Redox: Quest

1. Which of the following definitions is TRUE?
    a. The oxidizing agent causes reduction.
    b. A negative ion is called a cat ion.
    c. The anode is the electrode where reduction takes place.
    d. The half-reaction in which there is a gain of electrons is called reduction.

2. Identify the FALSE statement.
    a. The anode is the electrode where reduction takes place.
    b. A cat ion is a positively charged ion.
    c. A reducing agent is an atom, a molecule or an ion, which loses electrons.
    d. Oxidation is the half-reaction in which electrons are lost.

3. Given three definitions:
    i. A reaction involving a loss of electrons
    ii. A negatively charged ion
    iii. An electrode where reduction takes place

Which of the following terms match definitions i, ii, and iii respectively?
    a. oxidation ------ cat ion ------ anode
    b. reduction ------ anion------ cathode
    c. reduction ------ cat ion ------ anode
    d. oxidation ------ anion ------ cathode

4. Five strips of different metals are placed in solutions containing different metallic ions. The results are listed in table below. An "X" indicates that a reaction has occurred.

	$Pb^{2+}_{(aq)}$	$Mg^{2+}_{(aq)}$	$Cu^{2+}_{(aq)}$	$Zn^{2+}_{(aq)}$	$Ni^{2+}_{(aq)}$
$Pb_{(s)}$			X		
$Mg_{(s)}$	X		X	X	X
$Cu_{(s)}$					
$Zn_{(s)}$	X		X		X
$Ni_{(s)}$	X		X		

Place these metals in **decreasing** order of their tendency to undergo oxidation.
a. Cu, Ni, Pb, Zn, Mg
b. Cu, Pb, Ni, Zn, Mg
c. Mg, Zn, Ni, Pb, Cu
d. Mg, Zn, Pb, Ni, Cu

5. Using the following table:

$Sn_{(s)} + Au^{3+}_{(aq)} \rightarrow$ Reaction
$Al_{(s)} + Sn^{2+}_{(aq)} \rightarrow$ Reaction
$Cu_{(s)} + Au^{3+}_{(aq)} \rightarrow$ Reaction
$Cu_{(s)} + Pb^{2+}_{(aq)} \rightarrow$ Reaction
$Pb_{(s)} + Sn^{2+}_{(aq)} \rightarrow$ Reaction

Classify these elements in **decreasing** order of their tendency to undergo oxidation.
    a. Al, Sn, Pb, Cu, Au
    b. Al, Sn, Cu, Pb, Au
    c. Au, Cu, Pb, Sn, Al
    d. Au, Pb, Cu, Sn, Al

6. Determine the oxidation number of carbon in $HC_2O_4^-$
   a. 1+
   b. 3+
   c. 4+
   d. 6+

7. Hydrogen telluride, H_2Te, reacts with Ni^{+2} ions but not with Al^{+3} ions.
   Hydrogen sulphide, H_2S, reacts with Ag^+ ions but not with Ni^{2+} ions.

   Arrange these substances in decreasing order of their tendency to undergo oxidation.

   a. Ag, H_2S, Ni, H_2Te, Al
   b. Ni, H_2Te, Al, Ag, H_2S
   c. Al, H_2Te, Ni, H_2S, Ag
   d. H_2S, Ag, Al, H_2Te, Ni

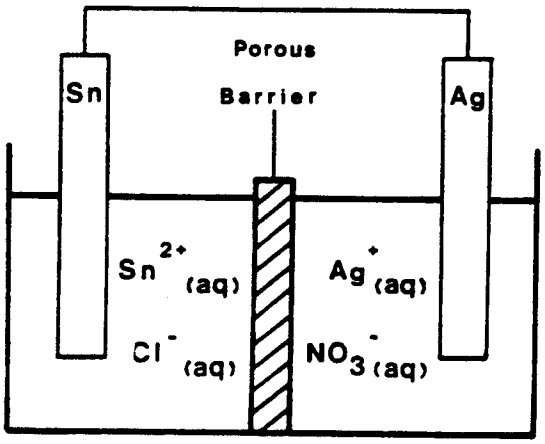
8. Identify the balanced reduction equation for Sn^{2+}
   a. $Sn^{2+} \rightarrow 2e^- + Sn^{4+}$
   b. $Sn^{2+} + 2e^- \rightarrow Sn^{4+}$
   c. $Sn^{2+} + 2e^- \rightarrow Sn$
   d. $Sn^{2+} \rightarrow 2e^- + Sn$

