52. Which of the following will **not** conduct electricity in aqueous solution?

(1) Copper sulphate (2) Sugar

(3) Common salt (4) None of these

53. Specific conductance of 0.1 M nitric acid is 6.3×10^{-2} ohm^{-1} cm^{-1}. The molar conductance of solution is:

(1) 630 ohm^{-1} cm^{2} mol^{-1}

(2) 315 ohm^{-1} cm^{2} mol^{-1}

(3) 100 ohm^{-1} cm^{2} mol^{-1}

(4) 6300 ohm^{-1} cm^{2} mol^{-1}

54. Reduction is defined as:

(1) Increase in positive valency

(2) Gain of electrons

(3) Loss of protons

(4) Decrease in negative valency

55. In acidic medium, equivalent weight of $K_2Cr_2O_7$ (Molecular weight = M) is:

(1) $\frac{M}{3}$ (2) $\frac{M}{4}$

(3) $\frac{M}{6}$ (4) $\frac{M}{2}$

56. In alkaline condition:

$KMnO_4 + 2KOH \rightarrow 2K_2MnO_4 + H_2O + O$

of Ba^{2+} and Cl^- are 127 and 76 ohm^{-1} cm^2 eq^{-1}. The equivalent conductivity of $BaCl_2$ at infinite dilution is:

(1) 101.5 (2) 139.5

(3) 203 (4) 279.5

58. Which of the following is **not** a redox reaction?

(1) $MnO_4^- \rightarrow MnO_2 + O_2$

(2) $Cl_2 + H_2O \rightarrow HCl + HClO$

(3) $2CrO_4^{2-} + 2H^+ \rightarrow Cr_2O_7^{2-} + H_2O$

(4) $MnO_4^- + 8H^+ + 5Ag \rightarrow Mn^{2+} + 4H_2O + 5Ag^+$

59. The electrodes of a conductivity cell are 3 cm apart and have a cross-sectional area of 4 cm^2. The cell constant of the cell (in cm^{-1}) is:

(1) 4×3 (2) $\frac{4}{3}$

(3) $\frac{3}{4}$ (4) $\frac{9}{4}$

60. The electrochemical equivalent of copper is 0.0003296 g/Coulomb. Calculate the amount of copper deposited by a current of 0.5 ampere flowing through copper sulphate solution for 50 minutes:

(1) 0.4944 (2) 0.3944

(3) 0.4934 (4) 0.4933

61. $\left(-\frac{1}{3}\right)$ oxidation state of nitrogen will be obtained in case of:
(1) Ammonia (NH_3)
(2) Hydrazoic acid (N_3H)
(3) Nitric oxide (NO)
(4) Nitrous oxide (N_2O)

62. The limiting molar conductivities ($\Lambda°$) for NaCl, KBr and KCl are 126, 152 and 150 S cm^2/mol respectively. The $\Lambda°$ for NaBr is:
(1) 278 S cm^2/mol (2) 176 S cm^2/mol
(3) 128 S cm^2/mol (4) 302 S cm^2/mol

63. Sulphur has highest oxidation state in:
(1) SO_2 (2) H_2SO_4
(3) $Na_2S_2O_3$ (4) $Na_2S_4O_6$

64. In a electrochemical cell:
(1) Potential energy changes into kinetic energy
(2) Kinetic energy changes into potential energy
(3) Chemical energy changes into electrical energy
(4) Electrical energy changes into chemical energy

65. When H_2 reacts with Na, it acts as:
(1) Oxidising agent
(2) Reducing agent
(3) Both (1) and (2)
(4) Cannot be predicted

66. $2I_2 + 2KI \rightarrow 2KI_3$
In the above reaction:
(1) Only oxidation takes place
(2) Only reduction takes place
(3) Both the above
(4) Neither oxidation nor reduction

67. If the reduction potential is more, then:
(1) It is easily oxidised
(2) It is easily reduced
(3) It acts as reducing agent
(4) It has redox nature

68. Find the **incorrect** statement:
(1) Higher reduction potential of non-metal means stronger reducing agent.
(2) Lower oxidation potential of a metal means weak oxidizing agent.
(3) Oxidation state of oxygen in O_3 is –1
(4) All of these

