x + y)$$

$$\text{and } iz = i(x + iy) = -y + ix.$$

Then, the area of the triangle formed by these lines is

$$\Delta = \frac{1}{2} \begin{vmatrix} x & y & 1 \\ (x - y) & (x + y) & 1 \\ -y & x & 1 \end{vmatrix}$$

Applying  $R_2 \leftrightarrow R_2 - (R_1 + R_3)$ ,

$$\Delta = \frac{1}{2} \begin{vmatrix} x & y & 1 \\ 0 & 0 & -1 \\ -y & x & 1 \end{vmatrix}$$

Expanding along  $R_2$ , we get

$$\Delta = \frac{1}{2} (x^2 + y^2)$$

$$\Rightarrow \Delta = \frac{1}{2} |z|^2$$

$$\Rightarrow \frac{1}{2} |z|^2 = 200 \text{ (given)}$$

$$\Rightarrow |z|^2 = 400$$

$$\Rightarrow |z| = 20$$

$$\therefore 3|z| = 3 \times 20 = 60$$

**Q96. Solution****Correct Answer: (C)**

$$I = \int_0^{2\pi} [\sin 2x(1 + \cos 3x)] dx \quad \dots (1)$$

$$I = \int_0^{2\pi} [\sin(2\pi - 2x)(1 + \cos(2\pi - 3x))] dx$$

Applying  $\left( \int_0^a f(x) = \int_0^a f(a-x) dx \right)$

$$I = \int_0^{2\pi} [-\sin 2x(1 + \cos 3x)] dx \quad \dots (2)$$

Adding (1) and (2)

$$2I = \int_0^{2\pi} ([\sin 2x(1 + \cos 3x)] + [-\sin 2x(1 + \cos 3x)]) dx$$

$$\Rightarrow 2I = \int_0^{2\pi} -1 dx \quad \left\{ \because [x] + [-x] = \begin{cases} 0 & : x \in \mathbb{I} \\ -1 & : x \notin \mathbb{I} \end{cases} \right.$$

$$\Rightarrow 2I = (-x)_0^{2\pi}$$

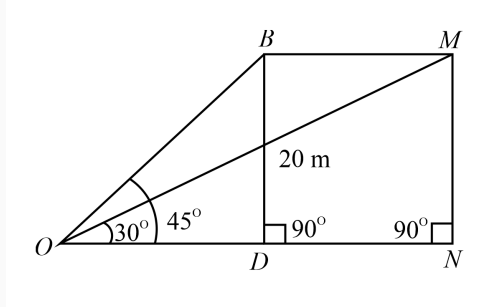
$$\Rightarrow 2I = -2\pi$$

$$\Rightarrow I = -\pi$$

**Q97. Solution****Correct Answer: (A)**

Let the bird be perched at  $B$ , the top of the tree  $BD$  and  $O$  be the observer. then,  $\angle BOD = 45^\circ$  and  $BD = 20\text{ m}$ .

Now, the bird flying horizontally reaches  $M$  in  $1\text{ s}$ .



Then,  $\angle MON = 30^\circ$ , where,  $MN \perp ON$

Now,  $BD = MN = 20\text{ m}$

From triangle  $BOD$ .

$$\tan 45^\circ = \frac{BD}{OD} = \frac{20}{OD}$$

$$\Rightarrow OD = 20\text{ m}$$

Now, from  $\triangle MON$

$$\tan 30^\circ = \frac{MN}{ON}$$

$$= \frac{20}{20+DN}$$

$$\Rightarrow \frac{1}{\sqrt{3}} = \frac{20}{20+DN}$$

$$\Rightarrow 20 + DN = 20\sqrt{3}$$

$$\Rightarrow DN = 20(\sqrt{3} - 1)$$

$$= 20 \times 0.732$$

$$= 14.64\text{ m}$$

Now,

$$\text{Speed} = \frac{\text{distance}}{\text{time}}$$

$$= \frac{BM}{1} = \frac{DN}{1}$$

$$= 14.64\text{ m/s}$$

**Q98. Solution****Correct Answer: (B)**

$$xy = 1$$

$$\therefore y = \frac{1}{x}$$

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

$$\therefore \text{Slope of the normal} = x^2$$

Slope of the line  $ax + by + c = 0$  is  $-\frac{a}{b}$ .

