B8 · 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.

B8-D01 · Numerical response

A student wants to drive $Mg^{2+} + Zn \rightarrow Mg + Zn^{2+}$ with a power source (Mg^{2+}/Mg −2.37 V; Zn^{2+}/Zn −0.76 V). What voltage must the source exceed, in volts to two decimal places?

1. $E°cell = -2.37 - (-0.76) = -1.61$ V. The source must exceed the size of this value, 1.61 V.

2. Cathode minus anode, then use the size of the negative value.

B8-D02 · Multiple choice

In an electrolytic cell, which terminal of the power source is the cathode joined to?

A. The positive terminal
B. The negative terminal
C. Neither terminal
D. Both terminals

1. Electrons are pushed out of the negative terminal and arrive at the cathode, where reduction happens.

2. The names anode and cathode follow the chemistry. The sign follows from where the electrons come from.

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Worked solutions | Items 3-4

B8-D03 · Multiple choice

In an electrolytic cell, which ions move toward the anode?

A. Cations
B. Anions
C. Electrons
D. Neutral atoms

1. The anode is positive, so anions move toward it. Cations move toward the negative cathode.

2. Electrons move only in the wires.

B8-D04 · Numerical response

For the electrolysis of molten NaCl, what is E°cell in volts to two decimal places? Use Na^+/Na −2.71 V and Cl_2/Cl^- +1.36 V.

1. Na^+ is reduced at the cathode and Cl^- is oxidized at the anode. E°cell = −2.71 − 1.36 = −4.07 V.

2. The negative sign shows that a power source is needed.

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Worked solutions | Items 5-6

B8-D05 · Select all that apply

Select every correct statement about electrolytic cells.

A. Oxidation happens at the anode
B. A power source is needed
C. The anode is the negative electrode
D. A salt bridge is not required

1. Oxidation always happens at the anode. A power source drives the reaction. A salt bridge is not required for an electrolytic cell.

2. In an electrolytic cell the anode is positive, not negative.

B8-D06 · Matching

Match each feature to the cell type it describes.

Items to match:

1. Needs a power source
2. Needs a salt bridge or porous barrier
3. Anode is negative
4. Anode is positive

Targets:

A. Voltaic cell
B. Electrolytic cell

1. An electrolytic cell needs a power source and has a positive anode. A voltaic cell needs a salt bridge and has a negative anode.

2. The definitions of anode and cathode are the same in both.

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Worked solutions | Items 7-8

B8-D07 · Numerical response

How many electrons appear in the anode half-reaction $2Cl^- \rightarrow Cl_2 + 2e^-$? Enter an integer.

1. Two chloride ions each give up one electron, so the half-reaction shows $2e^-$.

2. Each Cl_2 molecule needs two electrons.

B8-D08 · Multiple choice

To plate a metal spoon with silver, which statement is correct?

A. The spoon is the anode
B. The spoon is the cathode
C. The spoon is not connected
D. The spoon is the salt bridge

1. Silver ions are reduced to silver metal at the cathode, so the spoon is the cathode.

2. Reduction deposits the metal, and reduction always happens at the cathode.

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Worked solutions | Items 9-10

B8-D09 · Numerical response

What is E°cell in volts for a cell with silver electrodes in silver nitrate solution? Enter to two decimal places.

1. The same half-cell is used at both electrodes: 0.80 − 0.80 = 0.00 V.

2. A small voltage is still needed in practice to overcome resistance.

B8-D10 · Ordering / ranking

Arrange the steps for predicting the electrolysis of a molten salt.

First to last

1. Calculate E°cell and the minimum voltage
2. Write the reduction and the oxidation
3. Send the cation to the cathode and the anion to the anode
4. List the ions present
5. Match the electrons and add the halves

1. List the ions, decide the electrode for each, write the halves, match and add, then calculate.

2. The ions are listed first because they decide what can react.

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Worked solutions | Items 11-12

B8-D11 · Multiple choice

In a copper refining cell, which electrode gains mass?

A. The impure copper anode
B. The pure copper cathode
C. The salt bridge
D. Neither electrode

1. Cu^{2+} is reduced at the cathode, so pure copper builds up there.

2. The anode dissolves, so it loses mass.

B8-D12 · Written response

A student says that a negative E°cell means a reaction can never be made to happen. Explain what is wrong.

1. A negative value means the reaction is not spontaneous by itself.

2. A power source with a voltage greater than the size of the value can drive the reaction, as in an electrolytic cell.