

ANSWERSMATHEMATICS

1. (b) 2. (c) 3. (b) 4. (b) 5. (b) 6. (b) 7. (a) 8. (b) 9. (c) 10. (c)  
 11. (a) 12. (c) 13. (a) 14. (d) 15. (c) 16. (d) 17. (a) 18. (c) 19. (b) 20. (d)  
 21. (c) 22. (a) 23. (b) 24. (b) 25. (b) 26. (c) 27. (a) 28. (a) 29. (b) 30. (c)  
 31. (a) 32. (c) 33. (c) 34. (d) 35. (c) 36. (c) 37. (b) 38. (b) 39. (c) 40. (c)  
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EXPLANATIONS

1. The result holds only if

$$0 \leq 2 \cos^{-1} x \leq \pi$$

i.e., if  $\cos^{-1} x \leq \frac{\pi}{2}$

i.e., if  $1 \geq x \geq 0$ .

2.  $\sin^2 A = \sin^3 A$

$$\Rightarrow 2 \sin A \cos A = 3 \sin A - 4 \sin^3 A$$

$$\Rightarrow \sin A = 0 \text{ or } 2 \cos A = 3 - 4 \sin^2 A$$

$$\Rightarrow A = 0 \text{ or } 2 \cos A = 3 - 4(1 - \cos^2 A)$$

$$\Rightarrow A = 0 \text{ or } 4 \cos^2 A - 2 \cos A - 1 = 0$$

$$\Rightarrow A = 0 \text{ or } \cos A = \frac{2 + \sqrt{4 + 16}}{2} = \frac{1 + \sqrt{5}}{4}$$

$$\Rightarrow A = 0 \text{ or } A = 36^\circ$$

3. 
$$\int \left( \frac{2x}{1+x^2} \right) = \log \left( \frac{x + \frac{2x}{1+x^2}}{1 - \frac{2x}{1+x^2}} \right)$$

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

$$= 2 f(x)$$

4. 
$$|f(x) - f(-x)| = \left| \frac{|x|}{x} - \frac{|-x|}{-x} \right|$$

$$= \left| \frac{|x|}{x} + \frac{|x|}{x} \right| = \left| \frac{2|x|}{x} \right|$$

$$= 2 \frac{|x|}{|x|} = 2, x \neq 0.$$

$$\begin{aligned} 5. \quad \cos 7\theta + \cos \theta &= \cos (8\theta - \theta) + \cos \theta \\ &= \cos (\pi - \theta) + \cos \theta \\ &= -\cos \theta + \cos \theta = 0. \end{aligned}$$

$$6. \quad \sin (\sin^{-1} x + \cos^{-1} x) = \sin \frac{\pi}{2} = 1.$$

$\therefore$  Range of  $\sin (\sin^{-1} x + \cos^{-1} x)$  is  $\{1\}$

$$7. \quad \text{If } y = \frac{1-x}{1+x}$$

$$\Rightarrow y + xy = 1 - x$$

$$\Rightarrow x + xy = 1 - y$$

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

This shows that the function  $f(x) = \frac{1-x}{1+x}$  is inverse to itself.

$$\begin{aligned} 8. \quad \sec^2 (\tan^{-1} 2) + \operatorname{cosec}^2 (\cot^{-1} 3) &= \{1 + \tan^2 (\tan^{-1} 2)\} \\ &\quad + \{1 + \cot^2 (\cot^{-1} 3)\} \\ &= 1 + \{\tan (\tan^{-1} 2)\}^2 + 1 + \{\cot (\cot^{-1} 3)\}^2 \\ &= 1 + 2^2 + 1 + 3 = 15 \end{aligned}$$

$$10. \quad f(x) = \frac{x}{x-1} = \frac{1}{y}$$

$$\Rightarrow y = \frac{x-1}{x}$$

$$\therefore f(y) = \frac{y}{y-1} = \frac{x-1}{x-1-1}$$

$$= \frac{x-1}{x-1-x} = 1-x.$$

11. Maximum value of  $\sin x$  is 1, therefore  $\sin \alpha + \sin \beta + \sin \gamma = 3$  is possible only,

if  $\sin \alpha = \sin \beta = \sin \gamma = 1$

$$\text{i.e., if } \alpha = \beta = \gamma = \frac{\pi}{2}$$

i.e., if  $\cos \alpha = \cos \beta = \cos \gamma = 0$ .

