Regents Chemistry: Electrochemistry/Redox Review **Name** ***KEY***

1 1.) Which statement is true for any electrochemical cell?
(1) Oxidation occurs at the anode, only.
(2) Reduction occurs at the anode, only.
(3) Oxidation occurs at both the anode and the cathode.
(4) Reduction occurs at both the anode and the cathode.

2 2.) Given the equation: $2\ Al + 3\ Cu^{2+} \rightarrow 2\ Al^{3+} + 3\ Cu$
The reduction half-reaction is
(1) $Al \rightarrow Al^{3+} + 3e^-$
(2) $Cu^{2+} + 2e^- \rightarrow Cu$
(3) $Al + 3e^- \rightarrow Al^{3+}$
(4) $Cu^{2+} \rightarrow Cu + 2e^-$

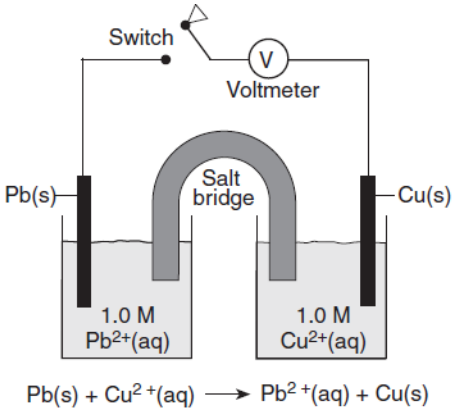
2 3.) Which type of reaction occurs when nonmetal atoms become negative nonmetal ions?
(1) oxidation (2) reduction (3) substitution (4) condensation

4 4.) In which compound does chlorine have the highest oxidation number?
(1) NaClO (2) $NaClO_2$ (3) $NaClO_3$ (4) $NaClO_4$

1 5.) A diagram of a chemical cell and an equation are shown to the right.

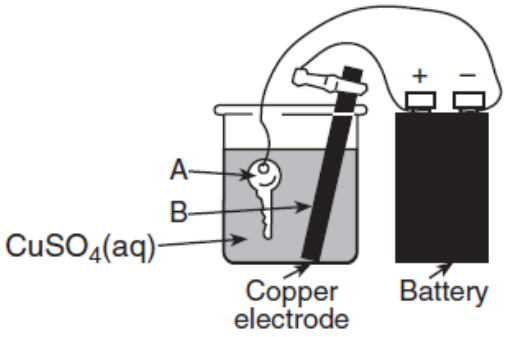
When the switch is closed, electrons will flow from

(1) the Pb(s) to the Cu(s)
(2) the Cu(s) to the Pb(s)
(3) the $Pb^{2+}(aq)$ to the Pb(s)
(4) the $Cu^{2+}(aq)$ to the Cu(s)



4 6.) What is the purpose of the salt bridge in a voltaic cell?
(1) It blocks the flow of electrons.
(2) It blocks the flow of positive and negative ions.
(3) It is a path for the flow of electrons.
(4) It is a path for the flow of positive and negative ions.

2 7.) The diagram to the right shows a key being plated with copper in an electrolytic cell.
Given the reduction reaction for this cell:
$Cu^{2+}(aq) + 2e^- \rightarrow Cu(s)$
This reduction occurs at
(1) *A,* which is the anode
(2) *A,* which is the cathode
(3) *B,* which is the anode
(4) *B,* which is the cathode



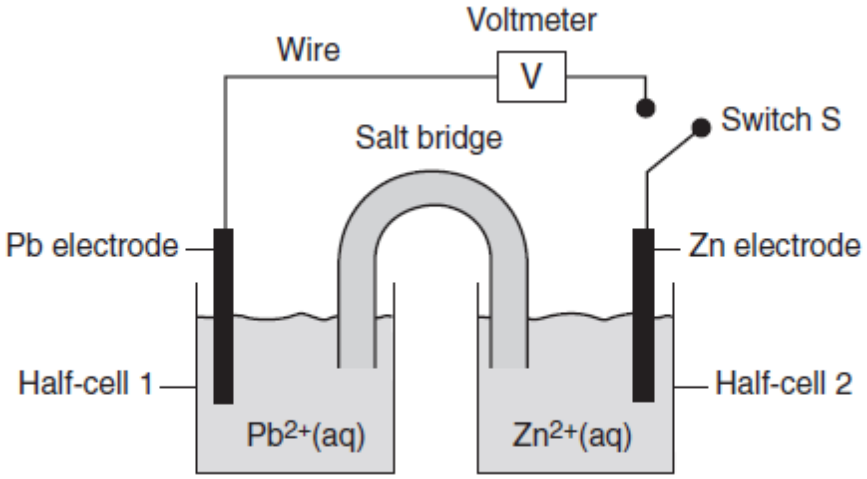
2 8.) A voltaic cell spontaneously converts
(1) electrical energy to chemical energy
(2) chemical energy to electrical energy
(3) electrical energy to nuclear energy
(4) nuclear energy to electrical energy

2 9.) Given the reaction for the corrosion of aluminum: $4\ Al + 3\ O_2 \rightarrow 2\ Al_2O_3$
Which half-reaction correctly represents the oxidation that occurs?
(1) $Al + 3e^- \rightarrow Al^{3+}$
(2) $Al \rightarrow Al^{3+} + 3e^-$
(3) $O_2 + 4e^- \rightarrow 2\ O^{2-}$
(4) $O_2 \rightarrow 2\ O^{2-} + 4e^-$

___1___ 10.) Which change in oxidation number indicates oxidation?
(1) –1 to +2 (2) –1 to –2 (3) +2 to –3 (4) +3 to +2

11.) State one difference between voltaic cells and electrolytic cells. Include information about *both* types of cells in your answer. [1]
Allow 1 credit for a correct response. Students must discuss both voltaic and electrolytic cells. Acceptable responses include, but are not limited to, these examples:
- ***Voltaic cells produce energy; electrolytic cells consume energy.***
- ***voltaic changes chemical to electrical, electrolytic opposite***
- ***Voltaic cells involve spontaneous redox reactions; electrolytic cells involve nonspontaneous redox reactions.***
- ***voltaic spontaneous/electrolytic not***

Base your answers to questions 12 through 14 on the diagram below, which represents a voltaic cell at 298 K and 1 atm.



$Pb^{2+}(aq) + Zn \rightarrow Pb + Zn^{2+}(aq)$

12.) In which half-cell will oxidation occur when switch *S* is closed? [1] ***Half-cell 2***

13.) Write the balanced half-reaction equation that will occur in half-cell 1 when switch *S* is closed. [1]

$Pb^{2+} + 2\ e^- \rightarrow Pb$

14.) Describe the direction of electron flow between the electrodes when switch *S* is closed. [1]

From the Zn electrode, through the wire, to the Pb electrode (from the anode to the cathode)

Base your answers to questions 15 and 16 on the unbalanced redox reaction below.

$$Cu(s) + AgNO_3(aq) \rightarrow Cu(NO_3)_2(aq) + Ag(s)$$

15.) Write the oxidation half-reaction. [1]

$Cu \rightarrow Cu^{2+} + 2\ e^-$

16.) Balance the redox equation below, using the smallest whole-number coefficients. [1]

_____ Cu(s) + __2__ $AgNO_3$(aq) → _____ $Cu(NO_3)_2$(aq) + __2__ Ag(s)