B16 · Extra practice

Worked solutions | Items 1-2

Extra practice for this lesson. Original questions, not released diploma items. Select one option for multiple choice; other tasks state the required response.

Use the givens and conditions in each prompt. Enter the requested count, coefficient, oxidation number or potential with the stated unit and precision.

B16-D01 · Multiple choice

A reaction has E°cell = +0.46 V. Which cell type does it make?

A. A voltaic cell
B. An electrolytic cell that needs a power supply
C. A cell that cannot run
D. A fuel cell only

1. A positive E°cell means the reaction is spontaneous, so it makes a voltaic cell.

2. A positive value is spontaneous.

B16-D02 · Numerical response

Al^{3+}/Al is −1.66 V and Ag^{+}/Ag is +0.80 V. What is E°cell, in volts to two decimal places?

1. E°cell = 0.80 − (−1.66) = +2.46 V.

2. Do not multiply the silver value by three.

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Worked solutions | Items 3-4

B16-D03 · Numerical response

A charge of 4500 C passes through a cell. How many moles of electrons is that, to three decimal places? Use F = 9.65 × 10^4 C/mol e^-.

1. $n(e^-) = 4500 \div (9.65 \times 10^4) = 0.0466$ mol, which rounds to 0.047 mol.

2. Divide the charge by the Faraday constant.

B16-D04 · Numerical response

What mass of silver forms from 0.0200 mol of electrons when $Ag^+ + e^- \rightarrow Ag$? Use M = 107.87 g/mol. Answer in grams to two decimal places.

1. The ratio is 1 to 1, so m = 0.0200 × 107.87 = 2.16 g.

2. Moles of metal times molar mass.

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Worked solutions | Items 5-6

B16-D05 · Numerical response

A 25.00 mL sample of Fe^{2+} needs 20.00 mL of 0.0200 mol/L MnO_4^- in the 5 to 1 reaction. Find $[Fe^{2+}]$ in mol/L to four decimal places.

1. $n(MnO_4^-) = 4.00 \times 10^{-4}$ mol, so $n(Fe^{2+}) = 2.00 \times 10^{-3}$ mol. $[Fe^{2+}] = 2.00 \times 10^{-3} \div 0.02500 = 0.0800$ mol/L.

2. Use the 5 to 1 mole ratio of Fe^{2+} to MnO_4^-.

B16-D06 · Multiple choice

Which method do you use to find the mass of a metal from a current and a time?

A. The reduction table
B. Faraday’s law
C. A redox titration
D. Oxidation numbers only

1. A current and a time give the charge, which is Faraday’s law.

2. Look at what is given: a current and a time.

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Worked solutions | Items 7-8

B16-D07 · Multiple choice

Which method do you use to find the concentration of Fe^{2+} from a volume of permanganate?

A. A redox titration
B. Faraday’s law
C. The anode rule
D. A battery plan

1. A volume of a known reactant that reacts with a sample is a titration.

2. Look at what is measured: a volume of a reactant.

B16-D08 · Multiple choice

Why does a magnesium block protect an iron pipe?

A. Magnesium has a lower reduction value, so it is oxidized instead
B. Magnesium is heavier
C. Magnesium is a cathode
D. Magnesium stops oxygen from touching the pipe

1. The metal with the lower reduction value is oxidized first and protects the iron, which is the cathode.

2. Compare −2.37 V and −0.45 V.

B16 · Extra practice

Worked solutions | Items 9-10

B16-D09 · Multiple choice

In electroplating, which electrode is the object that is plated?

A. The cathode
B. The anode
C. Neither
D. Both

1. The metal ions are reduced onto the object, and reduction happens at the cathode.

2. Recall Red Cat: reduction at the cathode.

B16-D10 · Select all that apply

Select every correct statement about the redox titration with permanganate.

A. The end point is the first lasting pale pink
B. Permanganate is its own indicator
C. Fe^{2+} is oxidized
D. Fe^{2+} is reduced

1. Permanganate is reduced and Fe^{2+} is oxidized. The pale pink end point shows a slight excess of permanganate.

2. Iron(II) loses an electron.

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Worked solutions | Items 11-12

B16-D11 · Matching

Match each problem to its method.

Items to match:

1. Voltage of a cell
2. Mass at an electrode
3. Concentration from a volume
4. Protect a pipe

Targets:

A. Faraday’s law
B. Redox titration
C. Reduction table
D. Sacrificial anode

1. Voltage uses the table, mass uses Faraday’s law, concentration uses a titration and protection uses a sacrificial anode.

2. Look at what is given in each problem.

B16-D12 · Ordering / ranking

Put the Faraday steps in order.

First to last

1. Multiply moles of metal by molar mass
2. Use the mole ratio from the half-reaction
3. Find the moles of electrons
4. Find the charge from current and time

1. Find the charge, then the moles of electrons, then the metal from the ratio, then the mass.

2. The charge comes first, from the current and the time.