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NATIONAL LEVEL SCIENCE TALENT SEARCH EXAMINATION - 2015 (UPDATED)

Paper Code: UN415

Solutions for Class : 11 (PCM)

Mathematics

1. **(B)** $c = 3$, $m = \tan 45^\circ = 1$

$y = mx + c$

$y = x + 3$

2. **(A)** Number of even places = 3,

Number of vowels = 2

Number of arrangements = ${}^3P_2 \times 4!$

$= 6 \times 24 = 144.$

3. **(B)** $A + C = B \Rightarrow \tan(A + C) = \tan$

$$\Rightarrow \frac{\tan A + \tan C}{1 - \tan A \tan C} = \tan B$$

$\Rightarrow \tan A + \tan C = \tan B - \tan A \tan B \tan C$

$\Rightarrow \tan A \tan B \tan C = \tan B - \tan A - \tan C$

4. **(D)** We have $2^{n+10} = 2.2^2 + 3.2^3 + 4.2^4 + \ldots + n.2^n$

$\Rightarrow 2(2^{n+10}) = 2.2^2 + 3.2^3 + \ldots + (n-1).2n \mid n.2^{n+1}$

Subtracting, we get -2^{n+10}

$= 2.2^2 + 2^3 + 2^4 + \ldots + 2n - n.2^{n+1}$

$$= 8 + \frac{8(2^{n-2} - 1)}{2 - 1} - n.2^{n+1}$$

$= 8 + 2^{n+1} - 8 - n.2^{n+1} = 2^{n+1} - (n)2^{n+1}$

$\Rightarrow 2^{10} = 2n - 2 \Rightarrow n = 513.$

5. **(B)** $n(A \cap B)$ = Number of even prime numbers = 1.

6. **(D)** Point of intersection of given lines is (6, 7)

Required distance

$$= \sqrt{(6-2)^2 + (7-3)^2} = \sqrt{32} = 4\sqrt{2}.$$

7. **(A)** According to the given condition $2b = a + c$,

$$q = \frac{2pr}{p + r} \text{ and } b^2 q^2 = (ap)(cr)$$

Substituting values of b and q from first two expressions in the last expression, we get

$$\frac{(a+c)^2}{4}\left(\frac{2pr}{p+r}\right)^2 = (ac)(pr)$$

$$\Rightarrow \frac{(a+c)^2}{ac}\frac{(p+r)^2}{pr}$$

$$\Rightarrow \frac{a}{c} + \frac{c}{a} = \frac{p}{r} + \frac{r}{p}.$$

8. **(B)** $a \geq b$, $c > 0$

$\Rightarrow a - b$ is either +ve or 0 and c is positive

$\Rightarrow (a - b)\, c$ is either +ve or 0.

$\Rightarrow ac - bc \geq 0.$

9. **(C)** $x^2 + 10x + 11 = k$

$B^2 - 4AC \geq 0 \Rightarrow 100 - 4(11 - k) \geq 0$

$\Rightarrow 25 - 11 + k \geq 0$

$\Rightarrow k \geq -14$

$\therefore x^2 + 10x + 11 = -14$

$\Rightarrow x^2 + 10x + 25 = 0$

$\Rightarrow (x + 5)^2 = 0$

$\Rightarrow x = -5$

$\therefore$ At $x = -5$ the function will have a minimum value of (–14).

10. **(C)** When A and B are finite sets then

$n(A \times B) = n(A) \times n(B)$

11. **(B)** The number of triangles that can be formed by using the vertices of a regular polygon is ${}^nC_3$. That is, $T_n = {}^nC_3$

Now, $T_{n+1} - T_n = 21$

$\Rightarrow {}^{n+1}C_3 - {}^nC_3 = 21$

$\Rightarrow {}^nC_2 + {}^nC_3 - {}^nC_3 = 21$

$\Rightarrow {}^nC_2 = 21 = {}^7C_2$

$\Rightarrow n = 7$

12. **(B)** $(\cos\theta + \sin\theta)^2 + (\cos\theta - \sin\theta)^2 = 2$

$\Rightarrow (\cos\theta + \sin\theta)^2 + 2\sin^2\theta = 2$

$\Rightarrow \cos\theta + \sin\theta = \pm\sqrt{2}\cos\theta$

13. **(C)** ${}^mC_{r-1}$, ${}^mC_r$, ${}^mC_{r+1}$, are in A.P.