Since the line  $ax + by + c = 0$  is a normal to the curve  $xy = 1$ ,  $x^2 = -\frac{a}{b}$

For this condition to hold true, either  $a < 0$ ,  $b > 0$  or  $b < 0$ ,  $a > 0$

**Q99. Solution****Correct Answer: (A)**

$$\tan^{-1}\left(\frac{1}{2}\right) + \tan^{-1}\left(\frac{1}{5}\right) + \tan^{-1}\left(\frac{1}{8}\right)$$

$$= \tan^{-1}\left[\frac{\frac{1}{2} + \frac{1}{5}}{1 + \frac{1}{2} \cdot \frac{1}{5}}\right] + \tan^{-1}\left(\frac{1}{8}\right)$$

$$\text{math> [ } \therefore \tan^{-1} x + \tan^{-1} y = \tan^{-1} \frac{x+y}{1-xy} ]$$

$$= \tan^{-1}\left[\frac{\frac{5+2}{10}}{\frac{10-1}{10}}\right] + \tan^{-1}\frac{1}{8}$$

$$= \tan^{-1}\left[\frac{7}{10} \times \frac{10}{9}\right] + \tan^{-1}\frac{1}{8}$$

$$= \tan^{-1}\frac{7}{9} + \tan^{-1}\frac{1}{8}$$

$$= \tan^{-1}\frac{7}{9} + \tan^{-1}\frac{1}{8}$$

$$= \tan^{-1}\left[\frac{\frac{7}{9} + \frac{1}{8}}{1 - \frac{7}{9} \cdot \frac{1}{8}}\right]$$

$$= \tan^{-1}\left[\frac{\frac{56+9}{72}}{\frac{72-7}{72}}\right]$$

$$= \tan^{-1}\left[\frac{65}{72} \times \frac{72}{65}\right]$$

$$= \tan^{-1}(1)$$

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

**Q100. Solution****Correct Answer: (A)**

$(p \wedge q) \Leftrightarrow (r \wedge q)$  is equivalent to

$$[\sim(p \wedge q) \vee (r \wedge q)] \wedge [\sim(r \wedge q) \vee (p \wedge q)]$$

**Q101. Solution****Correct Answer: (D)**

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

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

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

$$\text{Now, } A^3 = \begin{bmatrix} 0 & 0 & 1 \\ 0 & 1 & 2 \\ 1 & -1 & 1 \end{bmatrix} \begin{bmatrix} 1 & -1 & 1 \\ 2 & -1 & 0 \\ 1 & 0 & 0 \end{bmatrix}, \{\because A^3 = A^2 \cdot A\}$$

$$\Rightarrow A^3 = \begin{bmatrix} 1 & 0 & 0 \\ 4 & -1 & 0 \\ 1 & 0 & 1 \end{bmatrix}$$

$$\text{Now, } A^6 = A^3 \cdot A^3$$

$$\Rightarrow A^6 = \begin{bmatrix} 1 & 0 & 0 \\ 4 & -1 & 0 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} 1 & 0 & 0 \\ 4 & -1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

$$\Rightarrow A^6 = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

$$\text{Also, } A^6 = I$$

$$\Rightarrow |A| \neq 0$$

So,  $A$  is non-singular.

$$\Rightarrow A^6 = I$$

$$\text{Also, } AA^{-1} = A^{-1}A = I$$

$$\Rightarrow A^{-1}A^6 = A^{-1}I$$

$$\Rightarrow A^5 = A^{-1}$$

**Q102. Solution****Correct Answer: (B)**

The two curves intersect at  $(a, 2a)$  and  $(a, -2a)$

But  $P = (a, 2a)$

equation of normal to  $y^2 = 4ax$  at  $(a, 2a)$  is:

$$y - 2a = -(x - a)$$

and equation of normal to a  $y^2 = 4x^3$  at  $(a, 2a)$  is:

$$y - 2a = -\frac{1}{3}(x - a)$$

$$\therefore A = (3a, 0) \text{ and } B = (7a, 0)$$

$$\therefore \text{Mid point of } AB = (5a, 0)$$

**Q103. Solution****Correct Answer: (C)**

Total number of permutations

$$= 0 + k + k^2 + k^3 + \dots + k^r$$

( For one place we have  $k$  choices and so on)

$$= \frac{k(k^r - 1)}{k - 1}.$$

**Q104. Solution****Correct Answer: (D)**

Let  $\alpha$ ,  $\beta$  and  $\gamma, \delta$  are the roots of the equations  $x^2 + ax + b = 0$  and  $x^2 + bx + a = 0$  respectively.

