

- Which ionic equation represents a spontaneous reaction that can occur in a voltaic cell?
 - $\text{Cu(s)} + \text{Zn(s)} \rightarrow \text{Cu}^{2+}(\text{aq}) + \text{Zn}^{2+}(\text{aq})$
 - $\text{Cu(s)} + \text{Zn}^{2+}(\text{aq}) \rightarrow \text{Cu}^{2+}(\text{aq}) + \text{Zn(s)}$
 - $\text{Cu}^{2+}(\text{aq}) + \text{Zn(s)} \rightarrow \text{Cu(s)} + \text{Zn}^{2+}(\text{aq})$
 - $\text{Cu}^{2+}(\text{aq}) + \text{Zn}^{2+}(\text{aq}) \rightarrow \text{Cu(s)} + \text{Zn(s)}$
- Which energy conversion occurs in an operating voltaic cell?
 - chemical energy to electrical energy
 - chemical energy to nuclear energy
 - electrical energy to chemical energy
 - electrical energy to nuclear energy
- In an operating voltaic cell, reduction occurs
 - at the anode
 - at the cathode
 - in the salt bridge
 - in the wire
- Which statement is true for any electrochemical cell?
 - Oxidation occurs at the anode, only.
 - Reduction occurs at the anode, only.
 - Oxidation occurs at both the anode and the cathode.
 - Reduction occurs at both the anode and the cathode.
- When a voltaic cell operates, ions move through the
 - anode
 - cathode
 - salt bridge
 - external circuit
- Given the balanced ionic equation representing the reaction in an operating voltaic cell:

$$\text{Zn(s)} + \text{Cu}^{2+}(\text{aq}) \rightarrow \text{Zn}^{2+}(\text{aq}) + \text{Cu(s)}$$

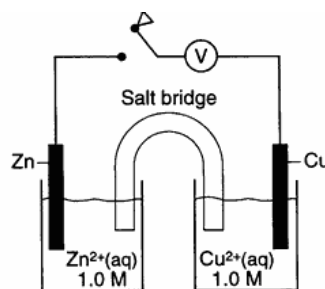
The flow of electrons through the external circuit in this cell is from the

- Cu anode to the Zn cathode
- Cu cathode to the Zn anode
- Zn anode to the Cu cathode
- Zn cathode to the Cu anode

- Given the balanced equation representing the reaction occurring in a voltaic cell:

$$\text{Zn(s)} + \text{Pb}^{2+}(\text{aq}) \rightarrow \text{Zn}^{2+}(\text{aq}) + \text{Pb(s)}$$
 In the completed external circuit, the electrons flow from
 - Pb(s) to Zn(s)
 - Pb²⁺(aq) to Zn²⁺(aq)
 - Zn(s) to Pb(s)
 - Zn²⁺(aq) to Pb²⁺(aq)

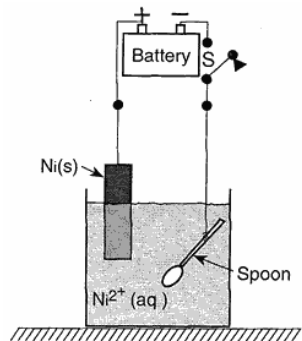
- The diagram below represents an electrochemical cell.



What occurs when the switch is closed?

- Zn is reduced.
 - Cu is oxidized.
 - Electrons flow from Cu to Zn.
 - Electrons flow from Zn to Cu.
- Which device requires electrical energy to produce a chemical change?
 - electrolytic cell
 - salt bridge
 - voltaic cell
 - voltmeter
 - Which statement describes the redox reaction that occurs when an object is electroplated?
 - It is spontaneous and requires an electric current.
 - It is spontaneous and produces an electric current.
 - It is non-spontaneous and requires an electric current.
 - It is non-spontaneous and produces an electric current.

11. The diagram below shows a spoon that will be electroplated with nickel metal.



What will occur when switch S is closed?

- A) The spoon will lose mass, and the Ni(s) will be reduced.
 - B) The spoon will lose mass, and the Ni(s) will be oxidized.
 - C) The spoon will gain mass, and the Ni(s) will be reduced.
 - D) The spoon will gain mass, and the Ni(s) will be oxidized.
12. Which energy conversion must occur in an operating electrolytic cell?
- A) electrical energy to chemical energy
 - B) electrical energy to nuclear energy
 - C) chemical energy to electrical energy
 - D) chemical energy to nuclear energy