

EXPLANATIONS

$$1. \quad \frac{1+i}{1-i} = \frac{1+i}{1-i} \cdot \frac{1+i}{1+i}$$

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

$$= \cos \frac{\pi}{2} - i \sin \frac{\pi}{2}$$

Hence, amplitude of the given number is  $\frac{\pi}{2}$   
(principal value)

$$2. \text{ Here, } ac = bc$$

$$\Rightarrow c(a-b) = 0$$

$$\Rightarrow a-b=0 \quad \text{only if } c \neq 0$$

( $\therefore$  product of two real numbers cannot be zero unless atleast one of them is zero)

$$3. \text{ If } x+2=y, \text{ then } y=\alpha, \beta$$

$$\Rightarrow x+2=\alpha, \beta$$

$$\Rightarrow x=\alpha-2, \beta-2$$

4. Since, the coefficients are not given to be real, we cannot conclude that the other root is  $3+4i$ . In fact, nothing is known about the second root as coefficient are not real.

5. Between any two distinct rational number there lie infinitely many rational (and also infinitely many irrational) numbers.

6. Let  $z = x + yi$ ;  $x, y, \in \mathbb{R}$ , then

$$\left| \frac{z-4}{z-8} \right| = 1$$

$$\Rightarrow |x+yi-4| = |x+yi-8|$$

$$\Rightarrow \sqrt{(x-4)^2 + y^2} = \sqrt{(x-8)^2 + y^2}$$

$$\Rightarrow -8x + 16 = -16x + 64$$

$$7. \quad x = 5 + i \pm \sqrt{(5+i)^2 - 4 \cdot 1 \cdot (18-i)}$$

$$= \frac{5+i \pm \sqrt{-48+14i}}{2}$$

$$= \frac{5+i \pm (7i+1)}{2}$$

$$= 3+4i, 2-3i$$

8. For rational roots, discriminant should be a perfect square of a rational number.

9. The given series is expansion of  $e^{x^2}$ .

$$10. \quad y = x - \frac{x^2}{2} + \frac{x^3}{3} - \frac{x^4}{4} + \dots$$

$$\Rightarrow y = \log_e(1+x)$$

$$\Rightarrow 1+x = e^y$$

$$\Rightarrow x = e^y - 1$$

11. The roots are of opposite signs

if product of the roots  $< 0$

$$\text{if } \frac{a^2 - 4a}{2} < 0$$

$$\text{if } a(a-4) < 0$$

$$\text{if } 0 < a < 4.$$

12. Since  $e, \approx 2.7183$ , therefore,  $2.719 < e < 2.72$  is not correct

$$13. \text{ Given expression} = \frac{1 \binom{e+1}{e}}{2 \binom{e-1}{e}} = \frac{e^2+1}{e^2-1}$$

$$14. \quad {}^{n-1}C_6 + {}^{n-1}C_7 > {}^nC_6$$

$$\Rightarrow {}^nC_7 > {}^nC_6$$

$$\Rightarrow \frac{n!}{(n-7)!7!} > \frac{n!}{(n-6)!6!}$$

$$\Rightarrow n-6 > 7$$

$$\Rightarrow n > 13$$

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

$$16. \text{ Required probability} = \frac{39}{52} \times \frac{39}{52}$$

$$= \frac{3}{4} \times \frac{3}{4} = \frac{9}{16}$$

17. Required probability

$$= \frac{48}{52} \times \frac{47}{51} \times \frac{46}{50} \times \dots \times \frac{23}{27}$$

$$= \frac{23 \times 24 \times 25 \times 26}{52 \times 51 \times 50 \times 49}$$

18. For any two stations in a definite order, we need one ticket.

So required number of tickets is  $P(20, 2)$ .

$$19. \quad (6-1)! \times {}^6P_2 = 5! \times 6 \times 5$$

$$= 120 \times 30$$

$$= 3600$$

$$20. \text{ Required probability} = \frac{|3|3|4|}{|3+4+1|}$$

$$21. E_1 \cap E_2 = \phi$$

$$\Rightarrow P(E_1 \cap E_2) = 0$$

$$\text{But } P(E_1) + P(E_2) \neq 0$$

$$\text{When } E_1 \neq \phi, E_2 \neq \phi$$

$$22. T_{r+1} = \frac{(-1)(-2)(-3)\dots(-r)}{|r|} (-x)^r$$

$$= (-1)^{2r} \frac{|r|}{|r|} x^r$$

$$23. \text{ We know, } (1+x)^n = {}^nC_0 + {}^nC_1x + {}^nC_2x^2 + \dots + {}^nC_nx^n.$$

$$\text{Substituting } x = -1.$$

24. Here, the second equation can be obtained from first by multiplying it with 7. So, we have only one equation  $2x + 3y = 7$  which can be satisfied by infinitely many pairs  $(x, y)$ .

