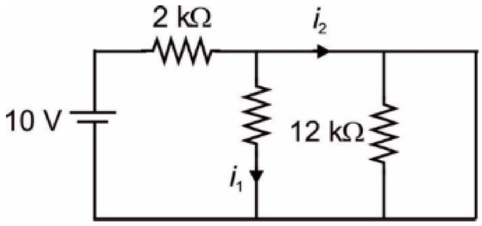
1. $\lambda = \frac{h}{mv}$

Hence, $\frac{\lambda_p}{\lambda_\alpha} = \frac{m_\alpha v_\alpha}{m_p v_p}$ $\quad \therefore \frac{v_p}{v_\alpha} = \frac{m_\alpha}{m_p} = \frac{4}{1}$

2. For Lyman, $\frac{1}{\lambda} = R\left[\frac{1}{1} - \frac{1}{4}\right] \Rightarrow \frac{1}{\lambda} = \frac{3R}{4}$

For Balmar, $\frac{1}{\lambda_B} = R\left[\frac{1}{4} - \frac{1}{9}\right] = \frac{5}{36}R$

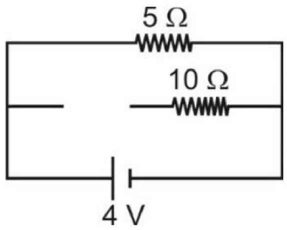
$\frac{\lambda_B}{\lambda} = \frac{3R}{4} \times \frac{36}{5R} = \frac{27}{5}$

3. 

$i_1 = 0$; $\quad i_2 = \frac{10}{2 \times 10^3} = 5mA$

4. $V_{dc} = V_{avg} = \frac{V_m}{\pi}$ (for H.W.R); $\quad V_{dc} = \frac{10}{\pi}V$

5. $\phi = \phi_0 + K \cdot E_m \Rightarrow 2hv = hv + \frac{1}{2}mv^2 \Rightarrow v = \sqrt{\frac{2hv}{m}}$

6. 

$I = \frac{4}{5}$=0.8A

7. In case 1 : $\frac{1}{2}mv_1^2 = 2hv_0 - hv_0 = hv_0$

In case 2 : $\frac{1}{2}mv_2^2 = 5hv_0 - hv_0 = 4hv_0$

Divide (1) and (2)

$\frac{v_1^2}{v_2^2} = \frac{hv_0}{4hv_0} = \frac{1}{4} \Rightarrow v_2 = 2v_1 = 8 \times 10^6 m/s$

8. The electron ejected with maximum speed V_{max} are stopped by electric field E = 4 N/C after travelling a distance d = 1 m

$\therefore \frac{1}{2}mV_{max}^2 = eEd = 4eV$

The energy of incident photon $= \frac{1240}{200} = 6.2eV$

From equation of photo electric effect

$\frac{1}{2}mV_{max}^2 = hv - \phi 0 \quad \therefore \phi_0 = 6.2 - 4 = 2.2eV$

9. Photodiode is used in reversed bias and saturation current is dependent on intensity option (4) represents I-V graph of photodiode.

10. For λ = 4800, photoelectrons emits. So threshold wavelength may be greater than 4800 Å.

11. $h\nu = \phi_0 + x$

$2h\nu = \phi_0 + x' \Rightarrow 2(\phi_0 + x) - \phi_0 = x'$

$\Rightarrow x' = \phi_0 + 2x \Rightarrow x' > 2x$

12. $E_{ph} = \frac{12420}{2000}eV = 6.210eV$

$KE_{max} = 6.21 - 4 = 2.21eV$; $\quad V_{sp} = 2.21$ volt

13.. Graph starts at $\frac{C}{\lambda_0}$

14. Answer (3)

15. Answer (4)

16. Answer (4)

17. $\overline{\overline{x+y} + \overline{x+y}} = z \Rightarrow x + y = z$

18.

