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MWF 2pm - 3pm

Exam 4

Fall 2018

Dec 5, 2018

Wednesday 7:30 - 9:00 PM

BUR 106

Remember to refer to the Periodic Table handout that is separate from this exam copy.
A table of standard potentials is on the back of the periodic table handout.

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 20 questions. Multiple-choice questions may continue on the next column or page – find all choices before answering.

001 5.0 points

Consider the following voltaic cell:

$$\mathrm{Pt} \left| \begin{matrix} \mathrm{Sn^{2+}} \\ (0.050\ \mathrm{M}) \end{matrix} , \begin{matrix} \mathrm{Sn^{4+}} \\ (0.50\ \mathrm{M}) \end{matrix} \right\| \begin{matrix} \mathrm{Ag^{+}} \\ (0.010\ \mathrm{M}) \end{matrix} \left| \mathrm{Ag} \right.$$

The experimental cell potential for the cell is closest to

1. 0.502 V

2. 0.561 V

3. 0.739 V

4. 0.354 V

5. 0.650 V

6. 0.798 V

7. 0.946 V

002 5.0 points

Consider the half-reactions and the balanced equation for the cell reaction represented by the skeletal equation

$$\mathrm{Mn(s) + Ti^{2+}(aq) \rightarrow Mn^{2+}(aq) + Ti(s)}\,.$$

What is its standard potential?

1. 1.405 V

2. 2.81 V

3. −1.405 V

4. −0.45 V

5. 0.45 V

6. −2.81 V

003 5.0 points

A reaction has $k = 8.39\ \mathrm{M^{-1} \cdot s^{-1}}$. How long does it take for the reactant concentration to drop from 0.0840 M to 0.0220 M?

1. 4.00 s

2. 8.39 s

3. 5.42 s

4. 2.00 s

5. 1.42 s

004 5.0 points

Suppose for some reaction the rate constant doubles in going from $T = 50°\mathrm{C}$ to $70°\mathrm{C}$. What is E_a for this reaction?

1. 24.0 kJ/mol

2. 8.12 kJ/mol

3. 39.2 kJ/mol

4. 16.1 kJ/mol

5. 1.01 kJ/mol

6. 32.0 kJ/mol

005 5.0 points

Indium metal, In(s), is electroplated from a concentrated solution of indium (III) chloride. 12.5 amps of current is passed for a total of 96 hours. What mass of indium is plated?

1. 1.30 kg

2. 1.71 kg

3. 4.24 kg

4. 5.14 kg

5. 3.92 kg

6. 2.57 kg

006 5.0 points

For the cell diagram

$$\mathrm{Pt\,|\,H_2(g)\,|\,H^+(aq)\,||\,Co^{3+}(aq), Co^{2+}(aq)\,|\,Pt}$$

what reaction occurs at the cathode?

1. $\mathrm{Co^{2+}(aq) \rightarrow Co^{3+}(aq) + e^-}$

2. $\mathrm{Co^{3+}(aq) + e^- \rightarrow Co^{2+}(aq)}$

3. $\mathrm{Co^{3+}(aq) + 2\,e^- \rightarrow Co^{+}(aq)}$

4. $\mathrm{\frac{1}{2}\,H_2(g) \rightarrow H^+(aq) + e^-}$

5. $\mathrm{2\,H_2O(\ell) + 2\,e^- \rightarrow H_2(g) + 2\,OH^-(aq)}$

007 5.0 points

A catalyst works by

1. providing an alternate reaction pathway with a higher activation energy.

2. increasing the average kinetic energy of the reactant molecules.

3. making the reaction more exothermic and therefore more favorable.

4. providing an alternate reaction pathway with a lower activation energy.

008 5.0 points

Consider the data collected for a chemical reaction between compounds A and B that is first order in A and first order in B:

	[A] M	[B] M	rate M/s
1	0.2	0.05	0.1
2	?	0.05	0.4
3	0.4	?	0.8

From the information above for 3 experiments, determine the missing concentrations of A and B. Answers should be in the order of [A] then [B].

1. 0.40 M; 0.20 M

2. 0.80 M; 0.20 M

3. 0.20 M; 0.80 M

4. 0.40 M; 0.10 M

5. 1.60 M; 0.40 M

6. 0.80 M; 0.10 M

009 5.0 points

Which type of widely used battery is NOT rechargeable?

1. alkaline

2. nickel-cadmium (NiCad)

3. lead-acid (storage batteries)

4. lithium-ion

010 5.0 points

Three separate experiments were performed on the rate of the reaction:

$$\mathrm{3\,A_2 + 2\,B \rightarrow 2\,A_3B}$$

The measured initial concentrations of $\mathrm{A_2}$ and B (in moles per liter) are shown below along with the measured initial rates of formation of $\mathrm{A_3B}$ (moles per liter per second).