69. The conductivity of strong electrolyte is:
(1) Increase on dilution slightly
(2) Decrease on dilution
(3) Does not change with dilution
(4) Depend upon density of electrolytes itself

70. In the conversion $NH_2OH \rightarrow N_2O$, the equivalent weight of NH_2OH will be:
(1) $\frac{M}{4}$ (2) $\frac{M}{2}$
(3) $\frac{M}{5}$ (4) $\frac{M}{1}$

71. Which of the following is **incorrect** regarding salt bridge solution?
(1) Solution must be strong electrolyte.
(2) Solution should be inert towards both electrodes.
(3) Size of cations and anions of salt should be different.
(4) Salt bridge solution is prepared in gelatin or agar-agar to make it semi-solid.

72. If E° for $F_2 + 2e^- \rightarrow 2F^-$ is 2.8 V, find E° for $\frac{1}{2}F_2 + e^- \rightarrow F^-$:
(1) 2.8 V (2) 1.4 V
(3) –2.8 V (4) –1.4 V

73. The number of moles of H_2O_2 required to completely react with 400 mL of 0.5 N $KMnO_4$ in acidic medium are:
(1) 0.1 (2) 0.2
(3) 1.0 (4) 0.5

74. A current of 0.5 ampere, when passed through $AgNO_3$ solution for 193 sec, deposited 0.108 Ag. Find the equivalent weight of Ag:
(1) 108 (2) 105
(3) 1.08 (4) 102

75. In the reaction:
$2Na_2S_2O_3 + I_2 \rightarrow Na_2S_4O_6 + 2NaI$, the oxidation state of sulphur is:
(1) Decreased (2) Increased
(3) Unchanged (4) None of these

76. On the electrolysis of aqueous solution of sodium sulphate, on cathode we get:
(1) Na (2) H_2
(3) SO_2 (4) SO_3

77. Consider a titration of potassium dichromate solution with acidified Mohr's salt solution using diphenylamine as the indicator. The number of moles of Mohr's salt required per mole of dichromate is:

(1) 3 (2) 4
(3) 5 (4) 6

78. HNO_2 acts both as reductant and oxidant, while HNO_3 acts only as oxidant. It is due to:

(1) Solubility ability
(2) Maximum oxidation number
(3) Minimum oxidation number
(4) Minimum number of valence electrons

79. **Assertion:** In a reaction:

$Zn(s)+CuSO_4(aq)\rightarrow ZnSO_4(aq)+Cu(s)$,

Zn is a reductant but itself get oxidized.

Reason: In a redox reaction, oxidant is reduced by accepting electrons and reductant is oxidized by losing electrons.

(1) Assertion is correct, reason is correct, reason is a correct explanation for assertion.
(2) Assertion is correct, reason is correct, reason is not a correct explanation for assertion.
(3) Assertion is correct, reason is incorrect.
(4) Assertion is incorrect, reason is correct.

80. In acidic medium H_2O_2 changes $Cr_2O_7^{2-}$ to CrO_5 which has two (– O – O –) bonds. The oxidation state of Cr in CrO_5 is:

(1) +5 (2) +3
(3) +6 (4) –10

81. Which of the following elements does not show disproportionation tendency?

(1) C*l* (2) Br
(3) F (4) I

82. In the reaction:

$MnO_4^- + xH^+ + ne^- \rightarrow Mn^{2+} + yH_2O$

What is the value of n?

(1) 5 (2) 8
(3) 6 (4) 3

83. Without losing its concentration, $ZnCl_2$ solution cannot be kept in contact with:

(1) Au (2) Al
(3) Pb (4) Ag

84. Which of the following compounds does not decolourize acidified $KMnO_4$ solution?

(1) $FeCl_3$ (2) $FeSO_4$
(3) FeC_2O_4 (4) H_2O_2

85. $H_2O_2 + H_2O_2 \rightarrow 2H_2O + O_2$ is an example of disproportionation because:

(1) Oxidation number of oxygen only decreases
(2) Oxidation number of oxygen only increases
(3) Oxidation number of oxygen decreases as well as increases
(4) Oxidation number of oxygen neither decreases nor increases