19. $ev = \frac{1}{2}mv^2 \Rightarrow 2emv = P^2$

$P = \sqrt{2emv} \Rightarrow \lambda = \frac{h}{\sqrt{2emv}}$

$\lambda = \frac{6.63 \times 10^{-34}}{\sqrt{2 \times 1.6 \times 10^{-19} \times 1.67 \times 10^{-27} \times 8.26 \times 10^4}}$

$\lambda = \frac{6.63 \times 10^{-34} \times 10^{21}}{\sqrt{2 \times 1.6 \times 1.67 \times 8.2}} \Rightarrow \lambda = 1.0 \times 10^{-13}m$

20. Photoelectric emf is proportional to intensity of light falling on the cell.

21. Answer (1)

22. $\overline{\overline{A} \cdot \overline{B}} = \overline{\overline{A+B}} = A + B \rightarrow OR$ gate

$\overline{\overline{A} \cdot \overline{B}} = \overline{\overline{AB}} = AB \rightarrow AND$ gate

$A\overline{B} + \overline{A}B = A \oplus B \rightarrow EX - OR$ gate

23. $\frac{n}{t} = \frac{power}{h\nu} = 9 \times 10^{13}/s$

24. Equation for graph between V_0 and ν is $V_0 = \frac{h}{e}\nu - \frac{\phi}{e}$ where $\left(\frac{h}{e}\right)$ is slope of graph & $\left(\frac{\phi}{e}\right)$ is intercept. As slope is same for P&Q, therefore

graphs are parallel. But intercept $\left(-\frac{\phi}{e}\right)$ is greater for P than Q.

25. Current is zero because for Si diode to be in ON state, potential difference required is 0.7 V

26. $\lambda = \frac{h}{mv} = \frac{h}{\sqrt{2mK}}$; $K' = 16K$

$$\lambda' = \frac{h}{\sqrt{2m \times 16K}} = \frac{\lambda}{4}$$

27. $\Delta V = \left[-10 - (-23)\right] = 13$

$$I = \frac{\Delta V}{R_e} = \frac{13}{(10+3)\times 10^3} = 10^{-3}\,A = 1mA$$

28. If pentavalent impurity is dopped then $N_C > N_P$
If trivalent impurity is dopped then $N_P > N_C$

29. Answer (4)

30. $\lambda = \frac{h}{\sqrt{2km}} = \frac{h}{\sqrt{2qvm}}$

$$\frac{\lambda_p}{\lambda_\alpha} = \sqrt{\frac{q_\alpha v_\alpha m_\alpha}{q_p v_p m_p}} = \sqrt{\frac{2q_p(800)(4m_p)}{q_p(100)m_p}}$$

$$\frac{\lambda_p}{\lambda_\alpha} = 8 \Rightarrow \lambda_\alpha = \frac{\lambda_p}{8}$$

31. $r \propto n^2 \Rightarrow \frac{r_{n=2}}{r_{n=3}} = \frac{4}{9} \Rightarrow r_{n=3} = \frac{9}{4}R = 2.25R$

32. Number of ?-particles emitted $= \frac{238-222}{4}$

This decreases atomic number to

90 – 4 × 2 = 82

Since, atomic number of ${}_{83}Y_{222}$ is 83, this is possible if one α–particle is emitted.

33. $\frac{1}{\lambda} = RZ^2\left(\frac{1}{n_1^2} - \frac{1}{n_2^2}\right) \Rightarrow \lambda' \propto \frac{1}{Z^2}$

$$\lambda_{Li^{++}} : \lambda_{He^+} : \lambda_H = 4 : 9 : 36$$

34. For stability binding energy per Nucleon should be more.

35. $N = \frac{n(n-1)}{2} = \frac{4(4-1)}{2} = 6$

36. $z^{X^A} \xrightarrow{3\alpha} z-6^{Y_1^{A-12}} \xrightarrow{2(a\beta^0)} z-8^{Y_2^{A-12}}$

In final product

No. of protons, P = z – 8

No. of neutrons, n = A – 12 – z + 8 = A – z – 4

$$\frac{n}{P} = \frac{A-z-4}{z-8}$$

37. Two nuclides are isotones if they have the same number of neutron.

38. $230 - (112 + 106) = 12MeV$

39. Answer (2)

40. Answer (4)

41. Fact

42. $E = mc^2 = 1\times 10^{-6} \times (3\times 10)^2$

$$= 1\times 10^{-6} \times 9 \times 10^{16} = 9\times 10^{10}\,J$$

43. For elastic collision to take place there must be no loss in the energy of electron. The hydrogen atom in ground state will absorb energy from colliding electron only if it can go from ground state to 1st excited state & for this atom requires energy 10.2 eV.
So if electron possesses energy less than 10.2 eV, it would never loose it & hence collision would be elastic.