25. Required number

$$= {}^nC_0 + {}^nC_1 + {}^nC_2 + \dots + {}^nC_n = 2^n.$$

(Sum of coefficient. in the expansion of  $(1+x)^n$ ).

26. Index (=10) being an even number, there is only one middle term namely  $\frac{10+2}{2}$  th. i.e. 6th term which equals  ${}^{10}C_5$ .

27. Operate  $C_1 \rightarrow C_1 + C_2 + C_3 + C_4$ ; take out  $x + 3a$  from  $C_1$  and then operate  $R_1 \rightarrow R_2 - R_1, R_3 \rightarrow R_3 - R_1, R_4 \rightarrow R_4 - R_1$

28. The second determinant has been obtained by the transformations  $R_2 \rightarrow 2R_2$  and  $C_2 \rightarrow 3C_2$  in succession.

$$29. \sin \theta \cos \theta = \frac{1}{2} (\sin 2\theta),$$

$$\text{and } -1 \leq \sin 2\theta \leq 1.$$

$$30. \sin\left(\sin^{-1} \frac{\sqrt{3}}{5} + \cos^{-1} \frac{\sqrt{3}}{5}\right) = \sin\left(\frac{\pi}{2}\right) = 1.$$

31. Operating  $R_1 \rightarrow R_1 + R_2 + R_3$ , we find that  $(x+9)$  is a factor of L.H.S. and hence  $-9$  is a root of the given equations.

$$32. \text{ For a unique solution, } \begin{vmatrix} 1 & 1 & 1 \\ 3 & 6 & 1 \\ \alpha & 2 & 3 \end{vmatrix} \neq 0$$

$$\text{i.e., } \alpha \neq \frac{13}{5}.$$

33. Since,  $\tan^{-1}x = 0$ , therefore

$$\therefore \sin 2\theta = \frac{2 \tan \theta}{1 + \tan^2 \theta} = \frac{2x}{1+x^2}$$

34. If  $l$  is the length of the arc,

$$r + r + l = \pi r$$

$$\Rightarrow l = r(\pi - 2)$$

35. A bijection from  $A$  to  $A$  is in fact an arrangement of its  $n$  elements which can be done in  $|n|$  ways.

Hence, the number of bijections from  $A$  to  $A = |n|$ .

36. Since  $|x| \geq x \forall x \in \mathbb{R}$ ,

therefore,  $|x| - x \geq 0 \forall x \in \mathbb{R}$

$$\text{Hence } D_1 = \mathbb{R}$$

37. Since,  $A + C = 180^\circ$  and  $B + D = 180^\circ$ , therefore,

$$\begin{aligned} \cos A + \cos B &= \cos(180^\circ - C) + \cos(180^\circ - D) \\ &= -(\cos C + \cos D) \end{aligned}$$

$$38. [x + y] = [x] + [y]$$

holds true if atleast one of  $x$  and  $y$  is an integer.

$$39. f(0) = 2^0 = 1, f(1) = 2^1, f(2) = 2^2 = 4, \dots$$

Since 1, 2, 4, ..... are in G.P., therefore,  $f(0), f(1), f(2), \dots$  are in G.P.

$$40. \frac{\sec \theta + \tan \theta}{\sec \theta - \tan \theta} = \frac{1 + \sin \theta}{1 - \sin \theta}$$

$$= \frac{1 + \frac{3}{5}}{1 - \frac{3}{5}} = 4.$$

$$41. \cos^{-1}x = \frac{\pi}{2} - \sin^{-1}x$$

$$= \frac{\pi}{2} - \frac{\pi}{5} = \frac{3\pi}{10}$$

$$42. \sin^{-1}(\cos(\sin^{-1}x)) + \cos^{-1}(\sin(\cos^{-1}x))$$

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

$$= \frac{\pi}{2} (\because \sin(\cos^{-1}x) = \cos(\sin^{-1}x) = \sqrt{1-x^2})$$

$$44. f'(x) = \frac{1}{(1+x)^2} - \frac{1}{1+x}$$

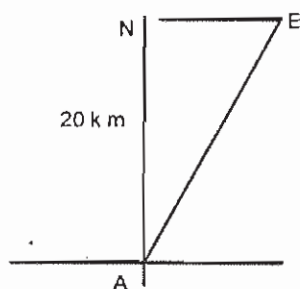
$$= \frac{-x}{(1+x)^2} < 0.$$

45.  $(1, 1)$  lies only on the line  $x - y = 0$ , which ought to be the correct alternative.