$$12. \quad \tan (2 \sin^{-1} (\frac{4}{5})) = \tan 2\theta, \text{ where } \theta = \sin^{-1} \frac{4}{5}$$

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

$$= \frac{2 \binom{4}{3} \binom{3}{4}}{1 - 2 \binom{4}{5}^2}$$

$$\left( \because \cos \theta = \cos (\sin^{-1} \frac{4}{5}) \right)$$

$$= \sqrt{1 - \frac{16}{25}}$$

$$13. \quad \lim_{x \rightarrow 0} \left( \frac{\sin x - x}{x} \right) \cos \frac{1}{x} = \lim_{x \rightarrow 0} \left( \frac{\sin x}{x} - 1 \right) \cos \frac{1}{x} = 0$$

$$14. \quad \lim_{x \rightarrow 0} f(x) = 0 \text{ and } \lim_{x \rightarrow 0} f(x) = \frac{\sin(-1)}{-1} = -\sin 1.$$

16. Here  $f(x) = |x-1| \forall x \in \mathbb{R}$ ,  
 $f(x)$  is not derivable when  $x-1=0$ ,  
i.e. at  $x=1$ .

$$\begin{aligned} 17. \quad \lim_{n \rightarrow \infty} \frac{\sum_{r=1}^n r}{n^2} &= \lim_{n \rightarrow \infty} \frac{n(n+1)}{2n^2} \\ &= \lim_{n \rightarrow \infty} \left( \frac{n+1}{2n} \right) \\ &= \frac{1}{2} \lim_{n \rightarrow \infty} \left( 1 + \frac{1}{n} \right) \\ &= \frac{1}{2} (1+0) = \frac{1}{2}. \end{aligned}$$

18. Putting  $-\frac{1}{x} = t$ , then

$$\int_1^2 \frac{1}{x^2} e^{-1/x^2} dx = \int_{-1}^{-1/2} e^t dt$$

$$19. \quad \int \frac{x+1}{(x+2)^2} e^x dx = \int \frac{(x+2)-1}{(x+2)^2} e^x dx = \int \left( \frac{1}{x+1} - \frac{1}{(x+2)^2} \right) e^x dx,$$

which is of the form  $\int (f(x) + f'(x))e^x dx$ .

20.  $\lim_{x \rightarrow 0^+} \frac{1}{x} \rightarrow \infty$  and  $\lim_{x \rightarrow 0^+} \frac{1}{x} \rightarrow -\infty$ , therefore,

$\lim_{x \rightarrow 0} \frac{1}{x}$  does not exist.

21.  $\lim_{x \rightarrow 0} (x) = 0$  and  $[x]$  is finite (equal to  $-1$  or  $0$ ) in a small deleted nhd of  $0$ ,

therefore,  $\lim_{x \rightarrow 0} x[x] = 0$

$$\begin{aligned} 22. \quad \int_0^{\pi/2} \sin x \sin 2x dx &= 2 \int_0^{\pi/2} \sin^2 x \cos x dx \\ &= 2 \left[ \frac{\sin^3 x}{3} \right]_0^{\pi/2} \end{aligned}$$

$$23. \int_{\pi/12}^{\pi/2} \frac{1}{\cos 2x} dx = 2 \int_0^{\pi/12} \sec 2x dx$$

$$= \left[ \frac{\log \left| \tan \left( \frac{\pi}{4} + x \right) \right|}{2} \right]_0^{\pi/12}$$

$$= \log \sqrt{3} - \log 1 = \frac{1}{2} \log 3.$$

$$24. \frac{d}{dx} (f(x)) = \frac{d}{dx} (e^{\log f(x)})$$

$$= e^{\log f(x)} \frac{d}{dx} (\log f(x))$$

$$= f(x) \frac{d}{dx} (\log f(x)).$$

$$25. \lim_{x \rightarrow 0} \frac{(1+x)^n - 1}{x} = \lim_{x \rightarrow 0} \frac{n(1+x)^{n-1}}{1}$$

