Name: _____ Key

Unit 13 Redox: Practice Test

A 1) In the reaction $2H_2(g) + O_2(g) \longrightarrow 2H_2O(g)$, the oxidizing agent is

A) O_2 B) O^{2-} C) H_2 D) H^+

C 2) What is the oxidizing agent in the reaction $2Fe^{2+} + Cl_2 \longrightarrow 2Fe^{3+} + 2Cl^-$?

A) Fe^{2+} B) Fe^{3+} C) Cl_2 D) Cl^-

B 3) According to the *Activity Series* chemistry reference table, which ion is the *strongest* oxidizing agent?

A) Ni^{2+} B) Au^{3+} C) Mg^{2+} D) Al^{3+}

C 4) In the reaction $Cu + 2H_2SO_4 \longrightarrow CuSO_4 + 2H_2O + SO_2$, copper is

A) oxidized and is the oxidizing agent C) oxidized and is the reducing agent

B) reduced and is the oxidizing agent D) reduced and is the reducing agent

A 5) Which redox equation is correctly balanced?

A) $Br_2 + Hg \longrightarrow Hg^{2+} + 2Br^-$ C) $Sn^{4+} + H_2 \longrightarrow Sn + 2H^+$

B) $Al^{3+} + K \longrightarrow Al + K^+$ D) $Cr^{3+} + Mg \longrightarrow Cr + Mg^{2+}$

A 6) The type of reaction in an voltaic cell is *best* described as a

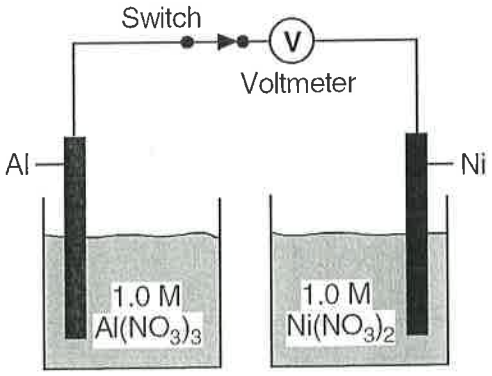
A) spontaneous oxidation-reduction reaction

B) spontaneous oxidation reaction, only

C) nonspontaneous oxidation reaction, only

D) nonspontaneous oxidation-reduction reaction

C 7) The diagram below represents a voltaic cell.



In order for the cell to operate, it should be provided with

A) an anode C) a salt bridge

B) an external path for electrons D) a cathode

D 8) In a voltaic cell the anode is the electrode at which → ANOX

A) reduction occurs and protons are lost
B) oxidation occurs and protons are lost
C) reduction occurs and electrons are lost
D) oxidation occurs and electrons are lost → LEO (lose e⁻ oxidation)

C 9) Which species acts as the anode when the reaction $Zn(s) + Pb^{2+}(aq) \longrightarrow Zn^{2+}(aq) + Pb(s)$ occurs in a voltaic cell? → ANOX

A) Pb(s)
B) $Pb^{2+}(aq)$
C) Zn(s)
D) $Zn^{2+}(aq)$

D 10) The overall reaction in a voltaic cell is $Zn(s) + Cu^{2+}(aq) \longrightarrow Zn^{2+}(aq) + Cu(s)$. As the reaction in this cell takes place, the → ANODE → CATHODE

A) mass of the Cu(s) electrode decreases
B) $Cu^{2+}(aq)$ concentration remains the same
C) $Zn^{2+}(aq)$ concentration remains the same
D) mass of the Zn(s) electrode decreases

C 11) According to the *Activity Series* chemistry reference table, which metal can reduce Ni^{2+} ions? (needs to be higher than Ni on Table J)

A) Cu B) Pb C) Fe D) Ag

D 12) The half-reaction $2H^+(aq) + 2e^- \longrightarrow H_2(g)$ will occur when $H^+(aq)$ reacts with (needs to be higher than H_2 on table)

A) Cu(s) B) Hg(ℓ) C) Ag(s) D) Pb(s)

B 13) What is the oxidation number of Pt in K_2PtCl_6? +1 +4 -1

A) +2 B) +4 C) -2 D) -4

A 14) In the reaction

$$2CrO_4^{2-}(aq) + 2H^+(aq) \longrightarrow Cr_2O_7^{2-}(aq) + H_2O(\ell),$$

(+6 on CrO_4^{2-}; +6 on $Cr_2O_7^{2-}$)

the oxidation number of chromium

A) remains the same B) increases C) decreases

D 15) In the compound Na_2HPO_4, which element has a negative oxidation number? (+1, -2) $[HPO_4]^{-1}$ $+1+x-8=-1$ $x=+6$

A) Na B) P C) H D) O

A 16) All redox reactions involve

A) both the gain and the loss of electrons
B) neither the loss nor the gain of electrons
C) the loss of electrons, only
D) the gain of electrons, only

B 17) Compared to the amount of mass and total charge at the beginning of a redox reaction, the amount of mass and total charge upon completion of the reaction is

A) less B) the same C) greater

D 18) A redox reaction is a reaction in which

A) reduction occurs first and then oxidation occurs
B) only oxidation occurs
C) only reduction occurs
D) reduction and oxidation occur at the same time

B 19) Which equation represents a redox reaction?

