1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1	2	3	1	3	2	2	1	3	4	1	2	1	4	4	2	4	3	1	1
21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
2	1	2	3	4	3	4	4	3	2	1	3	3	1	4	2	1	2	4	3
41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
1	4	2	3	4	3	2	4	1	2	2	3	4	1	3	1	4	4	3	4
61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80
1	4	1	1	2	4	4	1	1	2	1	3	3	3	2	1	2	1	1	4
81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
4	2	3	4	3	1	3	2	3	2	4	3	3	3	4	4	2	2	4	1
101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120
4	3	3	4	3	3	3	3	1	3	3	3	3	1	3	2	4	3	3	2
121	122	123	124	125	126	127	128	129	130	131	132	133	134	135	136	137	138	139	140
4	4	4	3	2	1	1	1	3	1	1	4	2	3	2	2	3	2	2	3
141	142	143	144	145	146	147	148	149	150	151	152	153	154	155	156	157	158	159	160
4	4	3	2	1	2	2	3	4	2	1	2	1	4	2	2	3	4	2	2
161	162	163	164	165	166	167	168	169	170	171	172	173	174	175	176	177	178	179	180
4	1	1	1	2	1	1	1	4	4	2	1	1	2	1	4	3	1	1	4

01. All reversible cycles do not have same efficiency as their operating temperatures might be different

02. $\frac{KA\left(\sqrt{T}-T_C\right)}{BC} = \frac{KA(T_C - T)}{CA}$, if AB = BC = l

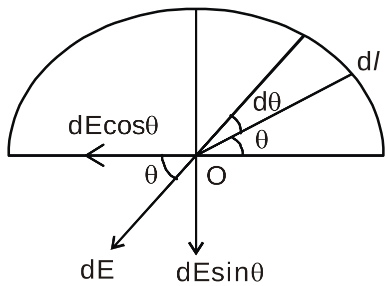
$CA = \sqrt{2}l, \frac{\sqrt{2}T - T_C}{l} = \frac{T_C - T}{\sqrt{2}l}, T_C = \frac{3T}{\sqrt{2}+1}$

05. $n_2 - n_1 = \frac{V}{\lambda_2} - \frac{V}{\lambda_1} = \frac{396}{(9/10)} - \frac{396}{1} = 44$

06. $\frac{2\pi}{\lambda} = 62.4, \lambda = \frac{2\pi}{62.4} = 0.1$ unit

08. 3μF + 3μF + 3μF = 9μF (all are in parallel)

10. $E = \int_0^{\pi} dE \sin\theta = \int_0^{\pi} \frac{\lambda \sin\theta}{4\pi \epsilon_0 a} d\theta$



$= \frac{\lambda}{4\pi \epsilon_0 a}\left[-\cos\theta\right]_0^{\pi} = \frac{\lambda}{2\pi \epsilon_0 a}$

11. $R_{eq.} = \frac{(2+2+2)\times 2}{(2+2+2)+2} = \frac{12}{8} = \frac{3}{2}$

$I = \frac{3}{3/2} = 2A$

12. $H = mL = \frac{V^2 \times t}{R \times J}, m = \frac{V^2 t}{JRL}$

$= \frac{(210)^2 \times 1}{4.2 \times 20 \times 80} = 6.56$ g/sec.

13. $F = \frac{\mu_0}{4\pi}\frac{2I_1I_2}{r} = 10^{-7} \times \frac{2\times1\times1}{1} = 2\times10^{-7}\ N/m$

14. $V = I_g\ G = 10^{-3} \times 100 = 0.10\ V$

16. Let G $= C^x g^y p^z$, $[M^{-1}L^3T^{-2}]^z$

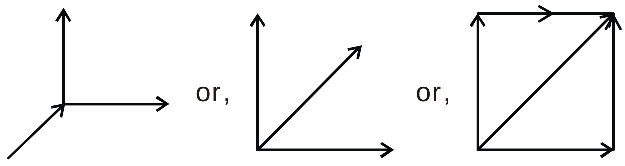
$= [LT^{-1}]^x\ [LT^{-2}]^y\ [ML^{-1}T^{-2}]^z$

$\Rightarrow$ z $= -1$, $x + y - z = 3$

$-x - 2y - 2z = -2$

or, $z = -1$, $x = 0$ and $y = 2$

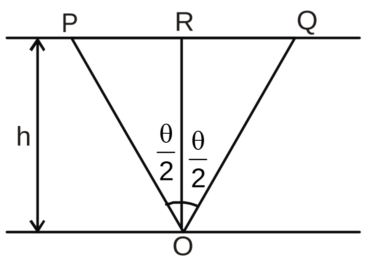
17.



