Name _____ Block: _____ Date: _____

Chemistry 12

SPONTANEOUS & NON-SPONTANEOUS REDOX REACTIONS

Describe each reaction as spontaneous or non-spontaneous.

1. $Au^{3+} + Fe^{3+} \rightarrow Fe^{2+} + Au$ _____
2. $Pb + Fe^{3+} \rightarrow Fe^{2+} + Pb^{2+}$ _____
3. $Cl_2 + F^- \rightarrow F_2 + 2Cl^-$ _____
4. $S_2O_8^{2-} + Pb \rightarrow 2SO_4^{2-} + Pb^{2+}$ _____
5. $Cu^{2+} + 2Br^- \rightarrow Cu + Br_2$ _____
6. $Sn^{2+} + Br_2 \rightarrow Sn^{4+} + 2Br^-$ _____
7. $Pb^{2+} + Fe^{2+} \rightarrow Fe^{3+} + Pb$ _____

8. Which member of each of the following pairs is the **stronger oxidizing agent**?
   a) Zn^{2+} or Ca^{2+} b) Cr^{3+} or Cu^{2+} c) Br_2 or I_2
9. Which member of each of the following pairs is the **stronger reducing agent**?
   a) Mn or Pb b) Cu^+ or Sn^{2+} c) Cr^{2+} or Fe^{2+}
10. Predict whether a spontaneous reaction is expected when the following are mixed, and state the product of any spontaneous reactions.
    a. Zn(s) and $H_2(g)$ _____
    b. Sn(s) and Sn^{4+} _____
    c. H^+ is added to Mn(s) _____
    d. Fe^{2+} is added to $Cr_2O_7^{2-}$ _____
    e. Fe^{2+} is added to acidic $Cr_2O_7^{2}$ _____
    f. Cu(s) and H^+ _____
    g. A mixture of $MnO_2(s)$ & H^+ is added to I^- _____
    h. SO_4^{2-} is added to Sn(s) _____
11. An electrochemical cell was made by joining a half-cell containing 1 M $Pb(NO_3)_2$ and a lead electrode to half cell consisting of 1 M $Zn(NO_3)_2$ and a zinc electrode. As the cell continues to operate, what happens to the $[Pb^{2+}]$? What happens to the $[Zn^{2+}]$?

12. You have been given three half-reactions: $A^{2+} + 2e^- \rightleftarrows A(s)$
$B^{2+} + 2e^- \rightleftarrows B(s)$
$C^{2+} + 2e^- \rightleftarrows C(s)$

The reactions are not in any order of tendency to reduce. The following experimental data if found:
A^{2+} reacts with C(s) but not with B(s)
Arrange the half-reactions in decreasing order of tendency to reduce (greatest tendency first).

13. You have been given four half-reactions: $D^{2+} + 2e^- \rightleftarrows D(s)$
$E^{2+} + 2e^- \rightleftarrows E(s)$
$F^{2+} + 2e^- \rightleftarrows F(s)$
$G^{2+} + 2e^- \rightleftarrows G(s)$

Experimentally, it was found that: F^{2+} reacts with D(s), E(s) and G(s)
no reaction occurs between D^{2+} and any of the metals
G^{2+} only reacts with D(s)
Arrange the half-reactions in decreasing strength of oxidizing agents (greatest strength first).

14. Determine the oxidation number for the element underlined.

$Pb\underline{S}O_4$	_____	$\underline{Cl}O_3^-$	_____
$H\underline{P}O_3^{2-}$	_____	$Na_2\underline{O}_2$	_____
$Ca\underline{H}_2$	_____	$Al_2(\underline{S}O_4)_3$	_____
$Na\underline{I}O_3$	_____	$\underline{C}_4H_{12}$	_____

15. $Al^{3+} + Zn \rightarrow Al + Zn^{2+}$
Substance oxidized _____ Oxidizing agent _____

16. $Cr_2O_7^{2-} + ClO_2^- \rightarrow Cr^{3+} + ClO_4^-$
Substance reduced _____ Oxidizing agent _____

17. $O_3 + H_2O + SO_2 \rightarrow SO_4^{2-} + O_2 + 2H^+$
Substance oxidized _____ Reducing agent _____

18. $3As_2O_3 + 4NO_3^- + 7H_2O + 4H^+ \rightarrow 6H_3AsO_4 + 4NO$
Substance reduced _____ Reducing agent _____