A) $H^+ + C_2H_3O_2^- \longrightarrow HC_2H_3O_2$ — lone element on one side
B) $Cu + 2Ag^+ + 2NO_3^- \longrightarrow 2Ag + Cu^{2+} + 2NO_3^-$
C) $2Na^+ + S^{2-} \longrightarrow Na_2S$
D) $NH_3 + H^+ + Cl^- \longrightarrow NH_4^+ + Cl^-$

A 20) Which of the following statements describes what occurs in the following redox reaction?

$Cu(s) + 2Ag^+(aq) \longrightarrow Cu^{2+}(aq) + 2Ag(s)$

A) Both mass and charge are conserved.
B) Only mass is conserved.
C) Neither mass nor charge is conserved.
D) Only charge is conserved.

___ 21) Based on the *Activity Series* chemistry reference table, which reaction will take place spontaneously?

A) $I_2(g) + 2Br^-(aq) \longrightarrow 2I^-(aq) + Br_2(g)$ — Br_2 is higher → should be reduced. Ca is higher → would be oxidized
B) $Mg(s) + Ca^{2+}(aq) \longrightarrow Mg^{2+}(aq) + Ca(s)$
C) $Ba(s) + (aq) + 2Na^+(s) \longrightarrow Ba^{2+}(aq) + 2Na(s)$
D) $Cl_2(g) + 2F^-(aq) \longrightarrow 2Cl^-(aq) + F_2(g)$ — F_2 is higher → should be reduced

Part 2: Questions

22) An electrochemical cell can be either voltaic or electrolytic.

(a) State *one* similarity between a voltaic and an electrolytic cell.

Oxidation occurs at the anode and reduction occurs at the cathode.

(b) State *one* difference between a voltaic and an electrolytic cell.

A voltaic cell involves a spontaneous redox reaction, while an electrolytic cell involves a non-spontaneous redox rxn.

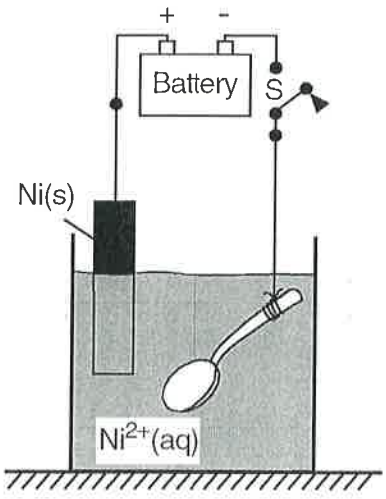
OR

Anode is (-) and cathode is (+) in voltaic cell, while anode is (+) and cathode is (-) in electrolytic cell.

more questions on back →

Questions 23 through 25 refer to the following:

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



23) Does the chemical cell diagram represent a voltaic or an electrolytic cell? [*Give one reason to support your answer.*]

electrolytic cell - there is a power source (battery)

24) Write the correct half-reaction for the deposition of Ni(s) on the surface of the spoon.

$Ni^{+2} + 2e^- \rightarrow Ni(s)$

25) Does the spoon represent the anode or the cathode in this electrochemical cell? [*Give one reason to support your answer.*]

The spoon represents the cathode because this is where reduction occurs (electrons are gained).

26) When a nickel coin is dropped into hydrochloric acid, a reaction occurs in which nickel (II) chloride is formed and hydrogen gas is released. When a copper penny is dropped into hydrochloric acid, no visible reaction occurs.

These reactions are summerized by the chemical equations below:

$Ni(s) + 2HCl(aq) \longrightarrow NiCl_2(aq) + H_2(g)$

$Cu(s) + HCl(aq) \longrightarrow$ no reaction

Using the *Reactivity Series* chemistry reference table and your knowledge of redox reactions, explain the difference in reactivity of nickel and copper with hydrochloric acid.

Ni(s) is more reactive than hydrogen, so it will spontaneously oxidize, and thus reduce $2H^+$ to $H_2(g)$. However, Cu(s) is less reactive than hydrogen, and thus cannot spontaneously reduce $2H^+$ to $H_2(g)$.