18. $t_1 = \frac{V}{\alpha}, t_2 = \frac{V}{\beta}, t_1 + t_2 = t = \frac{V}{\alpha} + \frac{V}{\beta} \Rightarrow$

$V = \frac{\alpha\beta}{\alpha+\beta}t$

19. $PQ = Vt, RQ = \frac{Vt}{2}$



$\tan\left(\frac{\theta}{2}\right) = \frac{RQ}{OR} = \frac{\left(\frac{Vt}{2}\right)}{h}$

$h = \frac{Vt}{2\tan\left(\frac{\theta}{2}\right)}$

20. Total force $= \int_0^L \frac{M}{L}\omega^2 l\,dl = \frac{M}{L}\omega^2\int_0^L l\,dl = \frac{ML\omega^2}{2}$

21. $W = \text{mass} = m\frac{d^2s}{dt^2}s, s = \frac{t^2}{2}, \frac{d^2s}{dt^2} = 2.\frac{1}{2} = 1$

$W = m\times1\times\frac{t^2}{2} = 3\times1\times\frac{2^2}{2} = 6J$

22. M.I. of disc about its diameter $= \frac{MR^2}{4} = \frac{I}{2}$

M.I. of disc about its tangent

$= \frac{I}{2} + MR^2 = \frac{I}{2} + 2I = \frac{5}{2}I.$

23. $\overrightarrow{r_{c.m}} = \frac{a\hat{i}\times m + b\hat{j}\times m + 0\times m}{m+m+m} = \frac{1}{3}\left(a\hat{i} + b\hat{j}\right)$

24. $L = m\times\sqrt{\frac{GM}{R_0}}\times R_0 = m\sqrt{GMR_0}$

25. $F = \frac{YA\Delta l}{L}$, work done = Force × av. distance

$= \frac{YA\Delta l}{L}\times\frac{0+\Delta l}{2} = \frac{YA(\Delta l)^2}{2L} = \frac{YAx^2}{2L}$

27. ratio = 1

$\Rightarrow$ viscous force acting upwards is balanced by the effective weight of body i.e. gravity pull on the body acting downwards.

28. RMS velocity does not change with pressure till temp. remains constant

29. $\frac{E_2}{E_1} = \left(\frac{T_2}{T_1}\right)^4 = \left(\frac{560}{280}\right)^4 = 16$

30. Heat given out by 100 g of water at 100°C to cool to 0°C = 100 × 1 × 100 = 10^4 cal. Heat spent in melting 100 g of ice at 0°C = 80 × 100 = 8000 cal. Amount of heat left = 10^4 – 8000 = 2000 cals.

Rise in temp. $= \frac{\Delta Q}{c.m} = \frac{2000}{1\times200} = 10°C$

34. $m = \frac{v}{u} = \frac{1}{2}, u = 2v, \frac{1}{v} + \frac{1}{u} = \frac{2}{R}$

$\frac{1}{v} - \frac{1}{2v} = \frac{2}{40}$ $\Rightarrow$ v = 10 cm

35. $\mu = \frac{\sin\left(\frac{A+\delta m}{2}\right)}{\sin\left(\frac{A}{2}\right)} = \sqrt{2} = \frac{\sin\left(\frac{60+\delta m}{2}\right)}{\sin\left(\frac{60°}{2}\right)}$

$\Rightarrow\ \delta m = 30°, i = \frac{A+\delta m}{2} = 45°$

36. $\beta = \frac{\lambda D}{d}, d = \frac{\lambda D}{\beta} = \frac{5000 \times 10^{-10} \times 1}{5 \times 10^{-3}} = 0.1mm$

37. $R.P. = \frac{D}{1.22 \times \lambda} = \frac{1.22}{1.22 \times 5000 \times 10^{-10}} = 2 \times 10^6$

39. Depends all these.

40. Helium atom has 2 electrons. When one electron is removed, the remaining atom is hydrogen like, whose energy in first orbit is $E_1 = -(2)^2 \times (13.6$ eV) = –54.4 eV. Therefore to remove the second electron from the atom an additional energy of 54.4 eV is required. Hence total energy required to remove both the electrons = 24.6 + 54.4 = 79 eV.