86. Calculate the oxidation number of P in PO_4^{3-} ion.

(1) +5 (2) +6
(3) +7 (4) +8

87. Which of the following is the **correct** match?

(1) Cl_2 – Only reducing agent
(2) $KMnO_4$ – Only reducing agent
(3) HNO_3 – Both oxidising and reducing agent
(4) SO_2 – Both oxidising and reducing agent

88. The specific conductance of a 0.1 N KCl solution at 23°C is 0.012 ohm^{-1} cm^{-1}. The resistance of cell containing the solution at the same temperature was found to be 55 ohm. The cell constant will be:

(1) 0.142 cm^{-1} (2) 0.66 cm^{-1}
(3) 0.918 cm^{-1} (4) 1.12 cm^{-1}

89. $2MnO_4^- + 5H_2O_2 + 6H^+ \rightarrow 2Z + 5O_2 + 8H_2O$. In this reaction Z is:

(1) Mn^{2+} (2) Mn^{4+}
(3) MnO_2 (4) Mn

90. When the electric current is passed through a cell having an electrolyte, the positive ions move towards the cathode and negative ions towards the anode. If the cathode is pulled out of the solution:

(1) The positive and negative ions will move towards anode.
(2) The positive ions will start moving towards the anode while negative ions will stop moving.
(3) The negative ions will continue to move towards anode while positive ions will stop moving.
(4) The positive and negative ions will start moving randomly.

91. The equation:

$$Mg(s) + CuO(s) \rightarrow MgO(s) + Cu(s)$$

represents:

I. Decomposition reaction
II. Combination reaction
III. Displacement reaction
IV. Double displacement reaction
V. Redox reaction

(1) II and V (2) III and V
(3) I and II (4) IV and V

92. The oxidation potentials of following half-cell reactions are given $Zn \rightarrow Zn^{2+} + 2e^{-}$; E° = 0.76V, $Fe \rightarrow Fe^{2+} + 2e^{-}; E° = 0.44\,V$ what will be the emf of cell, whose cell reaction is:

$$Fe^{2+}(aq) + Zn \rightarrow Zn^{2+}(aq) + Fe$$

(1) –1.20 V (2) +0.32 V
(3) –0.32 V (4) +1.20 V

93. Identify the **correct** statement about H_2O_2

(1) It acts as reducing agent only
(2) It acts as both oxidising and reducing agent
(3) It is neither an oxidiser nor reducer
(4) It acts as oxidising agent only

94. Equivalent weight of FeC_2O_4 in the change:

$FeC_2O_4 \rightarrow Fe^{3+} + CO_2$ is:

(1) $\frac{M}{3}$ (2) $\frac{M}{6}$
(3) $\frac{M}{2}$ (4) $\frac{M}{1}$

95. How many of the following metals release H_2 gas when reacted with 1 M $[H^+]$?

Na, K, Ca, Fe, Sn, Ni, Zn, Cr, Al, Cu, Ag, Au

(1) 5 (2) 6
(3) 8 (4) 9

96. Among the following which is the best oxidising agent?

(1) H_2SO_3 - sulfurous acid
(2) H_2SO_4 - sulphuric acid
(3) H_2SO_5 - persulfuric acid
(4) H_2SO_2 - hyposulfurous acid

97. Electrode potential data are given below:

$$Fe^{3+}(aq) + e^{-} \rightarrow Fe^{2+}(aq);\ E° = +0.77\ V$$

$$Al^{3+}(aq) + 3e^{-} \rightarrow Al(s);\ E° = -1.66\ V$$

$$Br_2(aq) + 2e^{-} \rightarrow 2Br^{-}(aq);\ E° = +1.08\ V$$

Based on the data given above, reducing power of Fe^{2+}, Al and Br^{-} will increase in the order:

(1) $Br^{-} < Fe^{2+} < Al$ (2) $Fe^{2+} < Al < Br^{-}$
(3) $Al < Br^{-} < Fe^{2+}$ (4) $Al < Fe^{2+} < Br^{-}$