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PRACTICE PAPER - VIII

46.



Displacement of body from its starting point

$$\begin{aligned} AE &= \sqrt{(20)^2 + (10)^2} \\ &= \sqrt{500} \\ &= \sqrt{100 \times 5} \\ &= 10\sqrt{5} \text{ km} \\ &= 22.36 \text{ km} \end{aligned}$$

48. We know, resistance,  $R = \frac{\text{volt}}{\text{ampere}}$

$$\begin{aligned} \text{or } 1 \text{ ohm} &= \frac{1 \text{ volt}}{1 \text{ ampere}} \\ &= \frac{10^8 \text{ emu of potential}}{1 \text{ emu of current}} \\ &= 10^9 \text{ emu of resistance} \end{aligned}$$

49. Actual weight of body = weight of body in air  
= 5N

When it is immersed in water, then weight in water = 2N

From the law of buoyant force,

Buoyant force = Weight of liquid displaced by body

$$\begin{aligned} &= \text{Actual weight} - \text{weight in water} \\ &= 5\text{N} - 2\text{N} = 3\text{N} \end{aligned}$$

50. The radiations of all wavelength which fall on the body, then radiations are absorbed by the perfectly black body. This is a body which neither reflects nor transmits any part of the incident heat radiations therefore, it appears black irrespective of the colour of the incident radiation. Hence, the absorptive power of a perfectly black body is 1 (unity).

51. Swimming in a fresh water pool corresponds to the Newton's third law which states that the forces of actions and reactions are equal. When a swimmer applies a force to push water in backward direction, then the water pushes him in forward direction. This forward force causes for swimmer to swim.

52. From Rutherford model theory, it is stated that an atom consists a positive charge and the electrons revolve in circular orbit around the nucleus.

53. Bohr's theory of model of an atom was modified by Sommerfield, since, Bohr's stated that the electron revolves in a fixed circular orbit around nucleus, while Sommerfield stated that the electron revolve in elliptical orbit around the nucleus.

54. The passenger move forward when the train stops, because of inertia the upper part of the body of the passenger is in the direction of initial velocity of train while the lower part stops with stop of train. Therefore, the passenger move forward when the train stops.

54. Mirage is formed due to total "internal reflections". As the temperature of the sand heats up the air, air index of refraction is altered gradually by heat gradient. It causes the wavefront of light to bend away from hot surfaces when these reflected rays come to our eyes then we see them back to form a virtual image. Therefore the image is appeared due to reflections of object by which the impression of wet surface is obtained.

56. Intensive properties are independent of quantity of matter possessed by the system.

58. Working of electric fan is based upon the principle of electric dynamo/generator. Since, electric generator converts D.C. energy from battery in to energy of rotations when coil carrying current is held in a magnetic field. By experiencing a torque, it rotates the coil of electric dynamo/generator.

59. Dopplers effect in sound is caused by relative motion of source and observer.

60. The data of duration of day given below:  
 Duration of day on mercury = 88 days of earth  
 Duration of day on venus = 225 days of earth  
 Duration of day on earth = one day  
 Duration of day on mars = 24 hours 56 min  
 From these observations, it is clear that duration of day is highest on venus.
62. If two similar waves propagate one along x-axis and another along y-axis and when they superimpose each other the resultant wave motion is along a straight line.
63. Photo electric effect corresponds particle nature of light and it is explained by quantum theory of light.
64. From the first law of Kirchhoffs, the algebraic sum of current meeting at the junction is zero,  

$$\sum i = 0.$$
 This law corresponds to the conservation of charge, since, moving charge do not accumulate at the junction.  
 Again from the second law of Kirchhoffs in a closed mesh. The algebraic sum of the resistance and respective current which is flowing in that mesh is zero, so  