$\Rightarrow {}^mC_{r-1} + {}^mC_{r+1} = 2 \cdot {}^mC_r$

$\Rightarrow \frac{{}^mC_{r-1}}{{}^mC_r} + \frac{{}^mC_{r+1}}{{}^mC_r} = 2$

$\Rightarrow \frac{r}{m-r+1} + \frac{r+1}{m-r} = 2$

$\Rightarrow r(m-r) + (r+1)(m-r+1)$

$= 2(m-r+1)(m-r)$

$\Rightarrow m^2 - m(4r+1) + 4r^2 = 2.$

14. **(B)** $|x| < 1 \Rightarrow -1 < x < 1$; $|x-1| \geq 1$

$\Rightarrow x - 1 \leq -1$ or $x - 1 \geq 1$

$\Rightarrow x \leq 0$ or $x \geq 2$

$A \cup B = \{x : -1 < x < 1$ or $x \leq 0$ or $x \geq 2\}$
$= \{x : x < 1$ or $x \geq 2\}$.

$\therefore D = R - (A \cup B) = \{x : 1 \leq x < 2\}$

15. **(A)** $a + b = 9$, $ab = 20$, $a > b$

$\Rightarrow a = 5, b = 4.$

$\therefore$ Equation of the line is $\frac{x}{5} + \frac{y}{4} = 1$

$\Rightarrow 4x + 5y = 20.$

16. **(A)** Sum of the coefficients $= b - c + c - a + a - b = 0 \Rightarrow 1$ is a root

Roots are equal $\Rightarrow$ Both the roots are equal to 1 $\Rightarrow$ Product of the roots = 1

$\Rightarrow \frac{a-b}{b-c} = 1 \Rightarrow a - b = b - c$

$\Rightarrow$ a, b, c are in A.P.

17. **(A)** $xy \geq 0$

$\Rightarrow (x \geq 0$, and $y \geq 0)$

or $(x \leq 0$ and $y \leq 0)$

Now $x \geq 0$, $y \geq 0$ represents the first quadrant and $x \leq 0$, $y \leq 0$ represents the third quadrant.

18. **(B)** Clearly, x can have any value i.e., $-\infty < x < \infty$.

19. **(B)** $\alpha + \beta = -\frac{b}{a}$, $\alpha\beta = \frac{c}{a}$

Required equation is $x^2 - (\alpha + \beta + \alpha\beta)x + (\alpha + \beta)\alpha\beta = 0$

$\Rightarrow x^2 - \left(-\frac{b}{a} + \frac{c}{a}\right)x + \left(\frac{-b}{a}\right)\left(\frac{c}{a}\right) = 0$

$\Rightarrow a^2x^2 + a(b-c)x - bc = 0.$

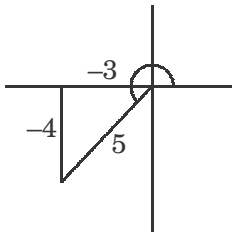
20. **(A)** Given $\tan A = 4/3$, A is in the III quadrant

$5\sin 2A + 3\sin A + 4\cos A$

$= 5(2\sin A\cos A) + 3\sin A + 4\cos A$

$= 10\left(-\frac{4}{5}\right)\left(-\frac{3}{5}\right) + 3\left(-\frac{4}{5}\right) + 4\left(-\frac{3}{5}\right)$

$= \frac{24}{5} - \frac{12}{5} - \frac{12}{5} = 0.$



21. **(C)** Coefficient of $(2r+4)^{th}$ term $= {}^{18}C_{2r+3}$

Coefficient of $(r-2)^{th}$ term $= {}^{18}C_{r-3}$

Coefficient of $(2r+4)^{th}$ term = Coefficient of $(r-2)^{th}$ term

$\Rightarrow {}^{18}C_{2r+3} = {}^{18}C_{r-3}$

$\Rightarrow 2r + 3 + r - 3 = 18$

$\Rightarrow 3r = 18 \Rightarrow r = 6.$

22. **(C)** $\{\varnothing, \{\varnothing\}, \{\{\varnothing\}\}, A\}$

23. **(A)** (3, 4) bisects the part between the axes

$\Rightarrow x$-intercept $= 2(3) = 6$,

y-intercept $= 2(4) = 8$.