$$= n. \text{ (By L-Hospital's rule)}$$

$$26. \int \log x dx = \int 1 \cdot (\log x) dx$$

$$= \log x \cdot x - \int \frac{1}{x} \cdot x dx$$

$$27. \hat{i} \cdot (2\hat{j} \times 3\hat{k}) + \hat{j} \cdot (2\hat{k} \times 3\hat{i}) + \hat{k} \cdot (2\hat{i} \times 3\hat{j})$$

$$= 6[\hat{i} \hat{j} \hat{k}] + 6[\hat{j} \hat{k} \hat{i}] + 6[\hat{k} \hat{i} \hat{j}]$$

$$= 18[\hat{i} \hat{j} \hat{k}] = 18$$

28. As we know,  $(2\hat{i} + 3\hat{j} - 4\hat{k}) \perp (a\hat{i} + b\hat{j} + c\hat{k})$

$$\Leftrightarrow 2a + 3b - 4c = 0$$

29. Circles touch internally, if

$$|C_1 C_2| = |r_1 - r_2|$$

30. Given line is,  $bx + ay - ab = 0$

$$\therefore \text{Required length} = \frac{|b \cdot 0 + a \cdot 0 - ab|}{\sqrt{a^2 + b^2}}$$

31.  $\vec{a} \times \vec{b} = \vec{0}$

$$\Leftrightarrow |\vec{a}| |\vec{b}|, \vec{a} \neq \vec{b}, \vec{b} \neq \vec{0}$$

32.  $\frac{\vec{u} \times \vec{v}}{|\vec{u} \times \vec{v}|}$  and  $-\frac{\vec{u} \times \vec{v}}{|\vec{u} \times \vec{v}|}$  are at right angles to  $\vec{u}$  and  $\vec{v}$ .

33. Any line perpendicular to given line is  $2x + y + \lambda = 0$ .

The point (0, 1) lies on it, if  $0 + 1 + \lambda = 0$ .

34. Required distance =  $\frac{|3 \times 0 + 4 \times 0 + 11|}{\sqrt{3^2 + 4^2}}$

$$= \frac{11}{5}.$$

35.  $\vec{a} \cdot \vec{b} = |\vec{a}| |\vec{b}| \cos \theta$

$$= 1 \times 1 \times \cos \theta = \cos \theta$$

36. By parallelepiped law,

$$[\vec{a} \vec{b} \vec{c}] = [\vec{b} \vec{c} \vec{a}] = [\vec{c} \vec{a} \vec{b}] = -[\vec{b} \vec{c} \vec{a}]$$

37. Since, the line  $x - y = 0$ , i.e.,  $y = x$  bisects the angle between the co-ordinate axis, therefore, required angle between this line and the x-axis ( $y = 0$ ) is  $45^\circ$ .

39. The given equation is of the form  $(\vec{r} - \vec{a}) \cdot (\vec{r} - \vec{b}) = 0$ , which is the equation of a sphere in the diameter form.

40. Since, the given spheres are concentric and are of different radii, hence they do not have any point in common.

41. Any line perpendicular to given line is  $x - 3y + \lambda = 0$ .

(2, 2) lies on this line if  $2 - 3 \cdot 2 + \lambda = 0$ .

if,  $y = 4$ .

Hence, the required line is,  $x - 3y + 4 = 0$  which meets y-axis where  $x = 0$ , i.e. where

$$3y + 4 \text{ or } y = \frac{4}{3}.$$

42. The line are at right angles if the product of slopes = -1,

i.e., if  $-\frac{1}{k-1} \times \frac{-2}{k^2} = -1$

i.e., if  $2 = k^2 - k^3$ ,

i.e., if  $k^3 - k^2 + 2 = 0$

i.e., if  $(k + 1)(k^2 - 2k + 2) = 0$ .

43. The foot of perpendicular from (x, y, z) on xy-plane is (x, y, 0).

$\therefore$  Required distance = |z|.