$$\therefore \alpha + \beta = -a, \alpha\beta = b \text{ and } \gamma + \delta = -b, \gamma\delta = a.$$

$$\text{Given } \alpha - \beta = \gamma - \delta \Rightarrow (\alpha - \beta)^2 = (\gamma - \delta)^2$$

$$\Rightarrow (\alpha + \beta)^2 - 4\alpha\beta = (\gamma + \delta)^2 - 4\gamma\delta$$

$$a^2 - 4b = b^2 - 4a \Rightarrow (a^2 - b^2) + 4(a - b) = 0$$

$$\Rightarrow a + b + 4 = 0. (\because a \neq b)$$

**Q105. Solution****Correct Answer: (A)**

Number is divisible by 4, if last two digits are 12, 24, 32 and 52. Remaining 3 place will be filled by 3! ways.

$$\begin{aligned}\therefore \text{Favourable outcomes} &= 3! \times 4 \\ \text{Hence, required probability} &= \frac{3! \times 4}{5!} \\ &= \frac{3! \times 4}{5 \times 4 \times 3!} = \frac{1}{5}\end{aligned}$$

**Q106. Solution****Correct Answer: (A)**

$$ab = 1$$

As  $a^4$  &  $b^4$  is always positive, so using A. M.  $\geq$  G. M

$$\frac{\frac{1}{a^4} + \frac{1}{4b^4}}{2} \geq \left( \frac{1}{a^4} \cdot \frac{1}{4b^4} \right)^{\frac{1}{2}}$$

$$\frac{1}{a^4} + \frac{1}{4b^4} \geq 2 \left( \frac{1}{4} \right)^{\frac{1}{2}}$$

$$\frac{1}{a^4} + \frac{1}{4b^4} \geq 1$$

So, minimum value is 1.

**Q107. Solution****Correct Answer: (A)**

The ascending order of the given data are

34, 38, 42, 44, 46, 48, 54, 55, 63, 70

$$\text{Hence, Median } M = \frac{46+48}{2} = 47$$

$$\therefore \text{Mean deviation} = \frac{\sum |x_i - M|}{n}$$

$$= \frac{\sum |x_i - 47|}{n}$$

$$= \frac{13+9+5+3+1+1+7+8+16+23}{10}$$

$$= 8.6$$

**Q108. Solution**

**Correct Answer: (A)**

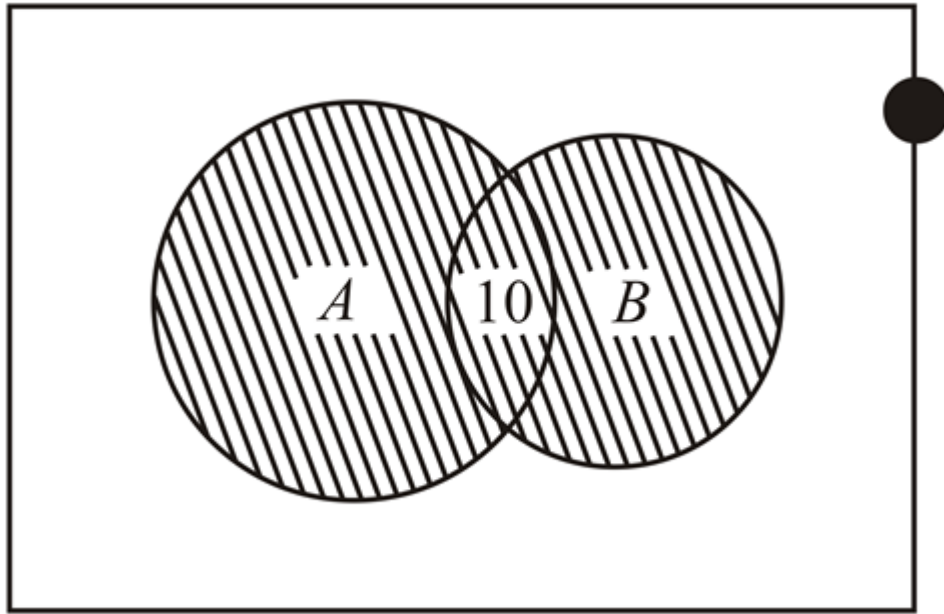
Let  $F$  = the set of people who speak French and

$S$  = the set of people who speak Spanish

Then,  $n(F) = 50$ ,  $n(S) = 20$ ,  $n(F \cap S) = 10$

As  $n(F \cup S) = n(F) + n(S) - n(F \cap S)$

$= 50 + 20 - 10 = 60$



Hence, 60 people speak at least one of these two languages.