$$\sum E = \sum IR.$$
 This law corresponds the law of conservation of energy.
65. Since, tungsten has high melting point ( $3410^\circ$ ) and possesses low resistivity therefore it is used in the filament of bulb.
68. When the body is made to oscillate, some kind of frictional force is present like friction because of air. This frictional force opposes the motion of oscillating body, when it is oscillating from equilibrium position or it returns towards the equilibrium position therefore, the energy given to the oscillating body in the initial displacement which is converted slowly but continuously into heat in doing work against friction. Because of this energy dissipation the amplitude of oscillation goes on decreasing and finally stops.
69. The rms velocity of gas molecules become zero at absolute temperature, it means molecular motion ceases and finally comes to stop.
71. Since,  $\alpha$ -particle consists of two unit of positive charge and 4 units of mass of hydrogen atom and ionised helium also contains 2 unit of charge and 4 units of mass of hydrogen atom.
72. The atoms which have different atomic number and different mass number but have same number of neutrons are known as isotones.
73. We know that the meteors are smaller pieces of stars and metals which are produced because of breaking of comets while approaching the sun. When these pieces come closely to earth and enter in the atmosphere, they began to burn because of frictions of atmosphere and are seen like a bright line of fire.
74. We know that, when two long straight and parallel conductors are placed nearly each other and then current is flowing through them in opposite directions, they will repel each other.
75. We know that when the parallel rays coming from an object comes to our eye and then focussed on the retina and we see the object very distinctly. Hence, retina works as a film in our eye.
76. We know that, the centripetal force is responsible for executing the circular motion.
77. We know, energy released per fission = 200 MeV  $\approx$  400 electron masses or  $\frac{1}{5}$  mass of proton.  
 In uranium there are 235 nucleons.  
 The percentage fraction of mass converts in to the energy has the order of  

$$= \frac{1/5}{235} \times 100\%$$

$$= \frac{20}{235} \% = 0.085 \approx 0.1\%$$
78. We know that the main source of sun's energy is nuclear fusion. In this lighter nuclei of hydrogen fuse to form a single nucleus of He and release a 26.7 MeV per fusion reaction.  

$$4 {}_1\text{H}^1 \longrightarrow {}_2\text{He}^4 + 2({}_1\text{e}^0) + 26.7 \text{ MeV}$$



79. The frequency remains constant when light travels from one medium to another medium.
80. When the cyclist takes a turn, then centripetal force acts on the cyclist.

$$\therefore F = \frac{mv^2}{r}$$

$$\text{or } F \propto v^2$$

Now if velocity is doubled, the centripetal force will become four times. Therefore, the chance of overturning is  $\frac{1}{4}$  times.

81. By the lens maker's formula, we have

$$\frac{1}{f} = (\mu - 1) \left( \frac{1}{R_1} - \frac{1}{R_2} \right)$$

Generally,  $\mu$  is the refractive index of material of lens, with respect to surrounding i.e., air, when the convex lens is placed in a medium of greater refractive index, then that of lens material as  $\mu_w > \mu_l > \mu_a$ .

Hence, convex lens behaves like diverging (lens), if it is immersed in oil or water.

82. From Lens Maker's formula,

$$\frac{1}{f} = (\mu - 1) \left( \frac{1}{R_1} - \frac{1}{R_2} \right) \quad \dots(i)$$

Given, for plano-convex lens,  $R_1 = 60$  cm and  $R_2 = \infty$ ,  $\mu = 1.6$

Now putting the given values in equation (i), we get

$$\frac{1}{f} = (1.6 - 1) \left( \frac{1}{60} - \frac{1}{\infty} \right) = \frac{0.6}{60}$$

$$\text{Hence, } f = \frac{60}{0.6} = 100$$

83. Given,  $t = 8$ th second,  $u = 0$  distance travelled in 8th second  $S_1 = 150$  m.

From equation of motion for particular time,

$$S_1 = ut + \frac{1}{2} a (2t - 1)$$

$$\text{or } 150 = 0 + \frac{1}{2} a (2 \times 8 - 1) = \frac{15a}{2}$$

$$\text{or } a = \frac{300}{15} = 20 \text{ m/s}^2$$

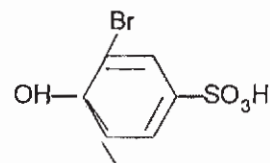
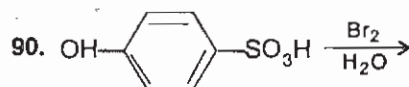
85. When a diamagnetic substance is placed in magnetic field of a bar magnet, then it will be repelled by the magnet.