44. d.c. of the two lines are  $\langle 1, 2, 0 \rangle$  and  $\langle 0, 0, 1 \rangle$ . Hence the two lines are at right angles. ( $\because 1 \times 0 + 2 \times 0 + 0 \times 1 = 0$ )

45. Required GM =  $(3^1 \times 3^2 \times 3^3 \times \dots \times 3^n)^{1/n}$

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

46. A device which converts alternating current (A.C.) into direct current (D.C.) is called rectifier. The process of converting a.c. into d.c. is called rectification.

47. 
$$F = \frac{1}{4\pi\epsilon_0} \frac{q_1 q_2}{r^2} = K \frac{q_1 q_2}{r^2}$$

$$K = \frac{1}{4\pi\epsilon_0} \frac{Fr^2}{q_1 q_2} = \text{Nm}^2\text{C}^{-2}$$

48. The material used for making permanent magnet should possess a high value of both retentivity and coercivity. Soft iron has high retentivity but due to small value of coercivity, it is unsuitable for making permanent magnets. Steel possesses fairly larger value of retentivity and high value of coercivity that is why it is preferred as permanent magnet.

49. For real image,  $m = \frac{-v}{u} = \frac{-f}{f+u}$

$$\Rightarrow 2 = \frac{-20}{20+u}$$

$$\Rightarrow u = -30 \text{ cm.}$$

50. Let initial energy =  $mgh_1$ , final energy =  $mgh_2$   
 $\therefore$  Loss in energy =  $\frac{mgh_1 - mgh_2}{mgh_1} \times 100 = 50\%$

51. From equation,  $g' = g - \omega^2 R_e \cos^2 \lambda$ .  
 where  $\lambda$  is the latitude which is  $0^\circ$  at equator and  $90^\circ$  at the poles. Therefore  $g'$  is maximum at equator and minimum at pole.

Hence value of  $g'$  decreases while going from equator to pole.

52. When negatively charged bob pendulum is moved over positive charge surface, the force acting on pendulum is not only  $mg$  but also electrical force ( $F_e$ ). Because of which restoring force changed from  $-mg' \sin \theta$  to  $-mg' \sin \theta$

where  $g' = g + \frac{F_e}{m}$

Since  $T' \propto \frac{1}{\sqrt{g'}}$ , therefore  $T' < T$

53. Let  $v$  be the speed of the bullet incident on the first plank.

Its speed after it passes the plank =  $\frac{19}{20}v$ .

If  $x$  is the thickness of the plank, the deceleration due to resistance of plank is given by

$$\left(\frac{19}{20}\right)^2 v^2 - v^2 = 2ax$$

$$\Rightarrow 2ax = \frac{-39}{400}v^2$$

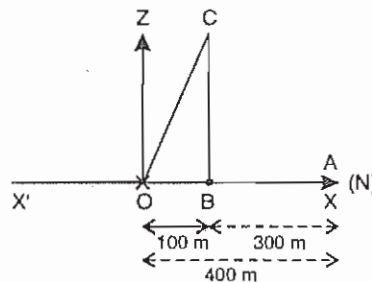
Let the bullet is stopped after passing through  $n$  such planks. Then the distance covered by bullet is  $nx$

$$\Rightarrow 0 - \left(\frac{19}{20}\right)^2 v^2 = 2anx$$

$$\Rightarrow -\left(\frac{19}{20}\right)^2 v^2 = n \times \frac{-39}{400}v^2$$

$$\Rightarrow n = \frac{361}{39} = 9.25 \approx 9$$

54. Given,  $OA = 400 \text{ m}$ ,  $AB = 300 \text{ m}$   
 $\therefore OB = 100 \text{ m}$ ,  $BC = 1200 \text{ m}$



The actual displacement of the plane, from the starting point is  $OC$ .

$$\therefore OC = \sqrt{1200^2 + 100^2}$$

$$= 1204 \text{ m} > 1200 \text{ m}$$

56. Isogonic lines are lines traced on the surface of the globe or upon a chart, connecting places at which the deviation of magnetic needle from the meridian or true north is the same i.e., the chart shows lines of equal magnetic declination.