   Given the oxidation potentials for two elements:

Magnesium	$Mg_{(s)} \rightarrow Mg^{2+}_{(aq)} + 2e^-$	$E^o = 2.37$ V
Cobalt	$Co_{(s)} \rightarrow Co^{2+}_{(aq)} + 2e^-$	$E^o = 0.28$ V

9. Which of the following substances can most easily be reduced?
   a. $Co^{2+}_{(aq)}$
   b. $Co_{(s)}$
   c. $Mg^{2+}_{(aq)}$
   d. $Mg_{(s)}$

   The diagram below represents an electrochemical cell.



$Sn_{(s)} \rightarrow Sn^{2+}_{(aq)} + 2e^-$ $E^o = 0.13$ V
$Ag_{(s)} \rightarrow Ag^+_{(aq)} 1e^-$ $E^o = -0.80$ V

10. Which of the following statements is FALSE?
    a. Electrons move through the write from the Sn electrode to the Ag electrode.
    b. The Sn electrode is the cathode.
    c. Silver metal forms on the Ag electrode.
    d. The $NO_{3\,(aq)}^-$ ions move through the porous barrier towards the Sn electrode in the solution.

11. Determine the E^o value for a Cr – Cu^{2+} cell.

    $Cr \rightarrow 3e^- + Cr^{3+}$ $\quad E^o = +0.74$ V
    $Cu \rightarrow 2e^- + Cu^{2+}$ $\quad E^o = -0.34$ V

    a. +0.40 V
    b. +0.46 V
    c. +1.08 V
    d. +2.50 V

12. Calculate the E^o value of a cell formed by the following two half-reactions:

    $Cr \rightarrow Cr^{3+} + 3e^-$ $\quad E^o = 0.74$ V
    $Pb \rightarrow Pb^{2+} + 2e^-$ $\quad E^o = 0.13$ V

    a. 0.61 V
    b. 0.87 V
    c. 1.19 V
    d. 1.87 V

13. Determine the coefficients which correctly balance the following oxidation-reduction equations:

    $MnO_4^- + H_2S + H^+ \rightarrow S + Mn^{2+} + H_2O$

    a. 1, 1, 6, 1, 1, 4
    b. 1, 3, 2, 3, 1, 4
    c. 2, 5, 6, 5, 2, 8
    d. 3, 2, 4, 2, 2, 8

14. When the following oxidation-reduction equation is balanced, what will be the values of a, b, c, d, e and f?

    $a\ SO_{2\,(g)} + b\ NO_{3\,(aq)}^- + c\ H_2O_{(l)} \rightarrow d\ SO_{4\,(aq)}^{2-} + e\ NO_{(g)} + f\ H_{(aq)}^+$

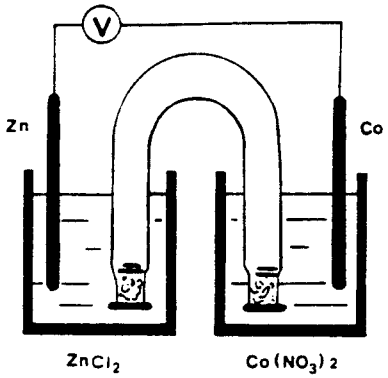
    a. 2, 3, 1, 3, 2, 2
    b. 3, 2, 1, 3, 2, 2
    c. 2, 3, 2, 3, 2, 4
    d. 3, 2, 2, 3, 2, 4