**Q109. Solution****Correct Answer: (A)**

Let the equation of the given line will be

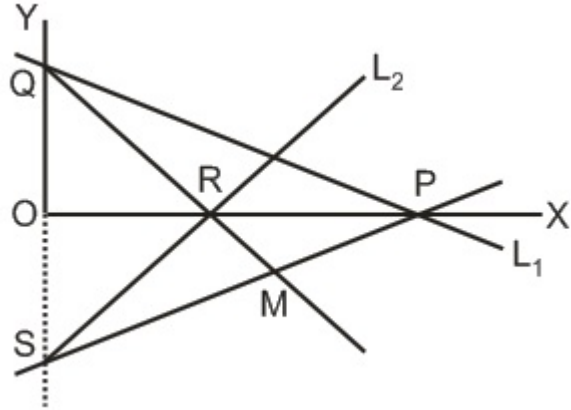
$$; L_1 \equiv ax + by + c = 0$$

$$\therefore P = \left(-\frac{c}{a}, 0\right), Q = \left(0, -\frac{c}{b}\right).$$

Any line  $L_2$  perpendicular to the line  $L_1$  is

$$; L_2 \equiv bx - ay + \lambda = 0$$

$$\therefore R = \left(-\frac{\lambda}{b}, 0\right), S = \left(0, \frac{\lambda}{a}\right)$$



;

The equation of the line PS is

$$y - 0 = \frac{0 - \frac{\lambda}{a}}{-\frac{c}{a} - 0} \left(x + \frac{c}{a}\right),$$

$$\text{i.e., } y = \frac{\lambda}{c} \left(x + \frac{c}{a}\right) \quad \dots(1)$$

The equation of the line QR is

$$; y - 0 = \frac{0 - \left(-\frac{c}{b}\right)}{-\frac{\lambda}{b} - 0} \left(x + \frac{\lambda}{b}\right)$$

$$\text{or } y = \frac{c}{\lambda} \left(x + \frac{\lambda}{b}\right),$$

$$\text{i.e., } y = \frac{-c}{\lambda} x - \frac{c}{b} \quad \dots(2)$$

The locus of the point of intersection of (1) and (2) is obtained by eliminating  $\lambda$  from (1) and (2).

$$\text{From (2), } y + \frac{c}{b} = -\frac{c}{\lambda} x$$

Multiplying (1) and this, we get

$$; y \left(y + \frac{c}{b}\right) = \frac{\lambda}{c} \left(x + \frac{c}{a}\right) \cdot \frac{-cx}{\lambda}$$

$$\text{or } y^2 + \frac{c}{b}y = -x \left(x + \frac{c}{a}\right)$$

$$\text{or } x^2 + y^2 + \frac{c}{a}x + \frac{c}{b}y = 0$$

**Q110. Solution****Correct Answer: (C)**

$$\begin{aligned}
& \lim_{x \rightarrow 0} \frac{\sqrt{1+x \sin x} - \sqrt{\cos x}}{\tan^2 \frac{x}{2}} \\
&= \lim_{x \rightarrow 0} \frac{1+x \sin x - \cos x}{\tan^2 \frac{x}{2} (\sqrt{1+x \sin x} + \sqrt{\cos x})} \\
&= \lim_{x \rightarrow 0} \frac{x \sin x + 2 \sin^2 \frac{x}{2}}{\tan^2 \frac{x}{2} (\sqrt{1+x \sin x} + \sqrt{\cos x})} \\
&= \lim_{x \rightarrow 0} \frac{\frac{\sin x}{x} + \frac{2 \sin^2 \frac{x}{2}}{x^2}}{\frac{\tan^2 \frac{x}{2}}{x^2} (\sqrt{1+x \sin x} + \sqrt{\cos x})} \\
&= \lim_{x \rightarrow 0} \left( \frac{\frac{\sin x}{x} + \frac{2 \sin^2 \frac{x}{2}}{x^2} \times \frac{1}{4}}{\frac{\tan^2 \frac{x}{2}}{x^2} \times \frac{1}{2} (\sqrt{1+x \sin x} + \sqrt{\cos x})} \right) \\
&= \frac{1 + 2 \times 1 \times \frac{1}{4}}{1 \times \frac{1}{4} (\sqrt{1+0} + \sqrt{1})} \\
&= 3
\end{aligned}$$

**Q111. Solution****Correct Answer: (A)**

$$f(x) = \frac{x|x|}{2} + \cos x + 1$$

$$f(x) = \begin{cases} \frac{x^2}{2} + \cos x + 1, & x \geq 0 \\ -\frac{x^2}{2} + \cos x + 1, & x < 0 \end{cases}$$

Case 1.

