Chemistry 101
Section 242
Fall 2007
Quiz #5
VERSION A
November 6, 2007

Required: Scantron form 882-E

Instructions:

Do not open this quiz until instructed to do so.

(1) Write your name on your Scantron Form

(2) Write Version A in the box for “Test No.”

(3) Answer all questions on your Scantron Form

(4) When instructed to do so, check to ensure that your quiz has 20 multiple choice questions
MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question. Questions 1 – 16 are based on Oxidation-Reduction Material. Questions 17 – 20 are based on material from the past exam.

1) Which of the following is an oxidation-reduction reaction?

A) \( \text{Pb}(\text{C}_2\text{H}_3\text{O}_2)_2(\text{aq}) + 2 \text{ NaCl}(\text{aq}) \rightarrow \text{PbCl}_2(\text{s}) + 2 \text{ NaC}_2\text{H}_3\text{O}_2(\text{aq}) \)

B) \( \text{Mg}(\text{s}) + 2 \text{ HCl}(\text{aq}) \rightarrow \text{MgCl}_2(\text{aq}) + \text{H}_2(\text{g}) \)

C) \( \text{NaI}(\text{aq}) + \text{AgNO}_3(\text{aq}) \rightarrow \text{AgI}(\text{s}) + \text{NaNO}_3(\text{aq}) \)

D) \( \text{HCl}(\text{aq}) + \text{LiOH}(\text{aq}) \rightarrow \text{LiCl}(\text{aq}) + \text{H}_2\text{O}(\text{l}) \)

E) All of the above are oxidation-reduction reactions.

2) Determine the oxidation state of P in \( \text{PO}_3^{3-} \).

A) +6
B) 0
C) -3
D) +2
E) +3

3) Determine the oxidation state of S in \( \text{H}_2\text{S} \).

A) +6
B) 0
C) -1
D) +2
E) -2

4) What element is undergoing oxidation (if any) in the following reaction?

\( \text{CH}_4(\text{g}) + 2 \text{ O}_2(\text{g}) \rightarrow \text{CO}_2(\text{g}) + 2 \text{ H}_2\text{O}(\text{g}) \)

A) H
B) O
C) C
D) both C and O
E) None of the elements is undergoing oxidation.
5) Determine the reducing agent in the following reaction.

\[ 2 \text{Li}_\text(s) + \text{Fe(C}_2\text{H}_2\text{O}_2)_2\text{(aq)} \rightarrow 2 \text{LiC}_2\text{H}_2\text{O}_2\text{(aq)} + \text{Fe}_\text(s) \]

A) Fe  
B) H  
C) C  
D) Li  
E) O

6) Balance the following redox reaction if it occurs in acidic solution. What are the coefficients in front of H\(^+\) and Fe\(^{3+}\) in the balanced reaction?

\[ \text{Fe}^{2+\text{(aq)}} + \text{MnO}_4^{-\text{(aq)}} \rightarrow \text{Fe}^{3+\text{(aq)}} + \text{Mn}^{2+\text{(aq)}} \]

A) \(H^+ = 2, \text{Fe}^{3+} = 3\)  
B) \(H^+ = 5, \text{Fe}^{3+} = 1\)  
C) \(H^+ = 3, \text{Fe}^{3+} = 2\)  
D) \(H^+ = 8, \text{Fe}^{3+} = 5\)  
E) \(H^+ = 8, \text{Fe}^{3+} = 1\)

7) Balance the following redox reaction if it occurs in acidic solution. What are the coefficients in front of Cd and Ag\(^{+}\) in the balanced reaction?

\[ \text{Cd}_\text(s) + \text{Ag}^{+\text{(aq)}} \rightarrow \text{Ag}_\text(s) + \text{Cd}^{2+\text{(aq)}} \]

A) \(\text{Cd} = 1, \text{Ag}^{+} = 1\)  
B) \(\text{Cd} = 3, \text{Ag}^{+} = 1\)  
C) \(\text{Cd} = 2, \text{Ag}^{+} = 2\)  
D) \(\text{Cd} = 2, \text{Ag}^{+} = 1\)  
E) \(\text{Cd} = 1, \text{Ag}^{+} = 2\)

8) What is the oxidation half reaction in the following chemical reaction?

\[ \text{Cr}_2\text{O}_7^{2-\text{(aq)}} + 6\text{Cl}^-\text{(aq)} + 14 \text{H}^+\text{(aq)} \rightarrow 2\text{Cr}^{3+\text{(aq)}} + 3\text{Cl}_2\text{(aq)} + 7 \text{H}_2\text{O}_\text{l(l)} \]

A) \(\text{Cr}_2\text{O}_7^{2-\text{(aq)}} + 14 \text{H}^+\text{(aq)} + 6\text{e}^- \rightarrow 2\text{Cr}^{3+\text{(aq)}} + 7 \text{H}_2\text{O}_\text{l(l)} \)
B) \(\text{Cr}_2\text{O}_7^{2-\text{(aq)}} + 14 \text{H}^+\text{(aq)} \rightarrow 2\text{Cr}^{3+\text{(aq)}} + 7 \text{H}_2\text{O}_\text{l(l)} + 6\text{e}^- \)
C) \(2\text{Cl}^-\text{(aq)} \rightarrow \text{Cl}_2\text{(aq)} + 2\text{e}^- \)
D) \(2\text{Cl}_2\text{(aq)} + 2\text{e}^- \rightarrow 2\text{Cl}^-\text{(aq)} \)
E) None of the above
9) How many electrons are transferred in the following reaction?

\[ 2P(s) + 3Br_2 \rightarrow 2PBr_3(l) \] ?