44. Average binding energy per nucleon is 8 MeV.

45. Fact

46. Conductance $(G) = \frac{1}{R} = \frac{1}{200}$

$$K = G\left(\frac{l}{A}\right)$$

$$\left(\frac{l}{A}\right) = \text{Cell constant} = \frac{0.015}{1} \times 200 = 3\,cm^{-1}$$

47. Higher the value of standard reduction potential higher is the oxidising power of the metal.

48. Cell reaction is $2Ag^+ + Cu \rightarrow Cu^{2+} + 2Ag$

$E^\circ_{cell} = 0.80 - 0.34 = 0.46$

Apply Nernst equation :

$$E_{cell} = E^\circ_{cell} - \frac{0.0591}{2}\log\frac{[Cu^{+2}]}{[Ag^+]^2}$$

$$E_{cell} = 0.46 - \frac{0.0591}{2}\log\frac{1.5\times 10^{-4}}{(4.5\times 10^{-4})^2}$$

$$E_{cell} = 0.375$$

$$\Delta G = -nFE = -2 \times 96500 \times 0.375 = -72375\,J$$

49. $\log(K_c) = \frac{nE^0_{cell}}{0.0591} = \frac{2\times 0.591}{0.0591} = 20$

$$K_c = 10^{20}$$

50. Reaction at cathode ; $H_2O(\ell) + e^- \rightarrow \frac{1}{2}H_2(g) + \overline{O}H$

Reaction at anode ; $Cl^-(aq) \rightarrow \frac{1}{2}Cl_2(g) + e^-$

51. $NaCl(aq) \rightarrow \underset{Cathode}{H_2} + \underset{Anode}{Cl_2}$

$$Na_2SO_4(aq) \rightarrow \underset{Cathode}{H_2} + \underset{Anode}{O_2}$$

$$\frac{W_{Cl_2}}{W_{O_2}} = \frac{E_{Cl_2}}{E_{O_2}} = \frac{35.5}{8} = \frac{11.2L}{5.6L} = \frac{2}{1}$$

52. $\lambda_m = \frac{1.65}{0.15} \times 10^3\, S\,cm^2\,mol^{-1} = 11 \times 10^3\, S\,cm^2\,mol^{-1}$

$11 \times 10^3 \times 10^{-4}\, Sm^2\,mol^{-1} = 1.1 Sm^2\,mol^{-1}$

53. Greater the ionic size, higher is the radii of hydrated ion and lower is the conductance

54. $2H^+(aq.) + 2e^- \rightarrow H_2(g)$

$$E = -\frac{0.0591}{2}\log\left(\frac{p_{H_2}}{(H^+)^2}\right) = -\frac{0.0591}{2}\log\left(\frac{10}{10^{-4}}\right)$$

$$= -\frac{0.0591}{2} \times 5 = -0.15\,V$$

55. $W = \frac{Eit}{96500}$ $\quad 18 = \frac{9 \times 3 \times t}{96500}$ $\quad \therefore t \approx 18\text{hrs.}$

56. $E^0_{Au^{3+}/Au} = +ve$

hence it will not reduce H^+ ion of acid to hydrogen.

57. $2H_2 + O_2 \rightarrow 2H_2O (n = 4)$

$2 mol H_2 \rightarrow 4 mole^- = 4 \times 96500C$

$11.2 LH_2 = 0.5 mol H_2 \rightarrow 1 mole^- = 96500C$

$i = \frac{Q}{t} = \frac{96500}{5000} = 19.3\,A$

58. During charging,

At Cathode: $PbSO_4 \rightarrow PbO_2$

At anode: $PbSO_4 \rightarrow Pb$.

59. $E^\circ_{cell} = 0.8 + 0.76 = 1.56\,V$

$\Delta G^\circ = -2 \times 1.56 \times 96500 = 301080\,J = 301kJ$

60. Iron is galvanised by zinc.

61. $z = \frac{63.5}{2F} = \frac{63.5}{2 \times 96500}$

$m = zit = \frac{63.5 \times 9.65 \times 1000}{2 \times 9650} = 3.175\,g$

62. $\Lambda^\circ_m CaCl_2\ \& = \lambda^\circ{}_m Ca^{2+} + 2\lambda^\circ{}_m Cl^- = x_1 + 2x_2$

$\Lambda^\circ E^\circ CaCl_2 = \frac{\Lambda^\circ_E CaCl_2}{2} = \frac{x_1 + 2x_2}{2}$

63. $2e^- + Fe^{2+} \rightarrow Fe; \Delta G_1 = -2 \times F \times a$ (i)