$g(x) = x^2$ ,  $h(x) = \cos x$  are both continuous functions for  $x \in R$  and  $f(x)$  is continuous for  $x \in R$ .

$f(x) \rightarrow \infty$  as  $x \rightarrow \infty$  and

$f(x) \rightarrow -\infty$  as  $x \rightarrow -\infty$ .

$f(x)$  is an onto function, since range is same as co-domain.

Case 2.

(A)  $x > 0$ 

$$f'(x) = x - \sin x$$

$$f'(x) > 0, \forall x > 0$$

(B)  $x < 0$ 

$$f'(x) = -x - \sin x$$

Let  $x = -\delta$ ,  $\delta > 0$ 

$$f'(-\delta) = \delta + \sin \delta = \begin{cases} > 0 & \delta \geq 1, \text{ since } -1 \leq \sin \delta \leq 1 \\ > 0 & 0 < \delta < 1, \text{ since } \delta, \sin \delta > 0 \end{cases}$$

$f(x)$  is strictly increasing in its domain.

Therefore,  $f(x)$  is one-one function.

**Q112. Solution****Correct Answer: (B)**

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

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

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

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

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

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

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

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

Which is linear in  $V$ .

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

So, the solution is

$$\begin{aligned} x^3 V &= \int x^3 \cdot \frac{3}{x^3} \cos x \, dx + c \\ &= 3 \sin x + c \end{aligned}$$

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

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

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

**Q113. Solution****Correct Answer: (B)**

$$\sqrt{\sin x} - \frac{1}{\sqrt{\sin x}} = \cos x$$

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

$$\text{Let } \sin x = t$$

$$t + \frac{1}{t} - 2 = 1 - t^2$$

$$t^2 - 2t + 1 = t(1 - t)(1 + t)$$

$$\Rightarrow (1 - t)[(1 - t) - t(1 + t)] = 0$$

$$\Rightarrow (1 - t)[1 - 2t - t^2] = 0$$

$$t = 1, \quad t^2 + 2t - 1 = 0$$

$$\sin x = 1, \sin x = \frac{-2 \pm \sqrt{4+4}}{2}$$

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

$$\sin x = 1, \Rightarrow x = \frac{\pi}{2}$$

$$\text{also } \sin x = \sqrt{2} - 1 \text{ and } \cos x < 0$$

$$\Rightarrow \text{one solution is } (0, 2\pi)$$

**Q114. Solution****Correct Answer: (B)**

$$\mathbf{b} = \pm 3(2\hat{\mathbf{i}} + 3\hat{\mathbf{j}} + 6\hat{\mathbf{k}})$$

Given that  $\mathbf{a} = 2\hat{\mathbf{i}} + 3\hat{\mathbf{j}} + 6\hat{\mathbf{k}}$  and  $|\mathbf{b}| = 21$  Now, taking option (b) Let  $|\mathbf{b}| = 3\sqrt{4 + 9 + 36} = 21$  and  $\therefore \mathbf{a}$  and  $\mathbf{b} = \pm 3\mathbf{a}$

$\mathbf{b}$  are collinear and magnitude of  $\mathbf{b}$  is 21 .

**Q115. Solution****Correct Answer: (D)**

Given differential equation is  $x \frac{dy}{dx} = y + x e^{\frac{y}{x}}$

$$\frac{dy}{dx} = \frac{y}{x} + e^{\frac{y}{x}}$$

It is homogeneous differential equation.

