|	**Chapter 12 Test**	**BLM 12.5.1**
ASSESSMENT		

Multiple-Choice Questions

Circle the letter for the choice that best completes the statement or answers the question.

1. During oxidation
   a) an atom gains neutrons
   b) an atom gains electrons
   c) an atom loses electrons
   d) an atom loses neutrons

2. In the reaction $2Ag^+(aq) + Fe(s) \rightarrow 2Ag(s) + Fe^{2+}(aq)$, what is the half-reaction representing reduction?
   a) $Fe(s) \rightarrow 2Ag^+(aq) + 2e^-$
   b) $Ag(s) + 1e^- \rightarrow Ag^+(aq)$
   c) $Fe(s) -2e^- \rightarrow Fe^{2+}(aq)$
   d) $Ag^+(aq) + 1e^- \rightarrow Ag(s)$

3. A reducing agent may be an atom that
   a) gains neutrons
   b) gains electrons
   c) loses electrons
   d) loses neutrons

4. In the reaction $6Na(s) + Cr_2O_7^{2-}(aq) + 14H^+(aq) \rightarrow 2Cr^{3+}(aq) + 6Na^+(aq) + 7H_2O(l)$, what is the oxidizing agent?
   a) $H^+(aq)$
   b) $Cr_2O_7^{2-}(aq)$
   c) $Na(s)$
   d) $Cr^{3+}(Aq)$

5. Which one of the following represents a redox reaction?
   a) $2Na(s) + Cl_2(g) \rightarrow 2NaCl(aq)$
   b) $2AgCl(aq) + Fe(NO_3)_2(aq) \rightarrow FeCl_2(aq) + 2AgNO_3(aq)$
   c) $LiF(aq) + KBr(aq) \rightarrow KF(aq) + LiBr(aq)$
   d) $SnSO_4(aq) + Ca(NO_3)_2(aq) \rightarrow CaSO_4(aq) + Sn(NO_3)_2(aq)$

6. Which one of the following is **not** a redox reaction?
   a) $2NaCl(aq) + Br_2(l) \rightarrow 2NaBr(aq) + Cl_2(g)$
   b) $CH_4(g) + 2O_2(g) \rightarrow CO_2(g) + 2H_2O(g)$
   c) $AgCl(aq) + Li(s) \rightarrow Ag(s) + LiCl(aq)$
   d) $FeCl_3(aq) + AlF_3(aq) \rightarrow FeF_3(aq) + AlCl_3(aq)$

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7. Using the following information, list the metal ions in order of increasing reactivity.

$$B^+(aq) + D(s) \rightarrow D^+(aq) + B(s)$$
$$D^+(aq) + C(s) \rightarrow \text{No reaction}$$
$$C^+(aq) + B(s) \rightarrow B^+(aq) + C(s)$$
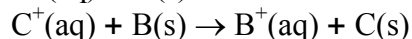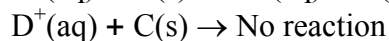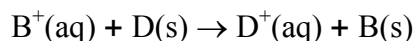
   a) C^+, B^+, D^+
   b) D^+, C^+, B^+
   c) D^+, B^+, C^+
   d) B, D^+, C^+

8. Which metal in question 7 is the strongest reducing agent?
   a) B
   b) D
   c) C
   d) not enough information to answer

Use the following table to answer questions 9 and 10.

Oxidation-Reduction Table

Strongest Oxidizing Agent	Weakest Reducing Agent
$Au^+(aq)$	$Au(s)$
$Pt^{2+}(aq)$	$Pt(s)$
$Ag^{2+}(aq)$	$Ag(s)$
$Hg^{2+}(aq)$	$Hg(s)$
$Cu^{2+}(aq)$	$Cu(s)$
$Sn^{2+}(aq)$	$Sn(s)$
$Ni^{2+}(aq)$	$Ni(s)$
$Co^{2+}(aq)$	$Co(s)$
$Tl^+(aq)$	$Tl(s)$
$Cd^{2+}(aq)$	$Cd(s)$
$Fe^{2+}(aq)$	$Fe(s)$
$Cr^{3+}(aq)$	$Cr(s)$
$Zn^{2+}(aq)$	$Zn(s)$
$Al^{3+}(aq)$	$Al(s)$
$Mg^{2+}(aq)$	$Mg(s)$
$Ca^{2+}(aq)$	$Ca(s)$
$Ba^{2+}(aq)$	$Ba(s)$
Weakest Oxidizing Agent	**Strongest Reducing Agent**