$3e^- + Fe^{3+} \rightarrow Fe; \Delta G_2 = -3 \times F \times b$ (ii)

$1e^- + Fe^{3+} \rightarrow Fe^{2+}; \Delta G_3 = -1 \times F \times E^\circ_{cell}$ (iii)

$\Delta G_3 = \Delta G_2 - \Delta G_1$

$-1 \times F \times E^\circ_{cell} = -3Fb - (-2Fa)$

$-E^\circ_{cell} = -3b + 2a \Rightarrow E^\circ_{cell} = 3b - 2a$

64. $\frac{(t_{1/2})_1}{(t_{1/2})_2} = \left(\frac{a_2}{a_1}\right)^{n-1} \Rightarrow \frac{75}{150} = \left(\frac{2}{1}\right)^{n-1} \Rightarrow 2^{-1} = 2^{n-1}$

$-1 = n - 1 \Rightarrow n = 0$

65. $t_{93.75} = \frac{2.303}{0.693} t_{1/2} \log\frac{100}{6.25}$

$t_{93.75} = \frac{2.303}{2.303 \times 0.3010} t_{1/2} \log 16$

$t_{93.75} = \frac{t_{1/2}}{0.3010} 4 \log \Rightarrow 2t_{93.75} = 4t_{1/2}$

66. $\log\frac{K_2}{K_1} = \frac{E_a}{2.303R}\left(\frac{T_2 - T_1}{T_1T_2}\right)$

$\log 2 = \frac{E_a}{2.303 \times 8.314} \times \frac{10}{298 \times 308} \Rightarrow E_a = 52.89 kJ$

67. When curves of metals crosses each other ten $\Delta G = 0$

68. A Catalyst does not alter Gibbs energy of reaction.

69. $A = A_0 - kt$; As $40 = 100 - k \times 30 \Rightarrow 60 = k \times 30$

$k = 2$ unit; $20 = 100 - k \times t \Rightarrow 80 = k \times t$, $t = 40$ min

70. Rate constant depends on temperature and catalyst both.

71. Unit of rate constant $(k) = \left(\frac{mol}{\ell}\right)^{1-n} time^{-1}$

72. $\frac{0.639}{t_{\frac{1}{2}}} = \frac{2.303}{t}\log\left(\frac{a}{a - x}\right)$;

$\frac{0.693}{6.93} = \frac{2.303}{46.06}\log\left(\frac{100}{100 - x}\right)$; $\quad x = 99\%$

73. (3)

74. Rate $= k[A] = \frac{0.693}{60} \times 0.1 = 1.15 \times 10^{-3} Ms^{-1}$

75. Molecularity of a reaction cannot be zero and it is only defined for an elementary step.

76. $\Delta H = E_{af} - E_{ab} \Rightarrow E_{ab} = 40 - (-10) = 50 kJmol^{-1}$

77. (2)

78. It is a first order reaction as

$$K = \frac{2.303}{10}\log\frac{5}{4} = 0.023$$

which is constant throughout.

79. Arrhenius equation is given as $k = Ae^{-Ea/RT}$

Comparing this equation with $k = Ae^{-6000/T}$

$\frac{-Ea}{RT} = \frac{-6000}{T}$

$E_a = 6000 \times R = 6000 \times 2 = 12000$ cal $= 12$ kcal

80. 2 hours = 8 half life

Amount left after n half lives $= \frac{A_0}{2^n}$

$0.5 = \frac{A_0}{2^8}$

$A_0 = 0.5 \times 2^8 = 128 g$

81. Anode : $\frac{1}{2}H_2(g) \rightleftharpoons H^+(aq) + e^-$

82. $\Lambda_m = \Lambda_m^\circ - A\sqrt{C}$

Units of $A\sqrt{C}$ = S cm^2 $mole^{-1}$

Units of A = S cm^2 $mole^{-3/2}$ $L^{1/2}$

83. In the cathode reaction manganese (Mn) is reduced from the +4 oxidation state to the +3 state.

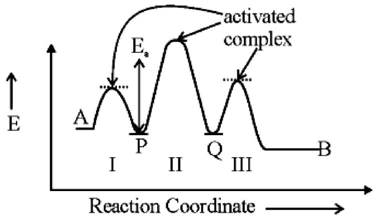
84. $M|M^{+2}||X|X^{2-}$

$E^0_{cell} = E^0_{M/M^{+2}} + E^0_{X/X^{-2}}$ = −0.46 + 0.34 = − 0.12V

As E^0_{cell} is negative so anode becomes cathode and cathode become anode. Spontaneous reaction will be $M^{+2} + X^{-2} \rightarrow M + X$

