001
version

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McCord CH302

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Exam 4

May 8, 2019

Wednesday 7:30 - 9:00 PM

A-L in HMA

M-Z In BUR 106

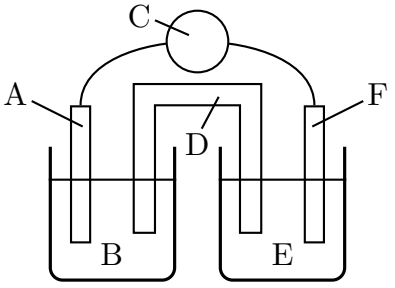
Remember to refer to the Periodic Table handout that is separate from this exam copy.

NOTE: Please keep this exam copy intact (all pages still stapled - including this cover page). You must turn in ALL the materials that were distributed. This means that you turn in your exam copy (name and signature included), bubble sheet, periodic table handout, and all scratch paper. Please also have your UT ID card ready to show as well.

This print-out should have 25 questions. Multiple-choice questions may continue on the next column or page – find all choices before answering.

001 (part 1 of 2) 4.0 points

The following two questions refer to this diagram for a voltaic cell. Neither of the two electrodes are an inert electrode.



Where would you find the species that is being oxidized?

1. A

2. C

3. E

4. B

5. D

002 (part 2 of 2) 4.0 points

If the half-reaction for the anode involves Fe^{2+} and Fe, which of these redox pairs could be in the cell on the right?

1. None of these can give a voltaic cell

2. H^+ and H_2

3. Cr^{3+} and Cr

4. Mn^{2+} and Mn

5. Sn^{2+} and Sn

003 4.0 points

When direct heat is applied to potassium chlorate, $KClO_3$, it decomposes to form KCl and other byproducts. Was chlorine oxidized or reduced? How many electrons were transferred during the process?

1. oxidized, 3 electrons

2. reduced, 3 electrons

3. oxidized, 6 electrons

4. reduced, 6 electrons

5. reduced, 9 electrons

6. oxidized, 4 electrons

004 4.0 points

Consider the lead-acid battery and the chemical reaction that drives it forward during use (discharge). Which of the following substances is *reduced* as the battery discharges and what electrode is it?

1. Pb, anode

2. Pb, cathode

3. $PbSO_4$, anode

4. $PbSO_4$, cathode

5. PbO_2, anode

6. PbO_2, cathode

005 4.0 points

Consider the following cell:

$$Pd\,|\,Pd^{2+}\,||\,Ru^{3+}\,|\,Ru$$

What is ΔG° for the overall cell reaction that is represented here? Balance the reaction using the lowest possible integer values.

1. +91.2 kJ

2. −91.2 kJ

3. −877 kJ

4. +877 kJ

5. +182 kJ

6. −182 kJ

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006 4.0 points

The following cell

$$\mathrm{Zn}\,|\,\mathrm{Zn^{2+}}\,(1\,\mathrm{M})\,||\,\mathrm{H^{+}}\,(?\,\mathrm{M})\,|\,\mathrm{H_2}\,(1\,\mathrm{atm})\,|\,\mathrm{Pt}$$

is found to have a potential of 0.540 V. Find the missing concentration of the H^+ and use it to determine the pH of that solution.

1. 5.50

2. 2.25

3. 7.50

4. 3.75

5. 1.69

6. 1.88

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007 4.0 points

What is the Faraday constant?

1. The average voltage carried by the cell flowing in the opposite direction of the electrons

2. The charge of one mole of electrons

3. The potential difference between half-reactions measured in volts

4. The metallic conductor that makes contact with an electrolyte in a galvanic cell

5. The rate of charge transferred per unit time

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008 4.0 points

If a scientist wants to plate out the largest mass of metal possible in the shortest period of time using his 5 amp electroplating system, which of these solutions should he choose as his plating solution?

1. $Cu(NO_3)_2$

2. $Al(NO_3)_3$

3. $Co(NO_3)_3$

4. $Mg(NO_3)_2$

5. $Cd(NO_3)_2$

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009 (part 1 of 2) 4.0 points

Consider the following reaction. How many electrons are transferred when the reaction is performed in basic conditions?

$$\mathrm{MnO_4^-} + \mathrm{S^{2-}} \longrightarrow \mathrm{SO_3^{2-}} + \mathrm{MnO_2}$$

1. 4 e^-

2. 8 e^-

3. 12 e^-

4. 6 e^-

5. 3 e^-

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010 (part 2 of 2) 4.0 points

In the balanced equation from the previous problem, what is the coefficient for the hydroxide ion? Is it a reactant or a product?

1. 8; product

2. 2; product

3. 2; reactant

4. 4; product

5. 6; product

6. 6; reactant

7. 1; reactant

011 4.0 points

Use half-reactions from the standard reduction table to calculate the K_{sp} for $Zn(IO_3)_2$.

1. 3.9×10^{-6}

2. 7.3×10^{-19}

3. 6.8×10^{-32}

4. 1.7×10^{-26}

5. 4.8×10^{-12}

012 4.0 points

On board the space shuttles, hydrogen fuel cells provided electrical energy, and astronauts drank the water that was produced. If the overall reaction is $2H_2 + O_2 \rightarrow 2H_2O$, what will be the standard potential (E°) for this fuel cell under acidic conditions?