57. Pressure gradient =  $\frac{\text{kg m}^3/\text{s}^2}{\text{m}} = \text{M L}^2 \text{T}^{-2}$

Velocity gradient =  $\frac{\text{m/s}}{\text{m}} = \text{M}^0 \text{L}^0 \text{T}^{-1}$

Potential gradient =  $\frac{\text{kg m}^2/\text{s}^2 \text{A}}{\text{m}} = \text{M L T}^{-3} \text{A}^{-1}$

Energy gradient =  $\frac{\text{kg m}^2/\text{s}^2}{\text{m}} = \text{M L T}^{-2}$

58. Fundamental frequency of closed pipe =  $\frac{v}{4L}$

Second overtone or fifth harmonic =  $\frac{5v}{4L}$   
 $= 250 \text{ Hz.}$

59. According to law of conservation of momentum

$$m_b v_b = m_a v_a$$

$$\Rightarrow 40 \times v_b = 4 \times 10$$

$$\Rightarrow v_b = 1 \text{ m/s.}$$

60. Negative temperature of coefficient means that as the temperature increases the resistance of the element decreases.
61. When angle of magnetic dip is zero, then magnetic field of earth become horizontal because magnetic dip is the angle between the direction of total intensity of magnetic field of earth and the horizontal line in the magnetic meridian.
62. Magnetic dipole moment is defined as the product of pole strength of either pole and distance between the poles.  
 $\Rightarrow M = m \times 2l$  is a vector quantity. The direction of magnetic dipole moment is from south to north pole.
63. The liquid which does not wet the walls of the container (e.g. mercury and glass) has a meniscus convex upwards, the value of the angle of contact is obtuse (i.e.  $\theta > 90^\circ$ ):
64. According to Bernoulli's theorem, when wind velocity over the wing is larger than the wind velocity under the wing, pressure of wind over the wings becomes less than the pressure of wind under the wings. This provides the necessary lift to the aeroplane.
65. Reduction factor of tangent galvanometer is numerically equal to the current needed to produce a deflection of  $45^\circ$ .
66. According to Huygen principle, every point on primary wavefront act as a source of spherical wavelets or secondary waves, such that the primary wavefront at some later time is the envelope of these wavelets.  
 The wavelets advance with a speed and frequency equal to those of primary wave at each point in space.
67. Secondary cells are electrochemical cells which have to be charged at first from an external electric source and then can be used to draw current from it. Such cells are rechargeable because of reversible chemical action.

68. Poisson ratio is ratio of lateral contraction strain to the elongation strain when a rod is stretched by in-line force applied to its ends, the sides being free to contract. If volume does not change under stretching, Poisson ratio = 0.5, but the value is often less in practice.

69. In practice, low frequency choke coil (radio frequency) is made of insulated copper wire wound on a soft iron core, while a high frequency choke coil has air as core material.

70. Here,

$$\frac{100 - 60}{60 - 0} = \frac{150 - x}{x - 20}$$

$$\Rightarrow 40(x - 20) = 60(150 - x)$$

$$\Rightarrow x = 98^\circ\text{C.}$$

71. Kundt's tube an apparatus to measure the speed of sound in gases under different controllable conditions of temperature and humidity.

72. The dew point indicates the highest temperature a surface may have in order that dew may condense on the surface from a humid atmosphere. When the dew point temperature and atmospheric temperature are equal, then air is said to be saturated. It means the relative humidity is 100%.

74. Speed of sound,  $v = \sqrt{\frac{\gamma RT}{M}}$   
 $\therefore v \propto \sqrt{T}$

The speed of sound in a gas is directly proportional to the square root of the absolute temperature of atmosphere (or gas).

75. When thin aluminium sheet is placed between the plates of a parallel plate capacitor, it acts as two capacitors connected in series of capacitance,

$$C = \frac{\epsilon_0 A}{d/2} = 2C$$

$$\therefore \text{Resultant capacitance} = \frac{1}{\frac{C'}{2}} + \frac{1}{\frac{C'}{2}}$$