$$\therefore \text{Put } y = vx \Rightarrow \frac{dy}{dx} = v + \frac{dv}{dx}$$

$$\therefore v + x \frac{dv}{dx} = \frac{vx}{x} + e^{\frac{vx}{x}}$$

$$\Rightarrow v + x \frac{dv}{dx} = v + e^v$$

$$\Rightarrow x \frac{dv}{dx} = e^v$$

$$\Rightarrow e^{-v} dv = \frac{1}{x} dx$$

On integrating both sides, we get

$$-e^{-v} = \log x + c$$

$$-e^{-\frac{y}{x}} = \log x + c$$

Given,  $y(1) = 0$

$$\therefore e^{-\frac{0}{1}} = \log 1 + c$$

$$-1 = 0 + c \Rightarrow c = -1$$

$$\therefore -e^{-\frac{y}{x}} = \log x - 1$$

$$\Rightarrow 1 = \log x + e^{-\frac{y}{x}}$$

**Q116. Solution****Correct Answer: (C)**

$$C = \pm \sqrt{a^2 m^2 + b^2}$$

$$= \pm \sqrt{4(16) + 1} = \pm \sqrt{65}$$

**Q117. Solution****Correct Answer: (D)**

We have given that  $f(x) = \sqrt{1 - \sqrt{1 - \sqrt{1 - x^2}}}$

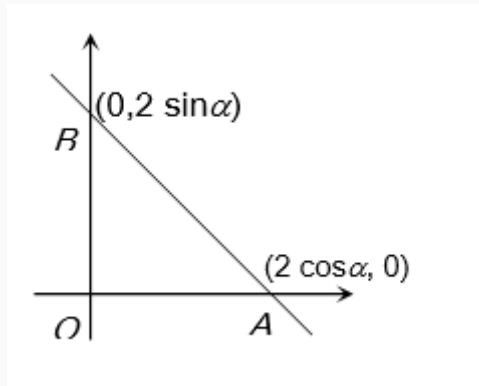
$$\therefore 1 - \sqrt{1 - \sqrt{1 - x^2}} \geq 0$$

$$\Rightarrow \sqrt{1 - \sqrt{1 - x^2}} \leq 1$$

$$1 - \sqrt{1 - x^2} \leq 1$$

$$\sqrt{1 - x^2} \geq 0$$

$$1 - x^2 \geq 0 \Rightarrow |x| \leq 1$$

**Q118. Solution****Correct Answer: (A)**

$$\Delta = \frac{1}{2}(2 \sin \alpha \cdot 2 \cos \alpha) = \sin 2\alpha$$

**Q119. Solution****Correct Answer: (D)**

If  $x, y, z$  are in A.P. , then  $y - x = z - y \Rightarrow 2y = x + z$

$$\therefore 2 \log \frac{3b}{5c} = \log \frac{5c}{a} + \log \frac{a}{3b}$$

$$\Rightarrow \log \left( \frac{3b}{5c} \right)^2 = \log \left( \frac{5c}{a} \cdot \frac{a}{3b} \right) \Rightarrow$$

$$\left( \frac{3b}{5c} \right)^2 = \frac{5c}{a} \cdot \frac{a}{3b} \dots\dots\dots \left\{ \because \log(x^k) = k(\log x) \text{ and } \log(x) + \log(y) = \log(xy) \right\}$$

$$\Rightarrow \frac{9b^2}{25c^2} = \frac{5c}{3b} \Rightarrow 27b^3 = 125c^3 \Rightarrow 3b = 5c$$

Also

$$b^2 = ac,$$

So,

$$9ac = 25c^2$$

or

$$9a = 25c.$$

$\therefore$

$$\frac{9a}{5} = 5c = 3b$$

$\Rightarrow$

$$\frac{a}{5} = \frac{b}{3} = \frac{c}{5}$$

$\Rightarrow$

$$b + c < a.$$

**Q120. Solution****Correct Answer: (D)**

$$\frac{1}{1 \cdot 2} - \frac{1}{2 \cdot 3} + \frac{1}{3 \cdot 4} - \dots \text{ upto } \infty$$

$$\frac{(2-1)}{1 \cdot 2} - \frac{(3-2)}{2 \cdot 3} + \frac{(4-3)}{3 \cdot 4} - \dots \text{ upto } \infty$$

$$= \left(1 - \frac{1}{2}\right) - \left(\frac{1}{2} - \frac{1}{3}\right) + \left(\frac{1}{3} - \frac{1}{4}\right) - \dots \text{ upto } \infty$$

$$= 1 - \frac{1}{2} - \frac{1}{2} + \frac{1}{3} + \frac{1}{3} - \frac{1}{4} - \frac{1}{4} + \frac{1}{5} \dots \text{ upto } \infty$$

$$= \left(1 - \frac{1}{2} + \frac{1}{3} - \frac{1}{4} + \dots \text{ upto } \infty\right) + \left(-\frac{1}{2} + \frac{1}{3} - \frac{1}{4} + \frac{1}{5} \dots \text{ upto } \infty\right)$$

$$= \left(1 - \frac{1}{2} + \frac{1}{3} - \frac{1}{4} + \dots \text{ upto } \infty\right) + \left(-1 + 1 - \frac{1}{2} + \frac{1}{3} - \frac{1}{4} + \frac{1}{5} \dots \text{ upto } \infty\right)$$

$$= \log_e(1+1) + (-1 + \log_e(1+1))$$

$$(\because \log_e(1+x)) = x - \frac{x^2}{2} + \frac{x^3}{3} - \frac{x^4}{4} + \dots \text{ upto } \infty$$

$$= \log_e 2 - 1 + \log_e 2$$

$$= 2\log_e 2 - 1 = \log_e 4 - \log_e e = \log_e(4/e) \quad \left\{ \because \log(x) - \log(y) = \log\left(\frac{x}{y}\right) \right\}$$