85. Step with highest activation energy is RDS, so step II is RDS

No. of activated complex = 3



P and Q are intermediates

(Number of intermediates = 2)

86. SO_2 and NH_3 are polar molecules. They are constituent particles of polar molecular solids.

87. r = K[A]'[B]'

0.1 = K(20)'(0.5)' .... (i)

0.40 = K(x)' (0.5)' .... (ii)

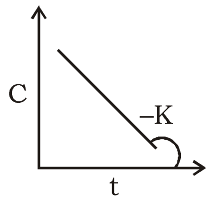
0.80 = K(40)' (y)' .... (iii)

From (i) and (ii) x = 80

From (i) and (iii) y = 2

88. $r = K[A]^2|B|$ if conc. are doubled

$r' = K[2A]^2 [2B]^1 \Rightarrow r' = 8r \Rightarrow x = 8$



$\Rightarrow$ Zero order, y = 0 $\Rightarrow$ x + y = 8

Answer–Key

1.	1	**2.**	4	**3.**	4	**4.**	2	**5.**	2	**6.**	3	**7.**	3	**8.**	4	**9.**	4	**10.**	4
11.	4	**12.**	2	**13.**	1	**14.**	3	**15.**	4	**16.**	4	**17.**	1	**18.**	1	**19.**	2	**20.**	3
21.	1	**22.**	3	**23.**	3	**24.**	2	**25.**	1	**26.**	2	**27.**	1	**28.**	4	**29.**	4	**30.**	3
31.	2	**32.**	4	**33.**	3	**34.**	1	**35.**	4	**36.**	2	**37.**	1	**38.**	2	**39.**	2	**40.**	4
41.	3	**42.**	3	**43.**	3	**44.**	1	**45.**	4	**46.**	2	**47.**	2	**48.**	3	**49.**	2	**50.**	1
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61.	4	**62.**	4	**63.**	1	**64.**	2	**65.**	1	**66.**	1	**67.**	3	**68.**	2	**69.**	2	**70.**	4
71.	3	**72.**	1	**73.**	3	**74.**	3	**75.**	1	**76.**	2	**77.**	2	**78.**	1	**79.**	1	**80.**	1
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91.	1	**92.**	4	**93.**	4	**94.**	3	**95.**	3	**96.**	1	**97.**	1	**98.**	3	**99.**	4	**100.**	3
101.	4	**102.**	3	**103.**	4	**104.**	3	**105.**	4	**106.**	4	**107.**	4	**108.**	1	**109.**	2	**110.**	4
111.	3	**112.**	2	**113.**	2	**114.**	1	**115.**	4	**116.**	3	**117.**	3	**118.**	2	**119.**	3	**120.**	4
121.	3	**122.**	3	**123.**	4	**124.**	3	**125.**	2	**126.**	3	**127.**	3	**128.**	3	**129.**	2	**130.**	1
131.	1	**132.**	3	**133.**	2	**134.**	1	**135.**	1	**136.**	3	**137.**	2	**138.**	1	**139.**	1	**140.**	3
141.	1	**142.**	1	**143.**	2	**144.**	2	**145.**	1	**146.**	2	**147.**	1	**148.**	1	**149.**	4	**150.**	1
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161.	2	**162.**	3	**163.**	3	**164.**	3	**165.**	2	**166.**	2	**167.**	4	**168.**	2	**169.**	2	**170.**	2
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1. For λ = 4800, photoelectrons emits. So threshold wavelength may be greater than 4800 Å.

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$2hv = \phi_0 + x' \Rightarrow 2(\phi_0 + x) - \phi_0 = x'$

$\Rightarrow x' = \phi_0 + 2x \Rightarrow x' > 2x$

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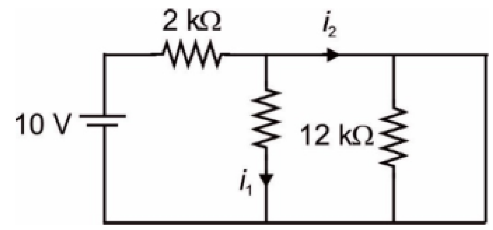
7. 