86. In  $\text{SO}_4^{2-}$ ,  $\text{PO}_4^{3-}$  and  $\text{BF}_4^-$  all the central atoms are in  $sp^3$  —hybridisation state. Hence they are isostructural species (tetrahedral).

87. Alpha particle possess 2 unit positive charge and 4 unit mass. Hence, it is represented as helium nucleus ( ${}_2\text{He}^4$ ) or helium ion ( $\text{He}^{++}$ ).

88. The number of atoms in a simple cubic unit cell is one because contribution of atom at eight corners of the cube =  $\frac{1}{8} \times 8 = 1$ .

89. The aqua-regia is a mixture of one part of conc.  $\text{HNO}_3$  and three parts of conc.  $\text{HCl}$ .



We know, that —OH group is ortho-para directing group therefore, substitution takes place at ortho positions only.

91. Absolute zero is the temperature of which the velocities of the gas molecules reduce to zero. It means molecular motion ceases at absolute zero.

92. The normality of the solution formed can be calculated as follows :

$$\text{Here, } N_1 = 0.400 \text{ N,}$$

$$V_1 = 250 \text{ ml}$$

$$V_2 = 250 + 1000 \text{ ml}$$

$$= 1250 \text{ ml}$$

$$\text{We know, } N_1 V_1 = N_2 V_2$$

$$\therefore 0.400 \times 250 = 1250 \times N_2$$

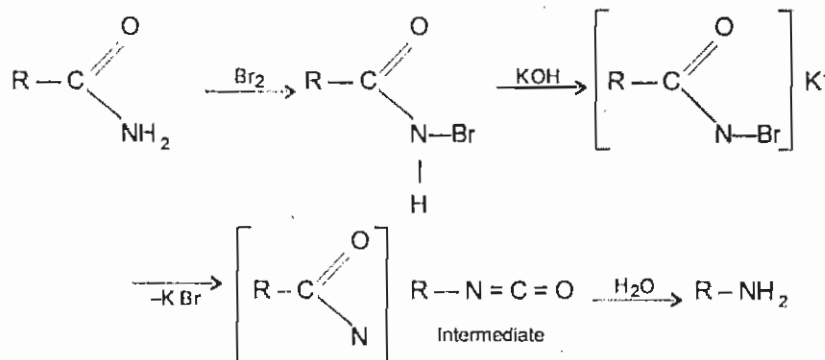
$$\text{or } N_2 = \frac{0.400 \times 250}{1250}$$

$$= 0.080 \text{ N}$$

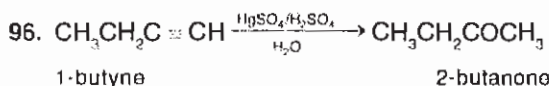
93. In sunlight, sulphurdioxide and chlorine reacts as follows :



94. This conversion is done by Hofmann reaction as follows



95. Roasting is the process in which sulphide ore is heated in presence of air to remove sulphur.



In this reaction, hydration on triple bond takes place.

97. In nuclear reactors, the control rods are made up of cadmium because cadmium rod absorbs excess neutrons.

98. Entropy change.

$$\Delta S_f = \frac{\Delta H_f}{T_f}$$

Given.  $\Delta H_f = 2930 \text{ J mol}^{-1}$ ;

$$T_f = 273 + 27 = 300 \text{ K}$$

Putting the values, we get

$$\Delta S_f = \frac{2930}{300} = 9.77 \text{ JK}^{-1} \text{ mol}^{-1}$$

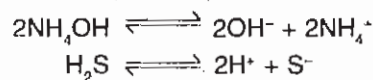
99. Argon gas was discovered by Ramsay and Rayleigh.

100. Solder is an alloy of lead. It is made up of 33% of lead and 67% of Tin.

101. Glycol has maximum viscosity because one molecule of Glycol possess two - OH groups which have greater intermolecular hydrogen bonding.

102. The maximum number of electrons which can be accommodated by an orbital is 2. Therefore, a p-orbital can accommodate 2 electrons with opposite spins.

103. Precipitation of IV group cations takes place only when they get  $\text{S}^{2-}$  ions in excess and this can only be possible by passing  $\text{H}_2\text{S}$  gas, in alkaline medium.