Trial	Initial $[\mathrm{A_2}]_0$ M	Initial $[\mathrm{B}]_0$ M	Initial rate M/s
1	1.5	3.0	7.0×10^{-8}
2	1.5	1.5	1.75×10^{-8}
3	4.5	3.0	2.1×10^{-7}

The reaction is...

1. first order in $[\mathrm{A_2}]$ and second order in [B]

2. second order in $[\mathrm{A_2}]$ and first order in [B]

3. first order in $[A_2]$ and first order in [B]

4. third order in $[A_2]$ and second order in [B]

5. None of these is correct.

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011 5.0 points

Consider the following reaction.

$$4NH_3 + 5O_2 \rightarrow 4NO + 6H_2O$$

If the rate of change for NO is 0.016 M/s, what is the rate of change for O_2 ?

1. +0.018 M/s

2. +0.024 M/s

3. −0.024 M/s

4. −0.020 M/s

5. +0.020 M/s

6. −0.018 M/s

7. +0.013 M/s

8. −0.013 M/s

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012 5.0 points

Which species will reduce Ag^+ but not Fe^{2+}?

1. Cr

2. Pt

3. H_2

4. Au

5. V

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013 5.0 points

What would you propose as the rate law for the reaction of bromine with nitric oxide if the second step of a proposed mechanism is the rate determining step?

Step 1: $NO + Br_2 \rightarrow NOBr_2$
Step 2: $NOBr_2 + NO \rightarrow 2\,NOBr$

1. $k\,[NO]^2$

2. $k\,[NO]\,[Br_2]\,[NOBr_2]$

3. $k\,[NO]^2\,[Br_2]\,[NOBr_2]^{-1}$

4. $k\,[NO]\,[Br_2]\,[NOBr_2]^{-1}$

5. $k\,[NO]^2\,[Br_2]$

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014 5.0 points

For a first-order reaction, after 230 s, 33% of the reactants remain. Calculate the rate constant for the reaction.

1. 0.00209 s^{-1}

2. 0.00482 s^{-1}

3. 0.000756 s^{-1}

4. 207 s^{-1}

5. 0.00174 s^{-1}

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015 5.0 points

Balance the following redox reaction in acidic solution. You will have to provide the H_2O and the H^+ for the reaction. Make sure all the coefficients are whole numbers.

$$NbO_2 + W \rightarrow Nb + WO_4^{2-}$$

What is the coefficient for WO_4^{2-} in the balanced equation?

1. 2

2. 4

3. 1

4. 6

5. 3

6. 5

016 5.0 points

The following reaction

$$A + B \rightarrow C$$

is found to follow the rate law

$$\text{rate} = k[A][B]$$

when will a plot of ln[A] vs time yield a straight line?

1. when the $[B] >> [A]$

2. when [B] = [A]

3. never

4. when the $[B] << [A]$

5. always

017 5.0 points

In the balanced reaction

$$2\ VO_3^- + 3\ Zn + 12\ H^+ \rightarrow 2\ V^{2+} + 3\ Zn^{2+} + 6\ H_2O$$

which species is the oxidizing agent?

1. H^+

2. H_2O

3. Zn^{2+}

4. VO_3^-

5. Zn

6. V^{2+}

018 5.0 points

A certain reaction (X → Y) is run and the half-life is found to be 7.0 minutes. The same reaction is run again using half the original amount of reactant X and the half-life changed to 3.5 minutes. What is the order of this reaction?

1. You must run one more experiment before you can tell.

2. first order

3. second order

4. Half lives are not indicators of order.

5. zero order

019 5.0 points

Calculate the emf of the following electrochemical cell:

$$\text{Pt(s)} \left| \begin{matrix} H_2SO_3(aq)\ , \\ SO_4^{2-}(aq), H^+(aq) \end{matrix} \right\| \left| \begin{matrix} Cr_2O_7^{2-}(aq)\ , \\ Cr^{3+}(aq), H^+(aq) \end{matrix} \right| \text{Pt(s)}$$

1. −1.50 V

2. −1.16 V

3. −0.24 V

4. +1.50 V

5. +0.24 V

6. +1.16 V

020 5.0 points

For a given electrochemical cell, E^0 was calculated to be −0.7V for a two-electron process. What is K_{eq} for the reaction at $T = 298$ K?

1. 1.74×10^{30}

2. 1.45×10^{-12}

3. 2.94

4. 1.05×10^{-27}

5. 2.1×10^{-24}