Dr. Wang **Chemistry 210, Fall 2006**

Mock Examination IV

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1. After balancing the redox reaction, Ag(s) + NO_3^-(aq) + H^+(aq) → Ag^+(aq) + H_2O(l) + NO(g), in acidic solution, you obtain the coefficient in front of Ag(s) as
(a) 2 (b) 3 (c) 4 (d) 1

2. After balancing the redox reaction, $Fe(OH)_2$(s) + O_2(g) + H_2O(l) → $Fe(OH)_3$(s), in basic solution, you obtain the coefficient in front of H_2O(l) as
(a) 2 (b) 3 (c) 4 (d) 1

3. At 850K, for the reaction, $2SO_2$(g) + O_2(g) $\rightleftharpoons$ $2SO_3$(g), ΔG^0 = -36.3kJ. The E_{cell} for a mixture at equilibrium at 850K is:
(a) -36.3kJ (b) 0 (c) +36.3kJ (d) 0.0427kJ (e) -0.0427kJ

4. The equilibrium constant for the reaction Sr(s) + Mg^{2+}(aq) → Sr^{2+}(aq) + Mg(s) is 2.69×10^4 at 25°C. Calculate E^0_{cell} for a cell made up of Sr/Sr^{2+} and Mg/Mg^{2+} half cells.
(a) 0.190V (b) 1.90V (c) 0.131V (d) 0.0131V

5. Calculate the standard cell potential of a voltaic cell that uses the Zn/Zn^{2+} and Ag/Ag^{+} half-cell reactions at 25°C. (Necessary data see the appendix.)
(a) -1.58V (b) 1.48V (c) 1.58V (d) -1.48V

6. The standard cell potential of a voltaic cell that uses the Zn/Zn^{2+} and Cu/Cu^{2+} half-cell reactions at 25°C is (Necessary data see the appendix.):
(a) -0.89V (b) 0.89V (c) 1.10V (d) -1.10V

7. Calculate the cell potential of a voltaic cell consisting of a Pb^{2+}/Pb half-cell and a $Pt/H^{+}/H_2$ half-cell if $[Pb^{2+}]$=5.0M, $[H^{+}]$=0.050M, and p_{H_2}=1.0atm.
(a) 0.032V (b) 0.23V (c) 2.3V (d) 0.023V

8. One of the half-reactions for the electrolysis of water is $2H^{+}(aq) + 2e^{-} \rightarrow H_2(g)$. If 1.8L of H_2 is collected at 25°C and 1.5atm, how many moles of electrons had to pass through the solution?
(a) 0.11 (b) 0.055 (c) 0.22 (d) 0.026

9. The equilibrium constant for the reaction $Cr(s) + Mg^{2+}(aq) \rightarrow Cr^{2+}(aq) + Mg(s)$ is 2.69×10^5 at 25°C. Calculate E^0_{cell} for a cell made up of Cr/Cr^{2+} and Mg/Mg^{2+} half-cells.
(a) 0.190V (b) 1.90V (c) 0.161V (d) 0.0161V

10. One of the half-reactions for the electrolysis of water is $2H^+(aq) + 2e^- \rightarrow H_2(g)$. If 0.057 moles of electrons had to pass through the solution, how many liters of H_2 is collected at 25°C and 1.0atm?
(a) 0.11 (b) 0.70 (c)0.22 (d) 0.026

11. The coordination number of the central metal atom in $[Pt(en)_3]^{2+}$ is
(a) 2 (b) 4 (c) 6 (d) 1

12. The coordination number of the central metal atom in $[CoCl_2(NH_3)_2]^+$
(a) 14 (b) 7 (c) 6 (d) 4

13. The coordination number of the central metal atom in $[CrCl_4]^+$
(a) 1 (b) 2 (c) 3 (d) 4

14. The oxidation number of the central atom in $[PtCl_4(NH_3)_2]^-$ is
(a) +1 (b) +2 (c) +3 (d) +4

15. The oxidation number of the central atom in $[PtCl_2(NH_3)_4]^+$ is
(a) +1 (b) +2 (c) +3 (d) +4

16. The oxidation number of the central atom in $[CrCl_5\ (H_2O)_3]^-$ is
(a) +2 (b) +3 (c) +4 (d) +5

17. The number of unpaired electrons in octahedral $[Fe(CN)_6]^{2-}$(Fe:[Ar]$4s^2 3d^6$) are
(a) 1 (b) 2 (c) 3 (d) 4 (e) 5

18. The number of unpaired electrons and the spin state in octahedral $[CoCl_6]^{3+}$ (Co:[Ar]$4s^2 3d^7$) are
(a) 2, one spin state (b) 3, one spin state (c) 4, high spin state
(d) 3, high spin state (e) 5, high spin state

19. The number of unpaired electrons and the spin state in octahedral $[Cu(H_2O)_6]^{2+}$ (Cu:[Ar]$4s^1 3d^{10}$) are
(a) 1, one spin state (b) 2, one spin state (c) 3, high spin state
(d) 4, high spin state (e) 5, high spin state

20. The absorption maximum for the complex ion $[Co(NH_3)_6]^{3+}$ occurs at 5.20×10^2 nm. The crystal field splitting in kJ/mol is
(a) 2.50×10^2 (b) 0.250×10^2 (c) 2.30×10^2 (d) 2.30×10^{-2}

USEFUL INFORMATION

R = 8.3145 J/mol K =0.08206 L atm/mol K

$h=6.63 \times 10^{-34}$ J s
$c=3.0 \times 10^{8}$ m/s

$$E_{cell} = E_{cell}^{0} - \frac{0.0592}{n}\log Q$$

$$E_{cell} = E_{cell}^{0} - \frac{0.0257}{n}\ln Q$$

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Selected Standard Electrode Potentials (298K):

$Ag^{+}(aq) + e^{-} \rightarrow Ag(s)$	E^{0}= 0.74V
$Cu^{2+}(aq) + 2e^{-} \rightarrow Cu(s)$	E^{0}= 0.15V
$2H^{+}(aq) + 2e^{-} \rightarrow H_2(g)$	E^{0}= 0.00V
$Pb^{2+}(aq) + 2e^{-} \rightarrow Pb(s)$	E^{0}= -0.13V
$Zn^{2+}(aq) + 2e^{-} \rightarrow Zn(s)$	E^{0}= -0.74V

Answer key

1. b	2. a	3. b	4. c	5. b	6. b	7. a	8. c	9. c	10. b
11. c	12. d	13. d	14. c	15. c	16. c	17. b	18. c	19. a	20. c