The required equation is $\frac{x}{6} + \frac{y}{8} = 1$

$\Rightarrow 4x - 3y = 24$

24. **(D)** $1 + 2 + 2^2 + \ldots$ n terms > 1000

$\Rightarrow \frac{1(2^n - 1)}{2 - 1} > 1000$

$\Rightarrow 2^n - 1 > 1000 \Rightarrow 2^n > 1000$

$2^{10} > 1001 > 2^9$

$\Rightarrow$ Least value of n is 10.

25. **(A)** Number of diagonals of a polygon of n sides $= 275$

$\Rightarrow n(n-3)/2 = 275$

$\Rightarrow n(n-3) = 550 = 25 \times 22$

$\Rightarrow n = 25$

26. **(D)** $\frac{1}{t_1} + \frac{1}{t_2} + \ldots + \frac{1}{t_{2003}}$

$= 4\left[\frac{1}{3.4} + \frac{1}{4.5} + \ldots + \frac{1}{2005 \times 2006}\right]$

$= 4\left[\frac{1}{3} - \frac{1}{4} + \frac{1}{4} - \frac{1}{5} + \ldots + \frac{1}{2005} - \frac{1}{2006}\right]$

$= 4\left[\frac{1}{3} - \frac{1}{2006}\right] = \frac{4 \times 2003}{3 \times 2006} = \frac{4006}{3009}.$

27. **(A)** $i^i = (e^{i\pi/2})^i$

$= e^{-\pi/2}$

28. **(C)** Sum of the roots = product of the roots

$\Rightarrow -\left(\frac{k-3}{2}\right) = \frac{3k-5}{2} \Rightarrow -k + 3 = 3k - 5$

$\Rightarrow 4k = 8 \Rightarrow k = 2.$

29. **(B)** $A + 8.{}^{14}P_7 = {}^{15}P_8 = {}^{14}P_8 + 8.{}^{14}P_7$

$\Rightarrow A = {}^{14}P_8.$

30. **(B)** $\tan\frac{\theta+\alpha}{2}\tan\frac{\theta-\alpha}{2}$

$= \frac{\tan^2(\theta/2) - \tan^2(\alpha/2)}{1 - \tan^2(\theta/2)\tan^2(\alpha/2)} = 3$

$= \frac{\frac{1-\cos\theta}{1+\cos\theta} - \frac{1-\cos\alpha}{1+\cos\alpha}}{\frac{1-\cos\theta}{1+\cos\theta} \cdot \frac{1-\cos\alpha}{1+\cos\alpha}}$

$= \frac{2(\cos\alpha - \cos\theta)}{2(\cos\alpha + \cos\theta)}$

$= \frac{\cos\alpha\,(1 - \cos\beta)}{\cos\alpha\,(1 + \cos\beta)}$

$= \tan^2\frac{\beta}{2}.$

31. **(B)** The ratio of Coefficient of r^{th} term and $(r+1)^{th}$ term $= 1 : 2$

$\Rightarrow {}^{20}C_{r-1} : {}^{20}C_r = 1 : 2$

$\Rightarrow \frac{r}{21 - r} = \frac{1}{2}$

$\Rightarrow 2r = 21 - r$

$\Rightarrow r = 7.$

32. **(D)** If $(x, y) \in A \times B$, then $x \in A$ and $y \in B$

$\Rightarrow x \notin B$ and $y \notin A$ ($\because$ A and B are disjoint)

$\Rightarrow (x, y) \notin B \times A$

$\therefore$ $A \times B$ and $B \times A$ are disjoint.