98. When the sample of copper with zinc impurity is to be purified by electrolysis, the appropriate electrodes are:

	Cathode	**Anode**
(1)	Pure zinc	Pure copper
(2)	Impure sample	Pure copper
(3)	Impure zinc	Impure sample
(4)	Pure copper	Impure sample

99. In the reaction:

$$C_2O_4^{2-} + MnO_4^{-} + H^{+} \rightarrow Mn^{2+} + CO_2 + H_2O$$

the reductant is:

(1) $C_2O_4^{2-}$ (2) MnO_4^{-}
(3) Mn^{2+} (4) H^{+}

100. The more positive the value of E°, the greater is the tendency of the species to get reduced. Using the standard electrode potential of redox couples given below, find out which of the following is the strongest oxidizing agents?

$$E°\ value: Fe^{3+}/Fe^{2+} = +0.77\ V;\ I_2/I^{-} = 0.54\ V;$$

$$Cu^{2+}/Cu = +0.34\ V;\ Ag^{+}/Ag = +0.80\ V;$$

(1) Fe^{3+} (2) I_2
(3) Cu^{2+} (4) Ag^{+}

does not conduct electricity.

53. **(1)**

$$\Lambda_m = \frac{\kappa \times 1000}{M}$$

$$= \frac{6.3 \times 10^{-2} \times 1000}{0.1}$$

$= 630\ ohm^{-1}\ cm^2\ mol^{-1}$

54. **(2)**

According to modern theory of reduction, the atoms/ions which gain electrons are reduced.

55. **(3)**

n-factor = 6

$$\text{Equivalent weight} = \frac{\text{Molecular weight}}{6}$$

56. **(1)**

$$e^- + Mn^{7+} \rightarrow Mn^{6+}$$

$$\therefore \quad E = \frac{M}{1}$$

57. **(3)**

$$\Lambda^\circ_{eq} BaCl_2 = \Lambda^\circ_{eq} Ba^{2+} + \Lambda^\circ_{eq} Cl^-$$

$= (127 + 76)\ ohm^{-1}\ cm^2\ eq^{-1}$

$= 203\ ohm^{-1}\ cm^2\ eq^{-1}$

.

No change

As there is no change in oxidation state, it is not a redox reaction.

59. **(3)**

$$\text{Cell constant} = \frac{\ell}{a} = \frac{3}{4}\ cm^{-1}$$

60. **(1)**

According to Faradays' first law, W = Zit

W = 0.5 × 50 × 60 × 0.0003296 = 0.4944 g

61. **(2)**

Hydrazoic acid $N_3H \Rightarrow$ O.N. of nitrogen × 3 + O.N. of H = 0

x × 3 + (+1) × 1 = 0

$$x = \frac{-1}{3}$$

62. **(3)**

$$\Lambda^\circ_{NaCl} = \Lambda^\circ_{Na^+} + \Lambda^\circ_{Cl^-} = 126\ S\ cm^2 / mol \quad .....(1)$$

$$\Lambda^\circ_{KBr} = \Lambda^\circ_{K^+} + \Lambda^\circ_{Br^-} = 152\ S\ cm^2 / mol \quad .....(2)$$

$$\Lambda^\circ_{KCl} = \Lambda^\circ_{K^+} + \Lambda^\circ_{Cl^-} = 150\ S\ cm^2 / mol \quad .....(3)$$

$$\Lambda^\circ_{NaBr} = \Lambda^\circ_{Na^+} + \Lambda^\circ_{Br^-} \quad .....(4)$$

For getting equation (4), add equation (1) and (2) and subtract (3) from it.

$= (126 + 152) - 150 = 128 \text{ S cm}^2\text{/mol}$

63. **(2)**

$\overset{*}{S}O_2 = +4$

$H_2\overset{*}{S}O_4 = +6$

$Na_2\overset{*}{S_2}O_3 = +2$

$Na_2\overset{*}{S_4}O_6 = +\frac{5}{2}$

64. **(3)**

Chemical energy changes into electrical energy.

65. **(1)**

O.N. of H_2 converts from zero to –1

$2\overset{\circ}{Na} + \overset{\circ}{H_2} \rightarrow 2\overset{+1}{Na}\overset{-1}{H}$

Thus, acts as oxidizing agent.