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If trivalent impurity is dopped then $N_P > N_C$

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$\frac{\lambda_p}{\lambda_\alpha} = \sqrt{\frac{q_\alpha v_\alpha m_\alpha}{q_p v_p m_p}} = \sqrt{\frac{2q_p(800)(4m_p)}{q_p(100)m_p}}$

$\frac{\lambda_p}{\lambda_\alpha} = 8 \Rightarrow \lambda_\alpha = \frac{\lambda_p}{8}$

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$\overline{\overline{A}}\cdot\overline{\overline{B}} = \overline{\overline{AB}} = AB \to AND$ gate
$A\overline{B} + \overline{A}B = A \oplus B \to EX-OR$ gate

32. $\frac{n}{t} = \frac{power}{h\nu} = 9\times 10^{13} / s$

33. For stability binding energy per Nucleon should be more.

34. Average binding energy per nucleon is 8 MeV .

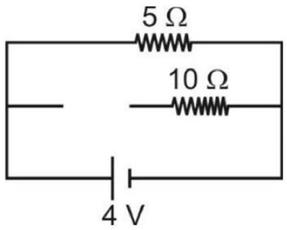
35. Fact

36. Graph starts at $\frac{C}{\lambda_0}$

37. Answer (3)

38. Answer (4)

39. Answer (4)

40. 

$I = \frac{4}{5}$=0.8A

41. In case 1 : $\frac{1}{2}mv_1^2 = 2hv_0 - hv_0 = hv_0$

In case 2 : $\frac{1}{2}mv_2^2 = 5hv_0 - hv_0 = 4hv_0$

Divide (1) and (2)

$\frac{v_1^2}{v_2^2} = \frac{hv_0}{4hv_0} = \frac{1}{4} \Rightarrow v_2 = 2v_1 = 8\times 10^6 m/s$

42. The electron ejected with maximum speed V_{max} are stopped by electric field E = 4 N/C after travelling a distance d = 1 m

$\therefore \frac{1}{2}mV_{max}^2 = eEd = 4eV$

The energy of incident photon $= \frac{1240}{200} = 6.2 eV$

From equation of photo electric effect

$\frac{1}{2}mV_{max}^2 = hv - \phi 0 \quad \therefore \phi_0 = 6.2 - 4 = 2.2 eV$

43. Photodiode is used in reversed bias and saturation current is dependent on intensity option (4) represents I-V graph of photodiode.

44. $\lambda = \frac{h}{mv}$

Hence, $\frac{\lambda_p}{\lambda_\alpha} = \frac{m_\alpha v_\alpha}{m_p v_p} \qquad \therefore \frac{v_p}{v_\alpha} = \frac{m_\alpha}{m_p} = \frac{4}{1}$

45. For Lyman, $\frac{1}{\lambda} = R\left[\frac{1}{1} - \frac{1}{4}\right] \Rightarrow \frac{1}{\lambda} = \frac{3R}{4}$

For Balmar, $\frac{1}{\lambda_B} = R\left[\frac{1}{4} - \frac{1}{9}\right] = \frac{5}{36}R$

$\frac{\lambda_B}{\lambda} = \frac{3R}{4}\times\frac{36}{5R} = \frac{27}{5}$

46. Greater the ionic size, higher is the radii of hydrated ion and lower is the conductance

47. $2H^+(aq.) + 2e^- \to H_2(g)$

$E = -\frac{0.0591}{2}\log\left(\frac{p_{H_2}}{(H^+)^2}\right) = -\frac{0.0591}{2}\log\left(\frac{10}{10^{-4}}\right)$

$= -\frac{0.0591}{2}\times 5 = -0.15 V$

48. $W = \frac{Eit}{96500} \quad 18 = \frac{9\times 3\times t}{96500} \quad \therefore t \approx 18 hrs.$

49. $2e^- + Fe^{2+} \to Fe; \Delta G_1 = -2\times F\times a$ (i)

$3e^- + Fe^{3+} \to Fe; \Delta G_2 = -3\times F\times b$ (ii)

$1e^- + Fe^{3+} \to Fe^{2+}; \Delta G_3 = -1\times F\times E^\circ_{cell}$ (iii)

