

Electrode potential, E_{cell} , Nernt equation and ECS

51. (b) Standard hydrogen electrode have zero electrode potential.

52. The electrode potential of a cell is given by the **Nernst equation**:

$$E = E^\circ - (RT / nF) \times \ln([\text{products}] / [\text{reactants}])$$

Where:

- E° = standard electrode potential
- R = gas constant
- T = temperature (in Kelvin)
- n = number of electrons transferred
- F = Faraday constant

This shows that the cell potential decreases from its standard value by a term proportional to the natural log of the **ratio of products to reactants**.

So, the correct option is:

(a) $E = E^\circ - (RT / nF) \ln([\text{products}] / [\text{reactants}])$

53. (a) $\Delta G = -nFE^\circ$

$$\Delta G = -1 \times 96500 \times 1.02 ; \Delta G = -98430$$

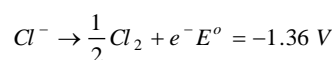
54. (c) Fuel cell converts the chemical energy into electrical energy.

55. (a) $E = E^\circ - \frac{2.303 RT}{nF} \log \frac{[M]}{[M^{n+}]}$

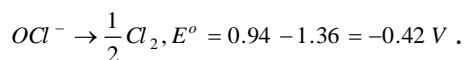
56. (a) Less is the reduction potential stronger is the reducing agent.

57. (a) Reducing power, *i.e.* the tendency to lose electrons increases as the reduction potential decreases.

58. (a) $OCl^- \rightarrow Cl^-, E^\circ = 0.94 V$



adding the two equations, we get



59. Correct answer: (b) and (c)

Word-friendly explanation:

- A higher (more positive) reduction potential means the species has a greater tendency to gain electrons, i.e., it is easily reduced.
- Substances that are easily reduced can oxidize others, so they act as oxidising agents.

Therefore:

- (b) It is easily reduced –True
- (c) It acts as oxidising agent –True

Most exam keys accept (b) as the primary correct answer, but (c) is also a correct statement.

60. (a) It cannot evolved H_2 from H_2S



61. (b) $E_{cell}^\circ = \frac{0.059}{n} \log K$

$$\log K = \frac{1.10 \times 2}{0.059} = 37.2881 \text{ or } K = 10^{-37} .$$

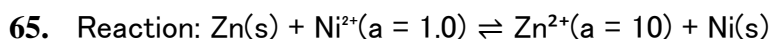
62. (d) The oxidizing character i.e. acceptance of electrons increases with the reduction potential.

63. (a) According to electrochemical series.

64. (d) $E_{cell} = E_{cell}^\circ - \frac{RT}{nF} \ln \frac{C_2}{C_1}$ and $\Delta G = -nF E_{cell}$

hence ΔG is the function of $\ln \left(\frac{C_2}{C_1} \right)$.





Observed emf, $E = 0.5105 \text{ V}$

Temperature, $T = 298 \text{ K}$

We know the **Nernst equation**:

$$E = E^\circ - (0.0591 / n) \times \log([\text{products}] / [\text{reactants}])$$

Here:

- $n = 2$ (since $\text{Zn} \rightarrow \text{Zn}^{2+} + 2\text{e}^-$)
- $[\text{products}] = \text{a}(\text{Zn}^{2+}) = 10$
- $[\text{reactants}] = \text{a}(\text{Ni}^{2+}) = 1.0$

Substitute:

$$0.5105 = E^\circ - (0.0591 / 2) \times \log(10 / 1)$$

$$\log(10) = 1$$

So:

$$0.5105 = E^\circ - (0.0591 / 2) \times 1$$

$$0.5105 = E^\circ - 0.02955$$

Now solve for E° :

$$E^\circ = 0.5105 + 0.02955$$

$$E^\circ = 0.54005 \text{ V} \approx \mathbf{0.5400 \text{ V}}$$

Correct answer: (a) 0.5400 V

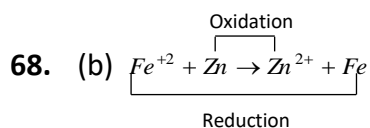
66. (c) $E = E^\circ - \frac{0.059}{n} \log \frac{[\text{Zn}^{++}]}{[\text{Cu}^{++}]} = 1.10 - \frac{0.059}{2} \log \frac{1}{0.1}$

$$= 1.10 - 0.0295 \log 10 = 1.07 \text{ volt .}$$

67. (b) $E_1 = E_o - \frac{0.0591}{2} \log \frac{0.01}{1} = E_o + \frac{0.0591}{2} \times 2$

$$E_2 = E_o - \frac{0.0591}{2} \log \frac{100}{0.01} = E_o - \frac{0.0591}{2} \times 4$$

$$\therefore E_1 > E_2.$$



$$EMF = E_{\text{cathode}} - E_{\text{anode}} = 0.44 - (0.76) = +0.32 \text{ V}.$$

69. (a) *Fe* is more electropositive than copper. Hence Cu^{2+} can oxidise *Fe*.
70. (b) $E^\circ = 0$ because hydrogen have zero potential.
71. (b) Cell potential of the cell is positive.
72. (a,b) Because these comes after the *Fe* in electrochemical series.
73. (c)
$$\begin{array}{c} \text{Oxidation} \\ \text{Fe}^{2+} + \text{Zn} \rightarrow \text{Zn}^{2+} + \text{Fe} \\ \text{Reduction} \end{array}$$

$$EMF = E_{\text{cathode}} - E_{\text{anode}} = -7.81 - (-7.62)$$

$$EMF = -0.19 \text{ V}.$$
74. (c) $\text{Cr}^{3+} > \text{Zn}^{2+} > \text{H} > \text{Fe}^{3+}$.
 Reducing nature decreasing order.
75. (a) More is reduction potential, more is the power to get itself reduced or lesser is reducing power or greater is oxidising power.

