B6 · 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.

B6-D01 · Multiple choice

Given Zn^{2+}/Zn −0.76 V and Ag^{+}/Ag +0.80 V. In a cell with a zinc electrode and a silver electrode, which electrode is the anode?

A. Silver, because it has the higher table value

B. Zinc, because it has the lower table value

C. Whichever is drawn on the left

D. Both are anodes

1. The lower table value belongs to the reducing agent. Zinc is oxidized, so it is the anode.

2. The drawing position does not decide the anode. The table values do.

B6-D02 · Numerical response

Given Cu^{2+}/Cu +0.34 V and Zn^{2+}/Zn −0.76 V. Calculate E°cell for the cell with copper as the cathode and zinc as the anode. Enter to two decimal places in volts.

1. $E°_{cell} = E°_{cathode} - E°_{anode} = 0.34 - (-0.76) = 1.10$ V.

2. The cathode value goes first. A negative answer would warn that the electrodes were swapped.

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Worked solutions | Items 3-4

B6-D03 · Multiple choice

What is the main job of a salt bridge in a voltaic cell?

A. To carry electrons between the beakers
B. To let ions move and balance the charge in each beaker
C. To make the reaction faster by heating it
D. To supply the metal for the electrodes

1. Ions move through the bridge to balance the charge that builds up in each beaker. Electrons move in the wire.

2. Without a bridge the charge build-up stops the electron flow.

B6-D04 · Select all that apply

Select every correct statement about a working voltaic cell.

A. Oxidation happens at the anode
B. Electrons travel through the wire from the anode to the cathode
C. Electrons travel through the solutions
D. Anions in the salt bridge move toward the anode beaker

1. Oxidation is at the anode. Electrons go through the wire from anode to cathode. Anions move toward the anode beaker to balance the positive charge made there.

2. Electrons do not travel through the solutions. Ions carry the charge there.

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Worked solutions | Items 5-6

B6-D05 · Matching

Match each term to its meaning in a voltaic cell.

Items to match:

1. Anode
2. Cathode
3. Salt bridge
4. Double line in notation

Targets:

A. Electrode where reduction happens
B. Stands for the salt bridge or porous barrier
C. Electrode where oxidation happens
D. Joins the solutions so ions can move

1. The anode is where oxidation happens. The cathode is where reduction happens. The salt bridge joins the solutions so ions can move. The double line stands for it in notation.

2. Learn the names by their job: oxidation at the anode, reduction at the cathode.

B6-D06 · Ordering / ranking

Arrange the parts of the notation for a Cu / Ag cell from left to right.

First to last

1. Cu(s)
2. $Cu^{2+}(aq)$
3. $Ag^{+}(aq)$
4. Ag(s)
5. Salt bridge ||

1. The notation reads Cu(s) | $Cu^{2+}(aq)$ || $Ag^{+}(aq)$ | Ag(s): the anode metal, its ion, the bridge, the cathode ion and the cathode metal.

2. The anode half is always on the left and the cathode half is always on the right.

B6 · Extra practice

Worked solutions | Items 7-8

B6-D07 · Numerical response

In the Cu / Ag cell, how many electrons does one copper atom give up? Enter an integer.

1. The anode half is $Cu \rightarrow Cu^{2+} + 2e^{-}$, so each copper atom gives up two electrons.

2. Two silver ions are needed to take those two electrons.

B6-D08 · Numerical response

What is the coefficient of Ag^{+} in the overall equation $Cu + __Ag^{+} \rightarrow Cu^{2+} + 2Ag$? Enter an integer.

1. Copper gives two electrons and each silver ion takes one, so two Ag^{+} are needed.

2. Check charge: the left is $2(+1) = +2$ and the right is $+2$.

B6 · Extra practice

Worked solutions | Items 9-10

B6-D09 · Multiple choice

A drawing shows the silver half on the left and the zinc half on the right. Silver has the higher table value. Which statement is correct?

A. The left electrode is the anode because it is on the left

B. Zinc is the anode even though it is drawn on the right

C. Silver is the anode because it is a metal

D. The cell cannot work with that layout

1. Zinc has the lower value and is oxidized, so it is the anode. The notation would still put zinc on the left.

2. Position in a drawing does not decide the anode.

B6-D10 · Multiple choice

A student calculates a negative E°cell for a cell. What should be checked first?

A. Whether the salt bridge is long enough

B. Whether the anode and cathode were swapped

C. Whether the electrodes are too large

D. Whether the solutions are coloured

1. The cathode is the half with the higher table value. A negative result is a warning that the two halves may have been swapped.

2. Recompute with the higher table value first.

B6 · Extra practice

Worked solutions | Items 11-12

B6-D11 · Numerical response

In a Zn / Cu cell, 2 mol of electrons pass through the wire. How many moles of Cu^{2+} are reduced at the cathode? Enter an integer.

1. The cathode half is $Cu^{2+} + 2e^- \rightarrow Cu$, so each Cu^{2+} takes two electrons.

2. 2 mol of electrons ÷ 2 electrons per Cu^{2+} = 1 mol of Cu^{2+}.

B6-D12 · Written response

Explain why a voltaic cell with no salt bridge or porous barrier stops working quickly.

1. Zn^{2+} builds up in the anode beaker and the cathode beaker is left with extra negative charge.

2. Without a bridge, ions cannot move to balance the charge, so the electrons stop flowing.