$\Delta G_3 = \Delta G_2 - \Delta G_1$

$-1\times F\times E^\circ_{cell} = -3Fb - (-2Fa)$

$-E^\circ_{cell} = -3b + 2a \Rightarrow E^\circ_{cell} = 3b - 2a$

50. $\frac{(t_{1/2})_1}{(t_{1/2})_2} = \left(\frac{a_2}{a_1}\right)^{n-1} \Rightarrow \frac{75}{150} = \left(\frac{2}{1}\right)^{n-1} \Rightarrow 2^{-1} = 2^{n-1}$

$-1 = n - 1 \Rightarrow n = 0$

51. $t_{93.75} = \frac{2.303}{0.693}t_{1/2}\log\frac{100}{6.25}$

$t_{93.75} = \frac{2.303}{2.303\times 0.3010}t_{1/2}\log 16$

$$t_{93.75} = \frac{t_{1/2}}{0.3010} 4\log \Rightarrow 2t_{93.75} = 4t_{1/2}$$

52. Rate constant depends on temperature and catalyst both.

53. Unit of rate constant $(k) = \left(\frac{mol}{\ell}\right)^{1-n} time^{-1}$

54. $\frac{0.639}{t_{\frac{1}{2}}} = \frac{2.303}{t}\log\left(\frac{a}{a-x}\right)$;

$\frac{0.693}{6.93} = \frac{2.303}{46.06}\log\left(\frac{100}{100-x}\right)$; $x = 99\%$

55. (3)

56. 2 hours = 8 half life

Amount left after n half lives $= \frac{A_0}{2^n}$

$0.5 = \frac{A_0}{2^8}$

$A_0 = 0.5 \times 2^8 = 128 g$

57. Anode : $\frac{1}{2}H_2(g) \rightleftharpoons H^+(aq) + e^-$

58. $\Lambda_m = \Lambda^\circ_m - A\sqrt{C}$

Units of $A\sqrt{C}$ = S cm^2 mole^{-1}

Units of A = S cm^2 mole$^{-3/2}$ L$^{1/2}$

59. SO_2 and NH_3 are polar molecules. They are constituent particles of polar molecular solids.

60. r = K[A]'[B]'

$0.1 = K(20)'(0.5)'$ .... (i)

$0.40 = K(x)'(0.5)'$ .... (ii)

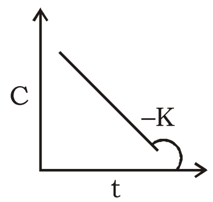
$0.80 = K(40)'(y)'$ .... (iii)

From (i) and (ii) x = 80

From (i) and (iii) y = 2

61. $r = K[A]^2|B|$ if conc. are doubled

$r' = K[2A]^2[2B]^1 \Rightarrow r' = 8r \Rightarrow x = 8$



$\Rightarrow$ Zero order, y = 0 $\Rightarrow$ x + y = 8

62. In the cathode reaction manganese (Mn) is reduced from the +4 oxidation state to the +3 state.

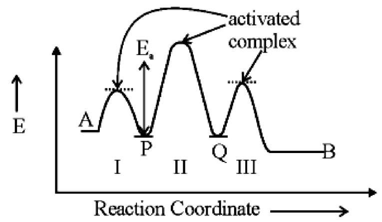
63. $M|M^{+2}||X|X^{2-}$

$E^0_{cell} = E^0_{M/M^{+2}} + E^0_{X/X^{-2}}$ = –0.46 + 0.34 = – 0.12V

As E^0_{cell} is negative so anode becomes cathode and cathode become anode. Spontaneous reaction will be $M^{+2} + X^{-2} \rightarrow M + X$

64. Step with highest activation energy is RDS, so step II is RDS

No. of activated complex = 3



P and Q are intermediates

(Number of intermediates = 2)

65. (2)

66. It is a first order reaction as

$$K = \frac{2.303}{10}\log\frac{5}{4} = 0.023$$

which is constant throughout.

67. Arrhenius equation is given as $k = Ae^{-Ea/RT}$

Comparing this equation with $k = Ae^{-6000/T}$

$\frac{-Ea}{RT} = \frac{-6000}{T}$

E_a = 6000 × R = 6000 × 2 = 12000 cal = 12 kcal

68. $\log\frac{K_2}{K_1} = \frac{E_a}{2.303R}\left(\frac{T_2 - T_1}{T_1T_2}\right)$

$\log 2 = \frac{E_a}{2.303 \times 8.314} \times \frac{10}{298 \times 308} \Rightarrow E_a = 52.89 kJ$

69. When curves of metals crosses each other ten $\Delta G = 0$

70. A Catalyst does not alter Gibbs energy of reaction.

71. $2H_2 + O_2 \rightarrow 2H_2O (n = 4)$

$2 mol H_2 \rightarrow 4 mol e^- = 4 \times 96500 C$

$11.2 L H_2 = 0.5 mol H_2 \rightarrow 1 mol e^- = 96500 C$

$i = \frac{Q}{t} = \frac{96500}{5000} = 19.3 A$

72. During charging,

At Cathode: $PbSO_4 \rightarrow PbO_2$

At anode: $PbSO_4 \rightarrow Pb$.