33. **(B)** $2^{1/4}.4^{1/8}.8^{1/16} \ldots \infty$

$= 2^{\frac{1}{4} + \frac{2}{8} + \frac{3}{16} + \ldots + \infty}$

$S = \frac{1}{4} + \frac{2}{8} + \frac{3}{16} + \ldots$

$\Rightarrow \frac{1}{2}S = \frac{1}{8} + \frac{2}{16} + \ldots$

Subtracting, $\frac{1}{2}S = \frac{1}{4} + \frac{1}{8} + \frac{1}{16} + \ldots = \frac{1}{2}$(G.P.)

$\Rightarrow S = 1.$

Hence value is $2^1 = 2.$

34. **(A)** Let ABCD be the square

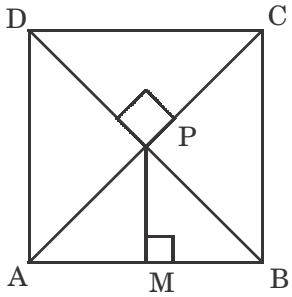
Point of intersection of the diagonals is the centre P(3, 7).

From P draw PM $\perp$ AB. Then M is midpoint of AB.

$\therefore$ AM = MB = PM = 2

Since a diagonal is parallel to $y = x$, its sides are parallel to the coordinates axes.

$\therefore$ M(3, 5) $\Rightarrow$ A(1, 5), B(5, 5), C(5, 9), D(1, 9).



35. **(B)** Given $a_{n+1} - a_n = 3n^2 + n$,

Then by putting n = 0, 1, 2, . . . , n – 1

we get $a_1 - a_0 = 0 \rightarrow (1)$,

$a_2 - a_1 = 3.1^2 + 1 \rightarrow (2)$,

$a_3 - a_2 = 3.2^2 + 2 \rightarrow (3)$, . . .

$a_n - a_{n-1} = 3 - (n-1)^2 + (n-1) \rightarrow (n)$

$(1) + (2) + \ldots + (n) \Rightarrow a_n - a_0$

$= 3 \sum (n-1)^2 + \sum (n-1)$

$$\Rightarrow a_n - 1 = \frac{(n-1)n(2n-1)}{2} + \frac{(n-1)n}{2}$$

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

$\Rightarrow a_n = n^3 - n^2 + 1.$

36. **(B)** $\because 1 + \omega + \omega^2 = 0$

$\therefore 1 + \omega + -\omega^2$

$\therefore (1 + \omega)^7 = -\omega^{14} = -\omega^2 = A + B\omega$

$\Rightarrow 1 + \omega = A + B\omega$

$\therefore A = 1, B = 1$

37. **(D)** $\alpha + \beta = -2 \Rightarrow \alpha^3 + \beta^3 + 3\alpha\beta(\alpha + \beta) = -8$

$\Rightarrow -56 + 3\alpha\beta(-2) = -8$

$\Rightarrow 6\alpha\beta = -48$

$\Rightarrow \alpha\beta = -8$

$\therefore$ The required equ. is $x^2 - (\alpha + \beta)x + \alpha\beta = 0$

$x^2 + 2x - 8 = 0$

38. **(D)**

39. **(B)** $(1 + x)^m = 1 + mx + \frac{m(m-1)}{1 \cdot 2} x^2 + \ldots.$

$$\therefore \frac{m(m-1)}{2} x^2 = -\frac{1}{8} x^2$$

$$\Rightarrow m = \frac{1}{2}$$

40. **(C)** $\cot\theta + \tan\theta = \frac{4}{\sqrt{3}}$

$$\Rightarrow \frac{\cos\theta}{\sin\theta} + \frac{\sin\theta}{\cos\theta} = \frac{4}{\sqrt{3}}$$

$$\Rightarrow \frac{\cos^2\theta + \sin^2\theta}{\sin\theta\cos\theta} = \frac{4}{\sqrt{3}}$$

$$\Rightarrow \frac{2}{\sin 2\theta} = \frac{4}{\sqrt{3}}$$

$$\Rightarrow \sin 2\theta = \frac{\sqrt{3}}{2}$$

$$\Rightarrow 2\theta = \frac{\pi}{3}$$

$$\Rightarrow \theta = \frac{\pi}{6}.$$

Physics

41. **(D)** $\alpha = \frac{\omega_1 - \omega_2}{t}$

$$= \left[\frac{1200 \times 2\pi}{60} - \frac{600 \times 2\pi}{60}\right] \text{rad s}^{-1}/10 \text{ s}$$

$= 2\pi$ rad s^{-2}

42. **(A)** Interatomic forces are of electric origin. They are attractive if the separation between them is greater than normal distance and are repulsive if the distance between them is less than normal distance.