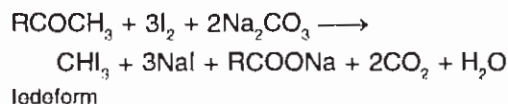
highly ionised

2H<sub>2</sub>O  
unionised

Hence,  $[\text{IV}][\text{S}^{2-}] > K_{sp}$  precipitation occurs.

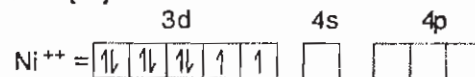
107.  $-\text{NHCOCH}_3$  is ortho and para directing group because it directs the incoming group to the ortho and para position.

108. Compounds having  $\text{CH}_3-\overset{\text{O}}{\parallel}{\text{C}}-$  give the iodoform test. Hence, all the given compounds give iodoform test.

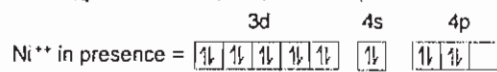


109. Lucas reagent is used for the distinction of primary, secondary and tertiary alcohols. It is a mixture of anhydrous  $\text{ZnCl}_2$  and conc.  $\text{HCl}$ .

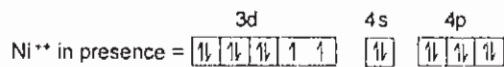
110. The geometry of  $[\text{Ni}(\text{CN})_4]^{2-}$  is square planar and  $[\text{Ni}(\text{Cl})_4]^{2-}$  is tetrahedral.



$\text{CN}^-$  is a strong ligand (According to C.F.T.), hence it makes Ni  $2+$  electrons to be paired up, while  $\text{Cl}^-$ , being weak ligand, cannot make Ni $^{2+}$  electrons to be paired up. Hence  $[\text{Ni}(\text{CN})_4]^{2-}$  shows  $dsp^2$  hybridization while  $[\text{Ni}(\text{Cl})_4]^{2-}$  shows  $sp^3$  hybridization.



of  $\text{CN}^-$  ion  $dsp^2$  hybridization (square planar)



of  $\text{CN}^-$  ion  $sp^3$  hybridization (Tetrahedral)

111. The surface water contains suspended impurities.

112. Isoelectronic means having same number of electrons.

$$\text{Number of electrons in CO} = 6 + 8 = 14$$

$$\text{Number of electrons in N}_2 = 7 + 7 = 14$$

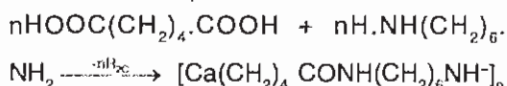
113. Avogadro's number is  $6.023 \times 10^{23}$  which is equal to molecules present in gram molecular mass.

115. The maximum concentration of nitrogen is present in urea.

$$\begin{aligned} \text{Molecular weight of urea (NH}_2\text{CONH}_2) \\ = 14 + 12 + 12 + 16 + 14 + 2 = 60 \end{aligned}$$

$$\therefore \% \text{ of N} = \frac{28}{60} \times 100 = 46.67\%$$

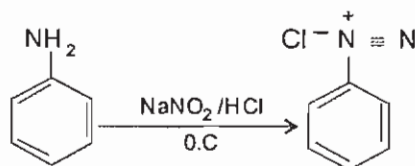
116. Nylon (66) is a polymer of hexamethylene diamine and adipic acid.



Hence, it contains amide linkage ( $-\text{CONH}-$ ) and is polyamide.

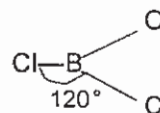
118. Aluminium can not be extracted by smelting process because it forms  $\text{Al}_2\text{O}_3$  which can not be reduced by carbon.

119. Aniline on treatment with sodium nitrite and HCl at  $0^\circ\text{C}$  produce benzene diazonium chloride.



benzene diazonium chloride

121.  $\text{BCl}_3$  is a planar molecule (trigonal planar) as it has  $sp^2$  hybridization.



122. de-Broglie wave do not travel with the speed of light because object with mass will travel with a velocity less than photon.

123. The equilibrium constant becomes one fourth because it is inversely proportional to concentration of reactants.

For reaction,  $\text{A} + \text{B} \rightleftharpoons \text{Z}$

$$K_c = \frac{[\text{Z}]}{[\text{A}][\text{B}]}$$

If concentrations of A and B are doubled, then

$$K'_c = \frac{[\text{Z}]}{2[\text{A}]2[\text{B}]} = \frac{1}{4} K_c$$