15. Given the following oxidation-reduction equation:

    $a\ Fe_{(aq)}^{2-} + b\ NO_{3\,(aq)}^- + c\ H_{(aq)}^+ \rightarrow d\ Fe_{(aq)}^{3+} + e\ NO_{(g)} + 2\ H_2O_{(l)}$

    What is the value of "d" when the equation is balanced?
    a. 2
    b. 3
    c. 4
    d. 6

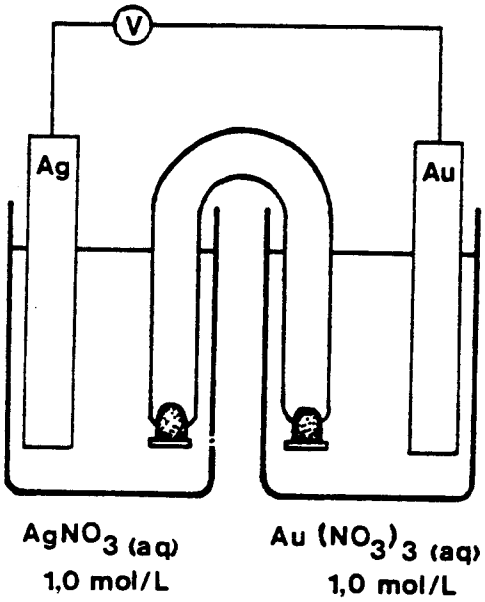
16. According to the following diagram, which of the following statements is FALSE?



$Zn_{(s)} \rightarrow Zn^{2+}_{(aq)} + 2e^-$ $E^o = 0.76$ V
$Co_{(s)} \rightarrow Co^{2+}_{(aq)} + 2e^-$ $E^o = 0.28$ V

a. The Zn electrode acts as the anode.
b. The electrons move through the wire from the Zn electrode to the Co electrode.
c. The $NO_3^-{}_{(aq)}$ ions move towards the Zn electrode through the salt bridge.
d. The oxidation half-reaction takes place at the Co electrode.

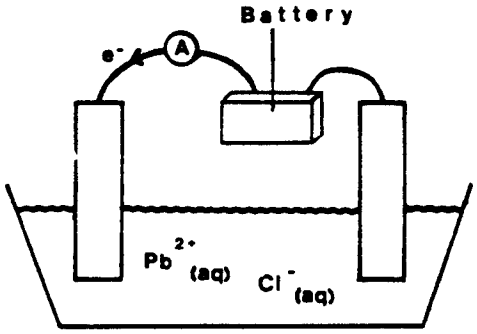
17. Calculate the E^o value for the following cell.



$Ag_{(s)} \rightarrow Ag^+_{(aq)} + 1e^-$ $E^o = -0.80$ V
$Au_{(s)} \rightarrow Au^{3+}_{(aq)} + 3e^-$ $E^o = -1.50$ V

a. 0.30 V
b. 0.70 V
c. 0.90 V
d. 2.30 V

18. The following diagram represents the apparatus used for the electrolysis of $PbCl_2$.



If 100 A of current run through the apparatus for 16 minutes, what mass of Pb will be deposited at the cathode? (1 mole of electrons = 96 000 C)

a. 3.4 g
b. 103 g
c. 207 g
d. 414

19. If 2 amperes of current pass through an electrolytic cell containing $Zn(NO_3)_2$ for 800 minutes, what mass of Zn will be deposited at the cathode?
(96 000 C = 1 mole of e^-)

a. 1.08 g
b. 32.7 g
c. 65.4 g
d. 131 g

20. A current of 40 amperes flows through an electrolytic cell for 2 hours. Calculate the number of moles of electrons that circulate during this time.
(1 mole of electrons = 9.6×10^4 coulombs)

a. 3.0×10^{-10} moles
b. 1.0×10^{-7} moles
c. 3.0 mole
d. 1.7×10^{29} moles