**Q121. Solution****Correct Answer: (C)**

$$\overrightarrow{AB} = 4\hat{i} - 12\hat{j} - 3\hat{k}$$

$$\overrightarrow{CD} = 3\hat{i} + 4\hat{j} - 12\hat{k}$$

$$\overrightarrow{AC} = 3\hat{i} - 7\hat{j} + 2\hat{k}$$

$$\overrightarrow{BD} = 2\hat{i} + 9\hat{j} - 7\hat{k}$$

$$\therefore d_1 = \frac{\left(\overrightarrow{AB} \times \overrightarrow{CD}\right) \cdot \overrightarrow{AC}}{\overrightarrow{AB} \times \overrightarrow{CD}} = \frac{\left(\overrightarrow{AB} \times \overrightarrow{CD}\right) \cdot \overrightarrow{BD}}{\overrightarrow{AB} \times \overrightarrow{CD}}$$

$$\therefore d_1 = \frac{23}{13}$$

**Q122. Solution****Correct Answer: (B)**

The given equation is  $\frac{dy}{dx} = \frac{2-y}{x^2}$

$$\Rightarrow \frac{dy}{dx} + y\left(\frac{1}{x^2}\right) = \frac{2}{x^2}$$

$$\text{Integrating factor} = e^{\int \frac{dx}{x^2}} = e^{-\frac{1}{x}}$$

$$\therefore \text{the solution is } (y)\left(e^{-\frac{1}{x}}\right) = \int \frac{2}{x^2} \left(e^{-\frac{1}{x}}\right) dx$$

$$\text{Let } -\frac{1}{x} = t$$

$$\frac{dx}{x^2} = dt$$

$$\text{i.e. } y \cdot e^{-\frac{1}{x}} = 2 \int e^t dt$$

$$\Rightarrow ye^{-\frac{1}{x}} = 2e^t + c \Rightarrow ye^{-\frac{1}{x}} = 2e^{-\frac{1}{x}} + c$$

$$\Rightarrow y = 2 + c \cdot e^{\frac{1}{x}}$$

Since, the curve is passing through  $P(1, 4)$

$$\Rightarrow \frac{2}{e} = c$$

$$\Rightarrow y = 2 + \frac{2}{e} \cdot e^{\frac{1}{x}}$$

**Q123. Solution****Correct Answer: (A)**

$$f(x) = e^x \cos x$$

$$f'(x) = -e^x \sin x + e^x \cos x$$

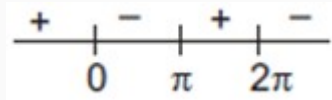
$$f'(x) = e^x (\cos x - \sin x)$$

Let  $g(x) = e^x [\cos x - \sin x]$  is the slope of the tangent to the curve, then,

$$g'(x) = e^x [-\sin x - \cos x] + e^x [\cos x - \sin x]$$

$$= e^x [-\sin x - \cos x + \cos x - \sin x]$$

$$g'(x) = -2e^x \sin x \Rightarrow x = 0, \pi, 2\pi$$



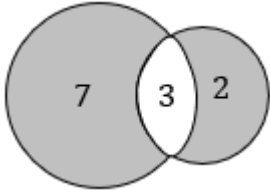
So it is minima at  $x = \pi$

**Q124. Solution****Correct Answer: (C)**

$$\text{Here, } P(R) = \frac{10}{100} = 0.1, P(F) = \frac{5}{100} = 0.05$$

$$P(F \cap R) = \frac{3}{100} = 0.03$$

$$\therefore \text{Required probability} = P(R) + P(F) - 2P(F \cap R) \\ = 0.1 + 0.05 - 2(0.03) = 0.09.$$