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

76. We know,  $P = \frac{V^2}{R}$

Resistance when cut in half =  $\frac{R}{2}$

Resistance when connected in parallel =  $\frac{R}{4}$

$$\Rightarrow P_2 = \frac{4V^2}{R}$$

$$\therefore P_1 : P_2$$

$$1 : 4.$$

$$77. \quad \left| \frac{e}{m_e} \right| = \left| \frac{1.6 \times 10^{-19}}{9.1 \times 10^{-31}} \right| = 1.75 \times 10^{11} \text{ C kg}^{-1}$$

$$\frac{e}{m_p} = \frac{1.6 \times 10^{-19}}{1.67 \times 10^{-27}} = 9.58 \times 10^7 \text{ C kg}^{-1}$$

$$\therefore \frac{e}{m_\alpha} = \frac{2 \times 1.6 \times 10^{-19}}{6.6 \times 10^{-27}} = 4.84 \times 10^7 \text{ C kg}^{-1}$$

$$78. \quad \text{From equation of motion, } S = ut + \frac{1}{2}gt^2$$

$$= \frac{1}{2} \times 90 \times 4 \times 4 = 80 \text{ m}$$

Hence, the total distance travelled by body is 80 m.

79. Fluorescent substance absorb the ultraviolet light and the reemit it almost instantaneously. Many body fluids contain fluorescent molecules. Forensic scientists use ultraviolet lights at crime scenes to find blood urine or semen (all fluorescent).

81. Angular momentum is quantized as,

$$mvr_n = n \frac{h}{2\pi}$$

$$82. \quad \vec{F} = -e \vec{v} \times \mathbf{B}, \quad F = -ev B \sin\theta$$

$$\theta = 0, \sin \theta = 0; \quad F = 0$$

Thus, it continues to move in the same direction.

83. The energy released per fission of a  ${}_{92}\text{U}^{235}$  nucleus is nearly 200 MeV.

85. Colour of the sky is blue because of scattering of light.

According to Rayleigh's scattering, scattering of light is inversely proportional to the wavelength of light.

$$\text{i.e., scattering} \propto \frac{1}{\lambda^4}$$

Since  $I_{\text{blue}} \approx \frac{1}{2} (I_{\text{red}})$ , hence blue is scattered 16 times more than red.

Therefore sky which is seen by scattered light appears blue in colour.

86. The dominant oxidation state in both (lanthanides and actinides) is +3. The properties of actinides are very similar to those of lanthanides when both are in +3 state.

87.  $\text{Li}^+$  and  $\text{Mg}^{2+}$  ions have similar polarising power or ionic potential and therefore, have similar properties. This type of relationship of the first element of a group with the second element of the next group is known as diagonal relationship.

88. Fractional distillation is used for the separation and purification of organic liquids from non-volatile liquids from a liquid mixture.

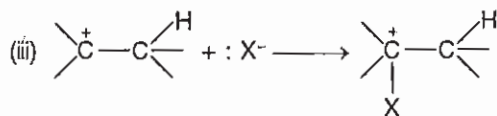
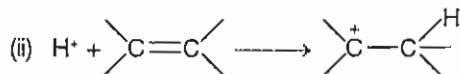
Osmosis involves the spontaneous flow of solvent molecules through semipermeable membrane from a pure solvent to a solution or from a dilute to concentrated solution.

Chromatography is based on selective distribution of the various constituents of a mixture between two phases, a stationary phase (which can be a solid or a liquid) and a moving phase (which can be a liquid or a gas).

However, according to Graham's law of diffusion, "At constant pressure and temperature the rate of diffusion of a gas is inversely proportional to the square of its density,".

89. Electronegativity is the property of a bonded atom. The relative tendency of an atom to attract the shared pair of electron towards itself is called electro negativity.

90. According to Markownikoff's rule, the negative part of the unsymmetrical reagent adds to less hydrogenated (more substituted) carbon atom of the double bond.



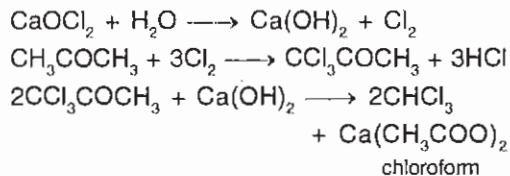
92. Helium is not soluble in blood even under high pressure, a mixture of 80% helium and 20% oxygen is used instead of ordinary air, by sea divers for respiration.

93. Group I elements are so highly electropositive that they emit electrons even when exposed to light (photoelectric effect) and this character increases on moving down the group from lithium towards cesium.