43. **(B)** Total energy at the time of projection

$$= \frac{1}{2} m v^2 = \frac{1}{2} \times 0.1 (20)^2 = 20 \text{ J}.$$

Half way up, P.E. becomes half the P.E. at the top.

i.e. P.E. $= \frac{20}{2} = 10$ J

$\therefore$ K.E. = 20 – 10 = 10 J

44. **(D)** Unit of Planck's constant is joule second.

45. **(B)** Below the sea level the pressure is increasing with depth in mine due to presence of atmosphere air there. The acceleration due to gravity below the surface of the earth decreases with the distance from the surface of the earth, as

$$g' = g\left(1 - \frac{d}{R}\right)$$

46. **(C)** Applying work-energy theorem,

work done by all the forces = change in kinetic energy.

$$W_{mg} + W_{air} = \frac{1}{2}mv^2$$

$$W_{air} = \frac{1}{2}mv^2 - W_{mg}$$

$$= \frac{1}{2}mv^2 - mgh$$

$$= \frac{1}{2} \times 5 \times (10)^2 - (5) \times (10) \times (20)$$

$$= -750 \text{ J}$$

47. **(B)** Rel. vel. of rain w.r.t. man

$$= \sqrt{3^2 + 10^2} = \sqrt{109} \text{ km/h}$$

48. **(D)** Surface tension of a liquid is due to force of attraction between like molecules of a liquid i.e. cohesive force between the molecules.

49. **(B)** According to Newton's first law of motion, the velocity of apple when dropped is equal to the velocity of train at that instant. As the velocity of train is decreasing but velocity of apple remains unchanged, the apple will fall ahead of his brother in the direction of motion of the train.

50. **(C)** Isothermal compression is reversible. The reverse is isothermal expansion. Heat required in this process is gained from the surroundings.

51. **(C)** $$\frac{\Delta T}{T} \times 100 = \pm\left(\frac{1}{2} \times \frac{\Delta l}{l} \times 100 + \frac{1}{2} \times \frac{\Delta g}{g} \times 100\right)$$

$$= \pm\left(\frac{1}{2} \times 1 + \frac{1}{2} \times 2\right) = \pm 1.5\%$$

52. **(C)** $g = GM/(6400)^2$ and

$g' = GM / 6400 + 3200)^2$

$$g'/g = \left(\frac{6400}{6400 + 3200}\right)^2 = \frac{4}{9}$$

53. **(D)** Centripetal force required for negotiating the curve is $M\ v^2/R$. When velocity is doubled, centripetal force required is quadrupled.

54. **(D)** Dipole moment = (charge) × (distance)

Electric flux = (electric field) × (area)

55. **(A)** m = 200 gm = 0.2 kg, u = 20 m s^{-1}, v = –10 m s^{-1}

The ball travels in the opposite direction after exerting force. So velocity is negative.

Impulse = F × t = m(v–u)

= 0.2 [–10 –20] = – 6 N s

Negative sign shows that the force exerted is in a direction opposite to the direction of initial velocity.

$$\text{Driving force} = \frac{\text{Impulse}}{\text{time}} = \frac{6}{0.05} = 120 \text{ N.}$$

56. **(C)** 15 g = 0.015 kg. 3 cm = 0.03 m

Due to the conservation of energy,

input energy - output energy

Decrease in kinetic energy = work done against friction

$$\frac{1}{2}mu^2 - \frac{1}{2}mv^2 = \text{frictional force} \times \text{distance travelled}$$

$$\frac{1}{2}(0.015)(300)^2 - \frac{1}{2}(0.015)(0)^2$$

$$= F \times (0.03)$$

F= 22 500 N

57. **(A)** Distance = speed × time

∴ Total distance =

$(2 \times 2) + (3)(3) + (5)(4) + (5)(2) = 43$ m

Total time taken is 15 s Hence,

$$\text{Average speed} = \frac{\text{Total distance}}{\text{Total time}} = \frac{43}{15}$$