66. **(3)**

Oxidation

$\overset{0}{I_2} + K\overset{-1}{I} \longrightarrow K\overset{-\frac{1}{3}}{I_3}$

Reduction

67. **(2)**

More the reduction potential, more is the tendency to get reduced.

68. **(4)**

(1) Higher R.P. $\Rightarrow$ Strong oxidizing agent

(2) Lower O.P. $\Rightarrow$ Stronger oxidizing agent

(3) O.S. of oxygen in $O_3 = 0$

69. **(2)**

Specific conductance or conductivity of strong electrolyte decreases on dilution as number of ions in unit volume decreases on dilution.

70. **(2)**

Oxidation state of N in NH_2OH,

$x + 3 - 2 = 0$

$x = -1$

Therefore, the charge on nitrogen is −1

Oxidation state of N in N_2O

$2x - 2 = 0$

$x = +1$

Since oxidation state of N changes from −1 to +1, the equivalent weight of NH_2OH is $\frac{M}{2}$.

71. **(3)**

Theory based question.

72. **(1)**

Electrode potential is an intensive property. Hence its value do not change by multiplying or dividing any equation with a constant.

73. **(1)**

Equivalent of H_2O_2 = Equivalent of $KMnO_4$

(n × n-factor) = (NV) $KMnO_4$

$n \times 2 = 0.5 \times \frac{400}{1000}$

$n = \frac{0.5 \times 0.4}{2}$

n = 0.1 mol

74. **(1)**

Given that, i = 0.5 A, m = 0.108 g, t = 193 sec

We know that $W = \frac{M \times it}{nF} = \frac{E \times it}{F}$

$0.108 \text{ g} = E \times \frac{0.5\text{A} \times 193 \text{ sec}}{96500 \text{ C/mol}}$

$E = \frac{96500 \times 0.108}{193 \times 0.5}$

E = 108 g/mol

75. **(2)**

Given the reaction:

$2Na_2\underset{+2}{S_2}O_3 + I_2 \rightarrow Na_2\underset{+2.5}{S_4}O_6 + 2NaI,$

We can see that the oxidation state of S increases.

76. **(2)**

$2H_2O + 2e^- \rightarrow H_2 + 2OH^-$ E° = –0.83 V

$Na^+ + 1e^- \rightarrow Na$ E° = –2.71 V

More the reduction potential, more is the tendency to undergo reduction. So, H_2 will be produced at cathode.

77. **(4)**

Equivalents of dichromate = Equivalents of Mohr's salt;

Number of Equivalents = n × n_f

Given: Moles of Dichromate = 1

1 × n_f of dichromate = n × n_f of Mohr's salt

1 × 6 = n × 1

n = 6

Number of moles of Mohr's salt required = 6 mol

78. (2)

HNO_2 acts both as reductant and oxidant, while HNO_3 acts only as oxidant.
It is due to maximum oxidation number.

79. (1)

Theory based question.

80. (3)

CrO_5 (Chromium oxide peroxide)
Calculated O.S. = +10
Maximum O.S. = +6
Calculated O.S. > Maximum O.S. so peroxy linkage is there.
2 peroxy linkages are present;
Actual O.S. = + 6 (Maximum O.S.)
So, option (3) is correct.

81. (3)

F is the most electronegative element so it can only be reduced.

82. (1)

$$\overset{+7}{Mn}O_4^- + xH^+ + ne^- \rightarrow \overset{+2}{Mn}^{2+} + yH_2O$$

$$5e^- + \overset{+7}{Mn} \rightarrow \overset{+2}{Mn}$$

So, $MnO_4^- + 8H^+ + 5e^- \rightarrow Mn^{2+} + 4H_2O$

83. (2)

In electrochemical series, Al is placed above Zn and all others are present below Zn. So aluminium displaces zinc from $ZnCl_2$ solution. Hence, it cannot be kept in contact with Al.

$2Al + 3ZnCl_2 \rightarrow 2AlCl_3 + 3Zn$

84. (1)

Strong oxidizing agents are typically compounds with elements in high oxidation states or with high electronegativity, which gain electrons in the redox reaction.
Here $KMnO_4$ is a strong oxidising agent
In $FeCl_3$, Fe is in its +3 oxidation state , it cannot be oxidised further.
Thus, the answer is option (1).