1. 1.23 V

2. 0.00 V

3. 0.615 V

4. 1.78 V

5. 0.830 V

013 4.0 points

What is the potential for the following cell?

$In \,|\, In^{3+}\,(0.010\,M)\,||\; Ce^{4+}\,(0.50\,M), Ce^{3+}\,(0.010\,M)\,|\,Pt$

1. 1.88 V

2. 2.09 V

3. 1.81 V

4. 1.95 V

5. 2.02 V

6. 2.37 V

014 4.0 points

A group of scientists have landed on a new planet in an alternate universe. On this planet, they have decided to use the Zn/Zn^{2+} half-reaction as their standard reference electrode. What is the new standard reduction potential for F_2?

1. + 2.11 V

2. + 3.63 V

3. + 2.87 V

4. 0 V

5. - 2.87 V

015 4.0 points

Using an electroplating system operating at 7.35 amps, it take 1.50 hours to plate out 5.00 grams of an unknown metal from its molten chloride salt, MCl_2. Identify the metal M.

1. Mg

2. Cd

3. Cu

4. Zn

5. Fe

016 (part 1 of 2) 4.0 points

What is the shorthand notation for the following electrochemical cell?

$2Cr^{2+}(aq) + Co^{2+}(aq) \longrightarrow 2Cr^{3+}(aq) + Co(s)$

1. Co^{2+} | Co || Cr^{2+} , Cr^{3+}

2. Pt | Cr^{2+} , Cr^{3+} || Co^{2+} | Co

3. Cr^{2+} | Cr^{3+} || Co^{2+} | Co

4. Co | Co^{2+} || Cr^{2+} , Cr^{3+} | Pt

5. Cr^{2+} , Cr^{3+} || Co^{2+} | Co

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017 (part 2 of 2) 4.0 points

What is the oxidizing agent in the previous problem?

1. Co

2. Cr^{2+}

3. Pt

4. Co^{2+}

5. Cr^{3+}

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018 4.0 points

Determine the potential for the following cell:

$$Mn \,|\, Mn^{2+}\,(0.025\,M) \,||\, Cd^{2+}\,(0.025\,M) \,|\, Cd$$

1. -0.78 V

2. -0.84 V

3. +0.78 V

4. +0.84 V

5. +0.72 V

6. -0.72 V

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019 4.0 points

Consider a standard voltaic cell at equilibrium. Which of the following is true?

1. $E > 0$, $\Delta G > 0$, $K > 1$

2. $E < 0$, $\Delta G > 0$, $K < 0$

3. $E = 0$, $\Delta G = 0$, $K > 1$

4. $E = 0$, $\Delta G = 0$, $K = 1$

5. $E < 0$, $\Delta G > 0$, $K < 1$

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020 4.0 points

An electrolytic cell is set up with two inert electrodes labeled J and K both placed into a single beaker of molten calcium chloride. You observe bubbles of pale green chlorine gas at electrode J and metallic calcium forming at electrode K. Which is true of electrode J?

1. It is the cathode and chloride is being reduced.

2. It is the anode and chloride is being reduced.

3. It is the cathode and chloride is being oxidized.

4. It is the anode and chloride is being oxidized.

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021 4.0 points

For the given cell:

$$Mn \,|\, Mn^{2+}\,(0.20\,M) \,||\, Mn^{2+}\,(?\,M) \,|\, Mn$$

Find the missing concentration of Mn^{2+} given that the cell potential is found to be 8.9 mV.

1. 0.40 M

2. 0.10 M

3. 0.28 M

4. 2.5 M

5. 0.20 M

6. 3.5 M

7. 0.14 M

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022 4.0 points

You are examining a non-rechargeable D-cell battery that you are about to put in a flashlight. You see that one end is labeled '+' and the other is labeled '−'. Now that you have studied batteries in general chemistry you know that the '+' indicates the end that is the:

1. cathode

2. Pt electrode

3. anode

4. inert electrode

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023 4.0 points

What are the oxidation states of Na, Cl, and O in $NaClO_4$?

1. Na = +1, Cl = +7, O = −8

2. Na = +1, Cl = +1, O = −2

3. Na = +9, Cl = −1, O = −8

4. Na = +3, Cl = −1, O = −2

5. Na = +1, Cl = +7, O = −2

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024 4.0 points

The following reaction occurs in acidic conditions. What is the coefficient of water in the overall balanced equation? Is it a reactant or a product?

$$As_2O_3 + NO_3^- \longrightarrow H_3AsO_4 + NO$$

1. 2; product

2. 3; reactant

3. 3; product

4. 2; reactant

5. 7; reactant

6. 4; reactant

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025 4.0 points

Consider the following short-hand notation for a concentration cell at standard conditions:

$$Pt(s)\,|\,H_2(g)\,|\,H^+(aq)\,||\,H^+(aq)\,|\,H_2(g)\,|\,Pt(s)$$

Which of the following will result in a positive cell potential?

1. This cell can only have a cell potential equal to 0 V

2. Increasing the pressure of H_2 in the cathode compartment

3. Decreasing the pH of the cathode compartment

4. Decreasing the pressure of H_2 in the anode compartment

5. Increasing the H^+ concentration in the anode compartment