B10 · 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.

B10-D01 · Numerical response

A current of 2.50 A flows for 8.00 minutes. What charge moves, in coulombs? Enter an integer.

1. The time is 8.00 × 60 = 480 s, so q = 2.50 × 480 = 1200 C.

2. Change minutes to seconds before multiplying.

B10-D02 · Numerical response

A charge of 4825 C passes through a cell. How many moles of electrons is that, to four decimal places? Use F = 9.65 × 10^4 C/mol e^-.

1. $n(e^-) = q \div F = 4825 \div (9.65 \times 10^4) = 0.0500$ mol.

2. Divide the charge by the Faraday constant.

B10 · Extra practice

Worked solutions | Items 3-4

B10-D03 · Numerical response

Given 0.0500 mol of electrons and $Ag^+ + e^- \rightarrow Ag$. What mass of silver forms, in grams to two decimal places? Use M = 107.87 g/mol.

1. One mole of electrons makes one mole of silver, so n(Ag) = 0.0500 mol and m = 0.0500 × 107.87 = 5.39 g.

2. The mole ratio from the half-reaction is 1 to 1.

B10-D04 · Numerical response

A charge of 1.93×10^4 C plates zinc from Zn^{2+}. What mass of zinc forms, in grams to two decimal places? Use M = 65.41 g/mol.

1. $n(e^-) = 1.93 \times 10^4 \div 9.65 \times 10^4 = 0.200$ mol. n(Zn) = 0.100 mol and m = 0.100 × 65.41 = 6.54 g.

2. Divide the moles of electrons by 2 for zinc.

B10 · Extra practice

Worked solutions | Items 5-6

B10-D05 · Numerical response

A steady current of 2.00 A delivers a charge of 1.93×10^4 C. How long does it flow, in seconds? Enter an integer.

1. $t = q \div I = 1.93 \times 10^4 \div 2.00 = 9650$ s.

2. Time equals charge divided by current.

B10-D06 · Numerical response

How many moles of electrons are needed to deposit 1.00 mol of chromium from Cr^{3+}? Enter an integer.

1. $Cr^{3+} + 3e^- \rightarrow Cr$, so 3 mol of electrons make 1 mol of chromium.

2. Read the coefficient of e^- in the half-reaction.

B10 · Extra practice

Worked solutions | Items 7-8

B10-D07 · Multiple choice

Why must the time be in seconds when we use q = It?

A. An ampere is one coulomb each second
B. Seconds are the only SI unit of time
C. The Faraday constant is in minutes
D. Minutes cannot be multiplied

1. One ampere is one coulomb per second, so the time must be in seconds to give coulombs.

2. Check the units of the ampere.

B10-D08 · Select all that apply

Select every correct statement about the Faraday constant.

A. It is about 9.65×10^4 C/mol e^-
B. It changes moles of electrons to coulombs
C. It is the molar mass of electrons in g/mol
D. It is listed in the data booklet

1. F is the charge on one mole of electrons. It converts between coulombs and moles of electrons and is in the data booklet.

2. F has the units C/mol, not g/mol.

B10 · Extra practice

Worked solutions | Items 9-10

B10-D09 · Ordering / ranking

Arrange the steps for finding the mass of metal deposited.

First to last

1. Multiply the moles of metal by the molar mass
2. Divide the moles of electrons by the electrons in the half-reaction
3. Find the charge from current and time
4. Divide the charge by the Faraday constant

1. Find the charge, find the moles of electrons, use the half-reaction for the moles of metal, then find the mass.

2. The half-reaction is used to change electrons into metal.

B10-D10 · Matching

Match each half-reaction to the moles of electrons needed for 1 mol of metal.

Items to match:

1. $Ag^{+} + e^{-} \rightarrow Ag$
2. $Cu^{2+} + 2e^{-} \rightarrow Cu$
3. $Al^{3+} + 3e^{-} \rightarrow Al$

Targets:

A. 1 mol

B. 2 mol

C. 3 mol

1. The moles of electrons equal the charge on the ion that is reduced.

2. Read the coefficient of e^{-} in each half-reaction.

B10 · Extra practice

Worked solutions | Items 11-12

B10-D11 · Multiple choice

A cathode has a mass of 10.00 g before plating and 10.50 g after. Which mass is used in Faraday calculations?

A. 10.00 g
B. 10.50 g
C. 0.50 g
D. 20.50 g

1. Only the gain in mass, 10.50 − 10.00 = 0.50 g, was made by the current.

2. Subtract the starting mass from the final mass.

B10-D12 · Written response

A student says that Faraday calculations always give the exact mass formed in a real cell. Explain what the calculation assumes.

1. The calculation makes an assumption. It assumes all the charge makes the product in the half-reaction.

2. Real cells can lose some charge to side reactions, so a little less product may form.