85. (3)

Reduction

$$\overset{+1\ -1}{2H_2O_2} \rightarrow \overset{+1\ -2}{2H_2O} + \overset{0}{O_2}$$

Oxidation

86. (1)

x + 4(–2) = –3 (x = O.N. of P)
x – 8 = –3
x = –3 + 8
x = +5

87. (4)

Oxidation states of central atoms:
Cl_2: Zero (–1 is minimum and +7 is maximum possible O.S.). So it can act like both O.A. and R.A.
$KMnO_4$: +7 for Mn (+7 is highest possible O.S.), it can only go to lower O.S. and thus acts like O.A.
HNO_3: +5 for N (+5 is highest possible O.S.) can only go to lower O.S. and thus acts like O.A.
SO_2:+4 for S (+6 is highest possible O.S. and –2 is lowest possible O.S.) it can act as both O.A. and R.A.

88. (2)

$\kappa = 0.012\ ohm^{-1}\ cm^{-1}$
R = 55 ohm

$$G = \frac{1}{55}\ ohm^{-1}$$

Cell constant, $\dfrac{\kappa}{G} = \dfrac{0.012}{\frac{1}{55}} = 0.012 \times 55 = 0.66\ cm^{-1}$

89. (1)

$$2MnO_4^- + 5H_2O_2 + 6H^+ \rightarrow 2Mn^{2+} + 5O_2 + 8H_2O$$

90. (4)

The positive and negative ions will start moving randomly.

91. (2)

Reduction

$$\overset{0}{Mg} + \overset{+2}{Cu}\,\overset{-2}{O} \longrightarrow \overset{+2}{Mg}\,\overset{-2}{O} + \overset{0}{Cu}$$

Oxidation

It is a redox as well as displacement reaction.

92. (2)

$$Fe^{2+} + Zn \rightarrow Zn^{2+} + Fe$$

$$E^\circ_{Zn^{2+}|Zn} = -0.76\ V$$

$$E^\circ_{Fe^{2+}|Fe} = -0.44\ V$$

$$E^\circ_{cell} = E^\circ_{cathode} - E^\circ_{anode}$$

= –0.44 – (–0.76)
= –0.44 + 0.76
= 0.32 V

93. **(2)**

In H_2O_2 oxidation state of O is –1 thus, it can gain as well as donate its electron. Hence, it acts as both oxidising and reducing agent.

94. **(1)**

There is oxidation in both half reactions.

So, $nf = nf_1 + nf_2$

$= 1 + 2$

$n_f = 3$

$$\text{Eq. wt.} = \frac{\text{M.wt.}}{\text{nf}}$$

$= M/3$

95. **(4)**

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

(ii) $M \text{ (metal)} \longrightarrow M^{2+}(aq) + 2e^-$

(iii) We know, metals which are below $\frac{H^+}{H_2}$ in electrochemical series will release H_2 gas.

(iv) In the given metals, 9 metals will release H_2 (Na, K, Ca, Fe, Sn, Ni, Zn, Cr, Al)

Hence, option (4) is correct.

96. **(3)**

H_2SO_5 because it has a peroxy linkage.

97. **(1)**

Lower the reduction potential higher, will be the reducing power.

$\therefore$ Reducing power $\rightarrow$ Al > Fe^{2+} > Br^-

98. **(4)**

In purification method of copper, impure copper is taken as anode and pure copper electrode is taken as cathode.

99. **(1)**

$$C_2O_4^{2-} + MnO_4^- + H^+ \rightarrow Mn^{2+} + CO_2 + H_2O$$

In this reaction $C_2O_4^{2-}$ act as a reducing agent, as it converts Mn^{7+} to Mn^{2+}.

100. **(4)**

Reduction potential is a measure of the tendency of a chemical species to acquire electrons or lose electrons to an electrode and thereby be reduced or oxidised respectively.

Here, the one with the highest reduction potential is $Ag^+/Ag = +0.80$ V

So, it has the tendency to get reduced, therefore it is the strongest oxidizing agent.