73. $E^\circ_{cell} = 0.8 + 0.76 = 1.56 V$

$\Delta G^\circ = -2 \times 1.56 \times 96500 = 301080 J = 301 kJ$

74. Reaction at cathode ; $H_2O(\ell) + e^- \rightarrow \frac{1}{2}H_2(g) + \overline{O}H$

Reaction at anode ; $Cl^-(aq) \rightarrow \frac{1}{2}Cl_2(g) + e^-$

75. $NaCl(aq) \rightarrow \underset{Cathode}{H_2} + \underset{Anode}{Cl_2}$

$Na_2SO_4(aq) \rightarrow \underset{Cathode}{H_2} + \underset{Anode}{O_2}$

$\frac{W_{Cl_2}}{W_{O_2}} = \frac{E_{Cl_2}}{E_{O_2}} = \frac{35.5}{8} = \frac{11.2L}{5.6L} = \frac{2}{1}$

76. $\lambda_m = \frac{1.65}{0.15} \times 10^3\ S\,cm^2\,mol^{-1} = 11 \times 10^3\ S\,cm^2\,mol^{-1}$

$11 \times 10^3 \times 10^{-4}\ Sm^2\,mol^{-1} = 1.1 Sm^2\,mol^{-1}$

77. Iron is galvanised by zinc.

78. $z = \frac{63.5}{2F} = \frac{63.5}{2 \times 96500}$

$m = zit = \frac{63.5 \times 9.65 \times 1000}{2 \times 9650} = 3.175\,g$

79. $\Lambda^\circ_m CaCl_2\ \& = \lambda^\circ_m Ca^{2+} + 2\lambda^\circ_m Cl^- = x_1 + 2x_2$

$\Lambda^\circ E^\circ CaCl_2 = \frac{\Lambda^\circ_E CaCl_2}{2} = \frac{x_1 + 2x_2}{2}$

82. Rate $= k[A] = \frac{0.693}{60} \times 0.1 = 1.15 \times 10^{-3} Ms^{-1}$

83. Molecularity of a reaction cannot be zero and it is only defined for an elementary step.

84. $\Delta H = E_{af} - E_{ab} \Rightarrow E_{ab} = 40 - (-10) = 50 kJmol^{-1}$

85. $A = A_0 - kt$; As $40 = 100 - k \times 30 \Rightarrow 60 = k \times 30$
k = 2 unit; $20 = 100 - k \times t \Rightarrow 80 = k \times t$, t = 40 min

86. $E^0_{Au^{3+}/Au} = +ve$
hence it will not reduce H^+ ion of acid to hydrogen.

87. Conductance $(G) = \frac{1}{R} = \frac{1}{200}$

$K = G\left(\frac{l}{A}\right)$

$\left(\frac{l}{A}\right) =$ Cell constant $= \frac{0.015}{1} \times 200 = 3 cm^{-1}$

88. Higher the value of standard reduction potential higher is the oxidising power of the metal.

89. Cell reaction is $2Ag^+ + Cu \rightarrow Cu^{2+} + 2Ag$

$E^\circ_{cell} = 0.80 - 0.34 = 0.46$

Apply Nernst equation :

$E_{cell} = E^\circ_{cell} - \frac{0.0591}{2} \log \frac{[Cu^{+2}]}{[Ag^+]^2}$

$E_{cell} = 0.46 - \frac{0.0591}{2} \log \frac{1.5 \times 10^{-4}}{(4.5 \times 10^{-4})^2}$

$E_{cell} = 0.375$

$\Delta G = -nFE = -2 \times 96500 \times 0.375 = -72375\,J$

90. $\log(K_c) = \frac{nE^0_{cell}}{0.0591} = \frac{2 \times 0.591}{0.0591} = 20$

$K_c = 10^{20}$

Answer–Key

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