94. Crooke's glass is a special type of glass containing cerium oxide. It does not allow the passage of ultraviolet rays and is used for making lenses.

95. Molecular solids are those in which the lattice sites are occupied either by atoms as in solid argon or krypton or by molecules - as in solid CO<sub>2</sub>, SO<sub>2</sub> or H<sub>2</sub>O. Such solids tend to be soft and have low melting points because the particles in the solid experience relatively weak intermolecular attractions. If the crystals contain only individual atoms, as in solid argon or krypton, or if they are composed of non-polar molecules, as in naphthalene, the only attractions between the molecules are the London forces.

96. Acetone forms chloroform when heated with bleaching powder.

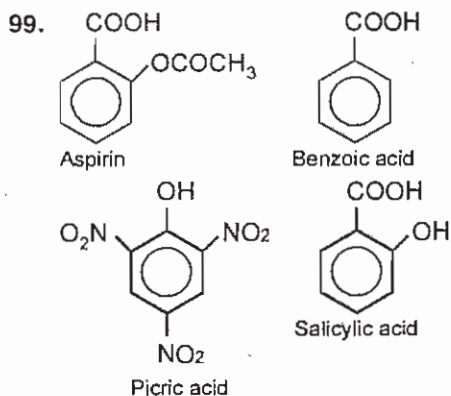
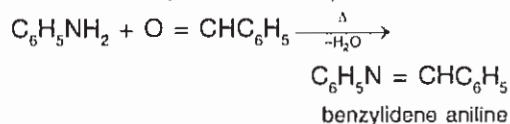


97. At STP, 44 g of CO<sub>2</sub> weighs = 22.4 litre

$$\therefore \text{At STP, 1 g of CO}_2 \text{ weighs} = \frac{22.4}{44}$$

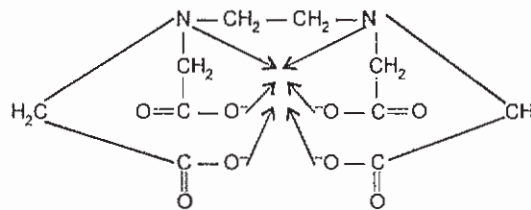
$$\therefore \text{At STP, 4.4 g of CO}_2 \text{ weighs} = \frac{22.4}{44} \times 4.4 = 2.24 \text{ litre.}$$

98. Aniline reacts with benzaldehyde and forms Schiff's base (benzal aniline) or anils.



100. The number of atoms of the ligands that are directly bound to the central metal atom or ion by coordinate bonds is known as the coordination number of the metal atom or

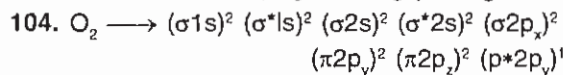
ion. It is actually the number of chemical bonds which the ligands form with the central metal atom or ion.



EDTA (ethylenediamine tetraacetate ion)

102. The octane number of fuel can be improved by increasing the percentage of branched chain alkanes, alkenes and aromatic hydrocarbons. Thus octane number can be changed by isomerisation (reforming), alkylation and aromatisation (cyclisation) etc.

103. The approximate composition of gasoline is C<sub>6</sub> – C<sub>11</sub> at boiling point 70 – 200°C and is used in motor fuel, dry cleaning, petrol gas etc.



(total 16 electrons)

Unpaired electrons show the paramagnetic nature of oxygen molecule.

105. Incorporating both enthalpy and change in entropy, Gibb's represented a relationship

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

where  $\Delta G$  = change in free energy,

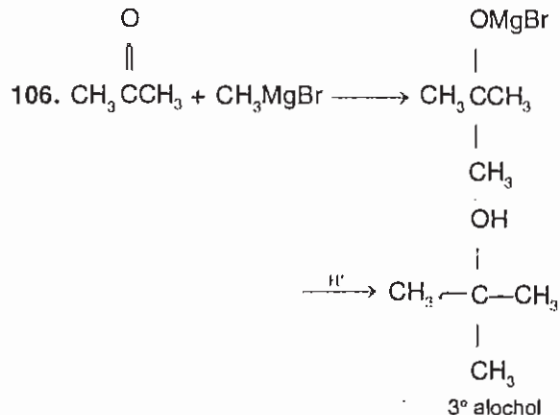
$\Delta H$  = change in enthalpy, and

$\Delta S$  = change in entropy, respectively.