= 2.87 m s^{-1}

58. **(B)** $$v_{es}^2 = \frac{2GM_e}{R} = 2G\frac{4}{3}\pi R^3 \rho \times \frac{1}{R} = \frac{8}{3}\pi GR^2\rho\ .$$

When radius R becomes 2R, v_{es} will become 4 times. It will be = 22 km s^{-1}

59. **(D)** In isothermal process, T = 0

$\Rightarrow \Delta U = 0$

$\Rightarrow$ U = constant

60. **(C)** l = 3.230 m, b = 1.49 m

thickness h = 1.99 cm = 0.0199 m

Total surface area = $2(lb + lh + bh)$

$= 2[3.230 \times 1.49 + 3.230 \times 0.0199 + 1.49 \times 0.0199] =$

$= 4.8127 + 0.064277 + 0.029651$

$= 4.906628 \times 2 = 9.81\ m^2$

Volume = $l \times b \times h$

$= 3.230 \times 1.49 \times 0.0199$

$= 0.09577\ m^3$

61. **(A)** $Y = \dfrac{FL}{\pi r^2 \Delta L}$ or $\Delta L = \dfrac{L}{r^2}$

Here L/r^2 is maximum when L = 40 cm and r = 0.20 mm as compared to other cases.

62. **(B)** Momentum is given by :

$p = mv$

if p = constant

$\Rightarrow$ mv = constant

$\Rightarrow$ v = constant

63. **(C)** Average velocity

$$= \frac{\text{displacemet}}{\text{time}} = \frac{2r}{t} = \frac{2 \times 40}{40} = 2\ \text{m/s}$$

64. **(B)** $h = \left(\dfrac{T^2R^2g}{4\pi^2}\right)^{1/3} - R$

$$= \left(\frac{(24 \times 60 \times 60)^2 \times (6.4 \times 10^6)^2 \times 9.8}{4 \times (22/7)^2}\right)^{1/3} -$$

6.4×10^6

$= 3.6 \times 10^7\ m = 36000\ km$

65. **(D)** $\omega = \dfrac{2\pi}{T} = \dfrac{2\pi}{12 \times 60 \times 60}$ rad/s

$$= \frac{\pi}{6 \times 60 \times 60}\ \text{rad/s}$$

Chemistry

66. **(D)** Half the nuclear distance between two covalently bonded chlorine atoms is its covalent radius 1.98/2 = 0.99 $\overset{0}{A}$.

67. **(C)** Magnalium contains Al = 95% and Mg = 5%.

68. **(B)** According to equation

$H_2(g) + Cl_2(g) \rightarrow 2HCl(g)$ $\Delta H = -184.6$ kJ

Formation of 2 moles of HCl gas releases 184.6 kJ of heat to the surroundings

Formation of 5.67 moles of HCl gas releases $\dfrac{184.6 \times 5.67}{2} = 523$ kJ of heat to the surroundings. So ΔH for the formation of 5.67 moles of HCl gas is –523 kJ.

69. **(C)** H_2O exhibits higher boiling point because of intermolecular hydrogen bonding.

70. **(A)** O.N. of Cr in $K_2Cr_2O_7$ is

$2 \times (+1) + 2x - (2 \times 7) = 0$ or $x = +6$

Similarly, O.N. of Cr in K_2CrO_4 is

$2 \times (+1) + x - (2 \times 4) = 0$ or $x = +6$.

71. **(D)** X-rays and microwaves (in fact, all electromagnetic waves) travel with the velocity of light.

72. **(C)** Thiophene contains S in addition to C-atoms in the ring and hence is not a carbocyclic but is a heterocyclic compound.

73. **(B)** Non-polar molecules have momentary dipole-induced dipole, i.e., dispersive interactions.

74. **(A)** In CO and CO_2, the two elements combining are C and O to form two compounds.