41. $\frac{1}{\lambda} = R\left(\frac{1}{1^2} - \frac{1}{h^2}\right) \quad \Rightarrow 1 = \lambda R\left(1 - \frac{1}{n^2}\right)$

$\Rightarrow \frac{1}{\lambda R} = 1 - \frac{1}{n^2} \quad \Rightarrow n = \sqrt{\frac{\lambda R}{\lambda R - 1}}$

42. in any medium, $C = \frac{1}{\sqrt{\mu_0 \mu_r \in_0 \in_r}}$

$\Rightarrow C = \frac{1}{\sqrt{\mu \in}}$

43. $I_e = I_c + I_b$, $I_c = I_e - I_b$ = 90 – 1 = 89 mA

44. Reverse biased, so I = 0

45. $\overline{A} \cdot \overline{B} = y$

46. Ans (3)

$\underset{xg}{NaCl} + \underset{4.9g}{H_2SO_4} \rightarrow \underset{6g}{NaHSO_4} + \underset{1.825g}{HCl}$

According to law of conservation of mass "mas is neither created nor destroyed during a chemical change"

$\therefore$ Mass of the reactants = Mass of products

x + 4.9 = 6 +1.825

or x = 2.925 g

47. Ans (2)

From the given data, we have

$(E_C - E_B) + (E_B - E_A) = (E_C - E_A)$

or $\left(\frac{hc}{\lambda_1} + \frac{hc}{\lambda_2}\right) = \frac{hc}{\lambda_3}$

or $\boxed{\lambda_3 = \frac{\lambda_1 \lambda_2}{\lambda_1 + \lambda_2}} \left[\because \frac{\lambda_1 + \lambda_2}{\lambda_1 \lambda_2} = \frac{1}{\lambda_3}\right]$

48. Ans (4)

(ΔE), The energy required to excite an electron in an atom of hydrgoen from n = 1 to n = 2 is ΔE (difference in energy E_2 and E_1)

Values of E_2 and E_1 are,

$E_2 = \frac{-1.312 \times 10^6 \times (1)^2}{(2^2)} = -3.28 \times 10^5 \text{ J mol}^{-1}$

ΔE is given by the relation,

$E_1 = -1.312 \times 10^6 \text{ J mol}^{-1}$

$\therefore \Delta E = E_2 - E_1 = [-3.28 \times 10^5] - [1.312 \times 10^6] \text{J mol}^{-1}$

$= (-3.28 \times 10^5 + 1.312 \times 10^6) \text{ J mol}^{-1}$

$= 9.84 \times 10^5 \text{ J mol}^{-1}$

Thus the correct answer is (4)

49. Ans (1)

50. Ans (2)

51. Ans (2)

52. Ans (3)

Moles of $A, (n_A) = \frac{p_A v_A}{RT} = \frac{8 \times 12}{RT} = \frac{96}{RT}$

Moles of B, $A, (n_B) = \frac{p_B v_B}{RT} = \frac{8 \times 5}{RT} = \frac{40}{RT}$

Total pressure × total volume = $(n_A + n_B) \times RT$

$p \times (12 + 8) = \frac{1}{RT}(96 + 40)RT, \quad P = 6.8$

Partial pressure of A = p × mole fraction of A

$= 6.8\left(\frac{96}{RT} \Big/ \frac{96 + 40}{RT}\right)$

= 4.8 atm

Partial pressure of B = 6.8 –4.8 = 2 atm

53. (i) $2C(s) + H_2(g) \rightarrow H - C \equiv C - H(g)$

$\Delta H = 225 \text{kJ mol}^{-1}$

(ii) $2C(s) \rightarrow 2C(g) \qquad \Delta H = 1410 \text{kJ mol}^{-1}$

$C(s) \rightarrow C(g) \Delta H = \frac{1410}{2} = 750 \text{ kJ mol}^{-1}$

(iii) $H_2(g) \rightarrow 2H(g) \ \Delta H = 330 \text{ kJ mol}^{-1}$

From equation (i) :

$225 = \left[2 \times \Delta H_{C(s) \rightarrow C(g)} + 1BE_{H-H}\right]$

$-[2 \times BE_{C-H} + 1 \times BE_{C \equiv C}]$

$225 = [1410 + 1 \times 330] - [2 \times 350 + 1 \times BE_{C \equiv C}]$

$225 = [1410 + 330] - [700 + BE_{C \equiv C}]$

$225 = 1740 - 700 - BE_{C \equiv C}$

$BE_{C \equiv C} = 815 \text{ kJ mol}^{-1}$

54. Ans (1)

$-W_{irreversible} = P_{ext}(V_2 - V_1)$

= 10 atm (2L – 1L)