At constant pressure, the reaction is

$$\Delta G = \Delta H + T \left( \frac{\partial(\Delta G)}{\partial T} \right)_p$$

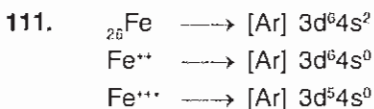
This equation is known as Gibbs-Helmholtz equation.



107. Methanol is also referred as wood alcohol or wood spirit or wood naphtha as the earliest method for its preparation was by destructive distillation of wood.

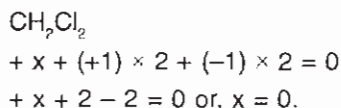
109. All cations are expected to act as Lewis acids since they are electron deficient in nature. However, cations such as  $\text{Na}^+$ ,  $\text{K}^+$  etc. (inert gas configuration) have a very little tendency to accept electrons. Therefore, they do not act as Lewis acids in Friedel-Craft's reactions.

110. When carbonates are heated they decompose to form the oxide. Sodium carbonate and potassium carbonate do not decompose. The carbonates become more difficult to decompose as you go down the group.



(in +2 state Fe is called ferrous and in +3 state as ferric).

112. Let the oxidation number of C in  $\text{CH}_2\text{Cl}_2$  be x.



113. The exact value of internal energy is not known as it includes all types of energies of molecules constituting the given mass of matter such as translational, vibrational, rotational, the kinetic and potential energy of the nuclei and electrons within the individual molecules and the manner in which the molecule are linked together, etc.

$$E = E_{\text{translational}} + E_{\text{rotational}} + E_{\text{vibrational}} + E_{\text{bonding}} + E_{\text{electronic}} \dots\dots$$

Thus, we can say that internal energy is partly potential and partly kinetic.

114. Bredig's arc method is suitable for the preparation of colloidal solutions of metals like gold, silver, platinum etc. An arc is struck between the metal electrodes under the surface of water containing some stabilizing agent such as a trace of KOH.

However, Fe does not react with alkalis that is why it is not obtained by Bredig's arc method.

115.  $\text{N}_2\text{O}_5$  is a white crystalline solid which readily decomposes into  $\text{NO}_2$  and  $\text{O}_2$ ,

116. For A,  $P_1 = 2P, V_1 = 2V, T_1 = 2T$   
For B,  $P_2 = P, V_2 = V, T_2 = T$

From ideal gas equation,  $\frac{P_1 V_1}{n_1 R T_1} = \frac{P_2 V_2}{n_2 R T_2}$

$$\Rightarrow \frac{2P \times 2V}{n_1 R \times 2T} = \frac{P \times V}{n_2 R T}$$

$$\Rightarrow \frac{2}{n_1} = \frac{1}{n_2}$$

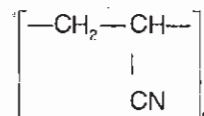
$$\Rightarrow \frac{n_1}{n_2} = \frac{2}{1}$$

117.  $r_n \propto n^2; A_n \propto n^4$

$$\frac{A_2}{A_1} = \frac{n_2^4}{n_1^4} = \frac{2^4}{1^4} = \frac{16}{1}$$

118. The properties which do not depend upon the quantity of matter present in the system or size of the system are called intensive properties. e.g. pressure, temperature, density, specific heat, surface tension etc.

120. Orlon is prepared by polymerisation of vinyl cyanide in presence of ferrous sulphate and hydrogen peroxide.



orlon

122. The triple point of any substance is that temperature and pressure at which the material can coexist in all three phases (solid, liquid and gas) in equilibrium. Specifically, the triple point of water is 273.16 K at 611.2 Pa.

125. Buffer solution can be obtained either by mixing a weak acid with its salt with a strong base ( $\text{CH}_3\text{COOH} + \text{CH}_3\text{COONa}$ ) or by mixing a weak base with its salt with a strong acid ( $\text{NH}_4\text{OH} + \text{NH}_4\text{Cl}$ ).