**Q125. Solution****Correct Answer: (D)**

$$\text{Consider } \lim_{x \rightarrow 0} \frac{\sqrt{1 - \cos 2x}}{\sqrt{2x}}$$

$$= \lim_{x \rightarrow 0} \frac{\sqrt{2}|\sin x|}{\sqrt{2x}} = \lim_{x \rightarrow 0} \frac{|\sin x|}{x}$$

$$\text{Let } f(x) = \frac{|\sin x|}{x}$$

$$\text{Now, LHL} = \lim_{h \rightarrow 0} \frac{|\sin(0-h)|}{0-h} = \lim_{h \rightarrow 0} \frac{\sin h}{-h} = -1$$

$$\text{and RHL} = \lim_{h \rightarrow 0} \frac{|\sin(0+h)|}{0+h} = \lim_{h \rightarrow 0} \frac{\sin h}{h} = 1$$

$$\therefore \text{LHL} \neq \text{RHL}$$

$$\text{Hence, } \lim_{x \rightarrow 0} \frac{|\sin x|}{x} \text{ does not exist}$$

**Q126. Solution****Correct Answer: (A)**

$$\text{We have, } g(n) = \begin{cases} n+1, & \text{if } n \text{ odd} \\ n-1, & \text{if } n \text{ even} \end{cases}$$

$$f(g(1)) = f(2) = 1$$

$$f(g(2)) = f(1) = 1$$

$$\therefore f(g(x)) \text{ is many one.}$$

$$f(g(2k)) = f(2k-1) = k$$

$$f(g(2k+1)) = f(2k+2) = k+1$$

$$\therefore f(g(x)) \text{ is onto.}$$

**Q127. Solution****Correct Answer: (C)**

$$\because A^T |A| B = A |B| B^T$$

Taking determinant on both sides, we get,

$$A^T |A| |B| = |A| |B| B^T$$

$$\Rightarrow |A| = 2$$

$$\text{Now, } AB^{-1} \text{adj}(A^T B)^{-1}$$

$$A \times \frac{1}{|B|} \times \frac{1}{|\text{adj}(A^T B)|}$$

$$|A| \times \frac{1}{|B|} \times \frac{1}{|A^T B|^2} = \frac{|A|}{|B|^3 |A|^2} = \frac{1}{16}$$

$$\text{i.e. } 4K = \frac{1}{4} = 0.25$$

**Q128. Solution****Correct Answer: (C)**

By comparing the given equation with general degree of second degree of pair of lines

$$ax^2 + 2hxy + by^2 + 2gx + 2fy + c = 0, \text{ we get}$$

$$\text{Here, } a = 2, b = 5, c = 7, h = 2, g = -2, f = -11$$

To eliminate 1st degree terms origin is to be shifted to the point of intersection of pair of lines

$$\left( \frac{hf - bg}{ab - h^2}, \frac{gh - af}{ab - h^2} \right) = \left( \frac{-22 + 10}{10 - 4}, \frac{-4 + 22}{10 - 4} \right) = (-2, 3)$$

**Q129. Solution****Correct Answer: (C)**

$\vec{p} \times \vec{q}$  is perpendicular to  $\vec{p}$  and  $\vec{q}$ . So  $\vec{p}, \vec{q}, \vec{p} \times \vec{q}$  are non-coplanar. Three non-coplanar vectors are linearly independent.

Therefore, the given linear relation is possible only when  $b - c = 0$ ,  $c - a = 0$  and  $a - b = 0$ . So,  $a = b = c$ .

Hence, the triangle is equilateral triangle.

**Q130. Solution****Correct Answer: (D)**

Given, The required equation of plane bisects the given two planes.  $\therefore \frac{3x-6y+2z+5}{\sqrt{3^2+(-6)^2+(2)^2}} = \pm \frac{4x-12y+3z-3}{\sqrt{4^2+(-12)^2+3^2}}$

$$\frac{3x-6y+2z+5}{\sqrt{49}} = \pm \frac{4x-12y+3z-3}{\sqrt{169}} \Rightarrow \frac{3x-6y+2z+5}{7} = \pm \frac{4x-12y+3z-3}{13}$$

$39x - 78y + 26z + 65 = \pm 28x - 84y + 21z - 21$  Now, solving for the positive value, we get

$39x - 78y + 26z + 65 \dots\dots\dots$  (i) or,  $11x + 6y + 5z + 36 = 0$  And for negative value, we get

$39x - 78y + 26z + 65 = -(28x - 84y + 21z - 21)$  or,  $67x - 162y + 47z + 44 = 0 \dots\dots(ii)$   $\therefore$  None of the answer matches with the given equation. Hence, Option D is correct in this case.