= 10 atm – L

$$-W_{irreversible} = \int_{V_1}^{V_2} P_{ex}dv = 2.303nRT\ \log \frac{V_2}{V_1}$$

$$= 1 \times 2.303 \times 0.0821\ \text{atm} - L/K/mol \times \log\frac{2}{1}$$

$= 16.96$ aatm – L

$$\frac{W_{reversible}}{W_{irreversible}} = \frac{16.96}{10.00} = 1.69 \approx 1.7$$

55. Ans (3)

$$pH = pK_a + \log\frac{[Salt]}{[Acid]}$$

$$5 = 4 + \log\frac{[Salt]}{[Acid]} \quad [\because pK_a = -\log K_a]$$

Given, $K_a = 1\times 10^{-4}$

$\therefore\ pK_a = -\log(1\times10^{-4}) = 4$

Now from from Handerson equation

$$pH = pK_a + \log\frac{[Salt]}{[Acid]}$$

Putting the values

$$5 = 4 + \log\frac{[Salt]}{[Acid]}$$

$$\log\frac{[Salt]}{[Acid]} = 5 - 4 = 1$$

Taking antilog

[Salt]/[Acid] =10 =10 :1

56. Ans (1)

57. Ans (4)

For the reaction :–

$$2NO_2(g) \rightleftharpoons 2NO)(g) + O_2(g)$$

Given $K_c = 1.8 \times 10^{-6}$ at 184°C

R = 0.0831 kj/mol.k

$$K_p = 1.8 \times 10^{-6} \times 0.0831 \times 457 = 6.836 \times 10^{-6}$$

$$[\because 184°C = (273+184) = 457k, \Delta n = (2+1,-1) = 1]$$

Hence it is clear that $K_p > K_c$

58. $$\underset{\substack{\text{Oxidised}\\ \text{RA}}}{\overset{-1}{2HI}} + \underset{\substack{\text{Reduced}\\ \text{OA}}}{H_2\overset{+6}{S}O_4} \rightarrow \overset{0}{I_2} + \overset{+4}{S}O_2 + 2H_2O$$

59. Ans (3)

$$CH_4(g) + H_2O(g) \xrightarrow[Ni]{1270K} CO + 3H_2$$

Mixture of CO and H_2 is called water gas.

60. Ans (4)

61. Ans (1)

62. Ans (4)

63. Ans (1)

64. Ans (1)

For bcc lattice body diagonal $= a\sqrt{3}$

The distance between the two oppositely charged ions $= \frac{a}{2}\sqrt{3}$

$$= \frac{387 \times 1.732}{2} = 335pm$$

65. Ans (2)

66. Ans (4)

$$Molarity(M) = \frac{wt \times 1000}{mol.wt. \times vol(ml)}$$

$$2 = \frac{wt}{63} \times \frac{1000}{250}$$

$$wt. = \frac{63}{2} gm$$

$$\text{wt. of } 70\% \text{ acid } = \frac{100}{70} \times 31.5 = 45\ gm$$

67. Ans (4)

Here n = 4, and $[H^+] = 10^{-3}$ (as pH = 3)

Applying Nernst equation

$$E = E° - \frac{0.059}{n}\log\frac{[Fe^{2+}]^2}{[H^+]^4(po_2)}$$

$$= 1.67 - \frac{0.059}{4}\log 10^7 = 1.67 - 0.103 = 1.567V$$

68. Ans (1)

69. Ans (1)

$$A(g) + 2B(g) \rightarrow C(g) + D(g)$$

Rate $= k[A][B]^2 = k(0.60)(0.80)^2$...... (i)

when $p_c = 0.20$ atm p_A is reduced to 0.40 and $p_B = 0.40$ (see stoichiometic representation)

Rate $= k\ [0.40][0.40]^2$ ...... (ii)

$$\therefore \text{(ii) divide by (i)} = \frac{0.40 \times 0.40 \times 0.40}{0.60 \times 0.80 \times 0.80} = \frac{1}{6}$$

70. Ans (2)

According to Freundlich equation.

$$\frac{x}{m} \propto p^{1/n} \text{or} \frac{x}{m} = kp^{1/n}$$

$$\text{or } \log\frac{x}{m} = \log kp^{1/n} \text{ or}$$

$$\log\frac{x}{m} = \log k + \frac{1}{n}\log p$$

71. Ans (1)

72. Ans (3)

73. Ans (3)

74. Ans (3)