9. Refer to the "Oxidation-Reduction" table to determine which metal can reduce Co^{2+}(aq).
   a) gold
   b) silver
   c) copper
   d) zinc

10. Refer to the "Oxidation-Reduction" table to determine which ion can oxidize Co(s).
    a) Ca^{2+}(aq)
   b) Zn^{2+}(aq)
    c) Fe^{2+}(aq)
    d) Cu^{2+}(aq)

11. A disproportionation reaction is one in which
    a) no oxidation or reduction occurs
    b) different atoms of the same element are oxidized and reduced
    c) one compound is reduced but no compounds are oxidized
    d) one compound reduces two other compounds

12. What is the oxidation number of sulfur in sulfuric acid?
    a) +8
    b) +6
    c) +4
    d) +2

13. What is the change in oxidation number for nitrogen in the following reaction?

$$N_2(g) + 3H_2(g) \rightarrow 2NH_3(g)$$
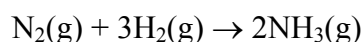
    a) $0 \rightarrow +3$
    b) $-3 \rightarrow 0$
    c) $0 \rightarrow 3$
    d) $-3 \rightarrow +3$

14. Which change would be classed as an oxidation?
    a) $Cr^{2+} \rightarrow Cr^{3+}$
    b) $2H^+ \rightarrow H_2$
    c) $Br_2 \rightarrow 2Br^-$
    d) $Mg^{2+} \rightarrow Mg$

15. When the half-reaction $Cr_2O_7^{2-} \rightarrow Cr^{3+}$ is balanced in acid solution, how many electrons are gained by the oxidizing agent?
    a) 6
    b) 3
    c) 2
    d) 1

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Numerical Response Questions

For each numerical response question, record the answer in the following response box.

16.
17.
18.
19.
20.

16. What is the oxidation number for carbon in each of the following compounds?

    CO CO_2 CH_4 C_2H_6

17. What is the oxidation number for sulfur in each of the following compounds?

    SO_2 SO_3 SO H_2SO_3

18. In a reaction between copper metal and aqueous iron(III) chloride, Fe^{3+} is reduced to Fe^{2+}(aq), while Cu(s) is oxidized to Cu^{2+}(aq). Determine the mass of Cu(s) required to react with 50 mL of 1.3 mol/L $FeCl_3$(aq).

19. Silver reacts in a single replacement reaction with 75 mL of 0.25 mol/L $AuCl_3$(aq). What mass of reducing agent is used?

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20. 46.5 g of chlorine gas is reacted with 96.2 g of silver to form silver chloride, AgCl(s). Determine the mass of oxidizing reagent that reacts.

Written Response Questions

Answer each question in the space provided. Use complete sentences, show problem-solving methods (with formulas), and include diagrams (with labels) when required.

21. An acidified solution of permanganate ion, MnO_4^-(aq), reacts with aqueous chloride ion, Cl^-(aq).
   a) In the reaction, MnO_4^- oxidizes the chloride ions, while the manganese is reduced to Mn^{2+}. Write the equations for the two half-reactions that will take place.

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   b) Balance the equation for the overall reaction.

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   c) A 100.0 mL sample of NaCl(aq) is reacted with 21.0 mL of 1.30 mol/L $KMnO_4$(aq). What is the concentration of NaCl(aq)?

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22. a) Balance the equation for the reaction between bromine, $Br_2(aq)$, and aqueous iodate ion, $IO_3^-(aq)$, in basic solution: $Br_2(aq) + IO_3^-(aq) \rightarrow Br^- + IO_4^-(aq)$

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   b) What volume of 0.788 mol/L $KIO_3(aq)$ will react with 4.00 g $Br_2(aq)$?

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23. Balance the reaction $I^-(aq) + S_2O_8^{2-}(aq) \rightarrow I_3^- + SO_2(g)$ in acid solution.

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