75. **(D)** Both hydrogen and alkali metals are liberated at the cathode when their halides are electrolysed. Thus hydrogen resembles alkali metals.

76. **(D)** From Lithium to Caesium stabilities of peroxide and superoxides increases due to high lattice energy. CsO_2 is the most stable superoxide.

77. **(A)** $N_2 + 3H_2 \rightleftharpoons 2NH_3$

2 1 3

Partial pressure at 725 K

$$Q_c = \frac{(P_{NH_3})^2}{(P_{N_2})(P_{H_2})^3} = \frac{3 \times 3}{2(1)^3} = 4.5\ \text{atm}^{-2}$$

$Q_c > K_c$ net reaction goes in backward direction.

78. **(B)** Benzene-1, 2, 3, 4, 5, 6-hexol

79. **(B)** The reaction, $2HI(g) \rightleftharpoons H_2(g) + I_2(g)$, is reverse of the reaction, $H_2(g) + I_2(g) \rightleftharpoons 2HI(g)$. So, the equilibrium constant of the former is reciprocal of the latter.

Therefore,

$$K(2HI(g) \rightleftharpoons H_2(g) + I_2(g)$$

$$= \frac{1}{K\left(H_2(g) + I_2(g) \rightleftharpoons 2HI(g)\right)} = \frac{1}{48} = 0.02$$

80. **(C)** $Ca(OH)_2 + Cl_2 \rightarrow \underset{\text{Bleaching powder}}{CaOCl_2} + H_2O$

Bleaching powder is a mixed salt of calcium hypochlorite, $CaOCl_2$ and basic calcium chloride, $CaCl_2 . Ca(OH)_2 . H_2O$

81. **(C)** H_2O_2 decomposes into water and oxygen in presence of light.

82. **(C)** Empirical formula is CH_4

	C	H
% Mass	75	25
A_r	12	1
% Mass/A_r	6.25	25
Divide by smallest ratio	1	4

83. **(A)** $P \propto d$ and also $P \propto T$.

Hence, $P \propto d \times T$

$$\text{or } \frac{P_1}{P_2} = \frac{d_1}{d_2} \times \frac{T_1}{T_2}$$

$$= \frac{1}{2} \times \frac{2}{1} = 1 .$$

84. **(C)** A liquid which is immiscible to water and has a vapour pressure of 10 – 15 mm of Hg at 373 K can be conveniently purified by steam distillation.

85. **(A)** $c = v\lambda$ or $\lambda = \frac{c}{v} = \frac{3 \times 10^8 \text{ m s}^{-1}}{589 \times 10^{-9} \text{ m}}$

$= 5.1 \times 10^{14} \text{ s}^{-1}$ (or Hz)

86. **(A)** More negative or less positive is the value of the standard reduction potential, greater is the reducing power of the metal, Here,

$$-3.03 \text{ V} < -1.18 \text{ V} < 0.52 \text{ V}$$

So, Y > Z > X

87. **(B)** Electronegativity decreases down a group but increases across a period but remains almost same along a diagonal. Therefore atoms A and Y have little difference in their electronegativities and hence AY bond is least polar.

88. **(D)** The thermal stabilities of the hydrides of carbon family decrease down the group as is evident from their thermal dissociation temperatures:

CH_4	SiH_4	GeH_4	SnH_4	PbH_4
1073 K	723 K	558 K	423 K	273 K

Thus plumbane (PbH_4) gives H_2 even at 273 K and hence has the maximum reducing character while CH_4 decomposes only at a very high temperature (1073 K) and hence has the least reducing character.

89. **(C)** $W = -P(V_2 - V_1)$

$= -10^5 \text{ Nm}^{-2} (10^{-2} - 10^{-3}) \text{m}^3$

$= -10^5 \times 10^{-2} (1 - 0.1) \text{Nm}$

$= -0.9 \times 10^3 \text{ Nm}$

$= -0.9 \times 10^3 \text{ J}$ = the 0.9 kJ

90. **(C)** During Na fusion, N of organic compound is converted into CN^-, but not to NO_3^-.S is converted to S^{2-} and to CNS^-, if both N and S are present.