A) 1  
B) 2  
C) 3  
D) 4  
E) None of the above.

10) What is the oxidation state of Cr in CrO₃?

A) +5  
B) +2  
C) +3  
D) +4  
E) +6

11) Which of the following is NOT a redox reaction?

A) \[ 4 \text{ Li}(s) + \text{O}_2(g) \rightarrow 2 \text{ Li}_2\text{O}(s) \]  
B) \[ \text{Mg}(s) + \text{Fe}^{2+} \rightarrow \text{Mg}^{2+}(aq) + \text{Fe}(s) \]  
C) \[ 2 \text{ Na}(s) + \text{Cl}_2(g) \rightarrow 2 \text{ NaCl}(s) \]  
D) \[ \text{Pb(NO}_3)_2(aq) + \text{Na}_2\text{SO}_4(aq) \rightarrow \text{PbSO}_4(s) + 2 \text{ NaNO}_3(aq) \]  
E) All of the above are redox reactions

12) ________________ is the gain of electrons.

A) Reduction  
B) Oxidation  
C) Hydrogenation  
D) Protonation  
E) Precipitation

13) Consider the equation below. What is the reduction half reaction?

\[ \text{Zn}_2 + \text{Cu}^{2+}(aq) \rightarrow \text{Zn}^{2+}(aq) + \text{Cu}_2 \]

A) \[ \text{Zn}(s) \rightarrow \text{Zn}^{2+}(aq) + 2 \text{ e}^- \]  
B) \[ \text{Zn}_2 + 2 \text{ e}^- \rightarrow \text{Zn}^{2+}(aq) \]  
C) \[ \text{Cu}^{2+}(aq) + 2 \text{ e}^- \rightarrow \text{Cu}_2 \]  
D) \[ \text{Cu}^{2+}(aq) \rightarrow \text{Cu}_2 + 2 \text{ e}^- \]  
E) None of the above.
14) On November 6, 2007, Dr. Meyer demonstrated the following redox reaction:

\[(\text{NH}_4)_2\text{Cr}_2\text{O}_7(s) \rightarrow \text{Cr}_2\text{O}_3(s) + 4 \text{H}_2\text{O}(g) + \text{N}_2(g)\]

Which of the following statements are true about this reaction?

A) In addition to being a redox reaction, it is classified as a decomposition reaction.
B) The reactant contains both the oxidizing and reducing agent
C) Nitrogen was oxidized during the reaction
D) Both A) and B) are true.
E) A), B) and C) are true.

15) What is the oxidation state of carbon in oxalic acid, \(\text{H}_2\text{C}_2\text{O}_4\)?

A) +1
B) +2
C) +3
D) +4
E) None of the above.

16) What is the reduction half-reaction for the reduction of aqueous silver ions to solid silver?

A) \(\text{Ag}^+_{(aq)} - 2\text{e}^- \rightarrow \text{Ag(s)}\)
B) \(\text{Ag}^+_{(aq)} + \text{e}^- \rightarrow \text{Ag(s)}\)
C) \(\text{Ag}^+_{(aq)} \rightarrow \text{Ag(s)} + \text{e}^-\)
D) \(\text{Ag}^+_{(aq)} \rightarrow \text{Ag(s)} - \text{e}^-\)
E) None of the above.

17) The following equation represents the first ionization energy of Boron

A) \(\text{B}^- \rightarrow \text{B} + \text{e}^-\)
B) \(\text{B}^+ \rightarrow \text{B} + \text{e}^-\)
C) \(\text{B} + \text{e}^- \rightarrow \text{B}^+\)
D) \(\text{B} \rightarrow \text{B}^+ + \text{e}^-\)
E) \(\text{B}^+ + \text{e}^- \rightarrow \text{B}\)

18) Which of the following is NOT a conjugate acid-base pair?

A) \(\text{H}_2\text{O}^+/\text{OH}^-\)
B) \(\text{H}_2\text{SO}_4/\text{HSO}_4^-\)
C) \(\text{C}_2\text{H}_3\text{O}_2^-/\text{HC}_2\text{H}_3\text{O}_2\)
D) \(\text{NH}_4^+/\text{NH}_3\)
E) All of the above are conjugate acid-base pairs.
19) How many of the following species are paramagnetic?
Sc³⁺, Br⁻, Mg²⁺, Se

A) 0  
B) 2  
C) 3  
D) 1  
E) 4

20) Which of the following is an Arrhenius base?
A) LiCl  
B) NaOH  
C) CH₃CO₂H  
D) CH₃OH  
E) More than one of these compounds is an Arrhenius base.