

# 214

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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.

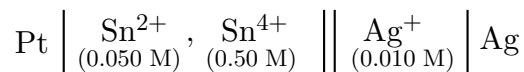
**NOTE:** Please keep this exam copy intact (all pages still stapled - including this cover page). You must turn in **ALL** the materials that were distributed. This means that you turn in your exam copy (name and signature included), bubble sheet, periodic table handout, and all scratch paper. Please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

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**001 5.0 points**

Consider the following voltaic cell:



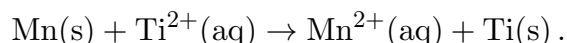
The experimental cell potential for the cell is closest to

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

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**002 5.0 points**

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



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

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**003 5.0 points**

A reaction has  $k = 8.39 \text{ M}^{-1} \cdot \text{s}^{-1}$ . 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

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**004 5.0 points**

Suppose for some reaction the rate constant doubles in going from  $T = 50^\circ\text{C}$  to  $70^\circ\text{C}$ . 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

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**005 5.0 points**

Indium metal,  $\text{In(s)}$ , 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



what reaction occurs at the cathode?

1.  $\text{Co}^{2+}(\text{aq}) \rightarrow \text{Co}^{3+}(\text{aq}) + e^-$
2.  $\text{Co}^{3+}(\text{aq}) + e^- \rightarrow \text{Co}^{2+}(\text{aq})$
3.  $\text{Co}^{3+}(\text{aq}) + 2e^- \rightarrow \text{Co}^+(\text{aq})$
4.  $\frac{1}{2} \text{H}_2(\text{g}) \rightarrow \text{H}^+(\text{aq}) + e^-$
5.  $2 \text{H}_2\text{O}(\ell) + 2e^- \rightarrow \text{H}_2(\text{g}) + 2 \text{OH}^-(\text{aq})$

**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]	[B]	rate
	M	M	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:



The measured initial concentrations of  $\text{A}_2$  and B (in moles per liter) are shown below along with the measured initial rates of formation of  $\text{A}_3\text{B}$  (moles per liter per second).

Trial	Initial [A <sub>2</sub> ] <sub>0</sub> M	Initial [B] <sub>0</sub> M	Initial rate M/s
1	1.5	3.0	$7.0 \times 10^{-8}$
2	1.5	1.5	$1.75 \times 10^{-8}$
3	4.5	3.0	$2.1 \times 10^{-7}$

The reaction is...

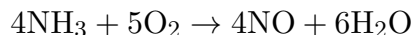
1. first order in  $[\text{A}_2]$  and second order in  $[\text{B}]$
2. second order in  $[\text{A}_2]$  and first order in  $[\text{B}]$

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.



If the rate of change for NO is 0.016 M/s, what is the rate of change for  $\text{O}_2$  ?

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**

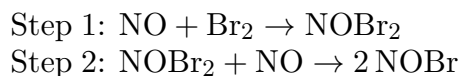
Which species will reduce  $\text{Ag}^+$  but not  $\text{Fe}^{2+}$ ?

1. Cr
2. Pt
3.  $\text{H}_2$
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?



1.  $k [\text{NO}]^2$
2.  $k [\text{NO}] [\text{Br}_2] [\text{NOBr}_2]$
3.  $k [\text{NO}]^2 [\text{Br}_2] [\text{NOBr}_2]^{-1}$
4.  $k [\text{NO}] [\text{Br}_2] [\text{NOBr}_2]^{-1}$
5.  $k [\text{NO}]^2 [\text{Br}_2]$

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**014 5.0 points**

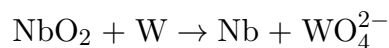
For a first-order reaction, after 230 s, 33% of the reactants remain. Calculate the rate constant for the reaction.

1.  $0.00209 \text{ s}^{-1}$
2.  $0.00482 \text{ s}^{-1}$
3.  $0.000756 \text{ s}^{-1}$
4.  $207 \text{ s}^{-1}$
5.  $0.00174 \text{ s}^{-1}$

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**015 5.0 points**

Balance the following redox reaction in acidic solution. You will have to provide the  $\text{H}_2\text{O}$  and the  $\text{H}^+$  for the reaction. Make sure all the coefficients are whole numbers.



What is the coefficient for  $\text{WO}_4^{2-}$  in the balanced equation?

1. 2
2. 4
3. 1
4. 6
5. 3
6. 5

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**016 5.0 points**

The following reaction



is found to follow the rate law

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

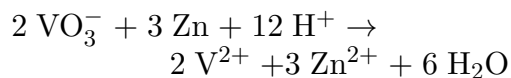
when will a plot of  $\ln[A]$  vs time yield a straight line?

1. when the  $[B] \gg [A]$
2. when  $[B] = [A]$
3. never
4. when the  $[B] \ll [A]$
5. always

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**017 5.0 points**

In the balanced reaction



which species is the oxidizing agent?

1.  $\text{H}^+$
2.  $\text{H}_2\text{O}$
3.  $\text{Zn}^{2+}$
4.  $\text{VO}_3^-$
5.  $\text{Zn}$
6.  $\text{V}^{2+}$

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**018 5.0 points**

A certain reaction ( $X \rightarrow Y$ ) 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

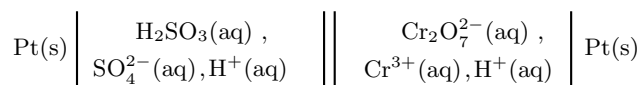
4. Half lives are not indicators of order.

5. zero order

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**019 5.0 points**

Calculate the emf of the following electrochemical cell:



1.  $-1.50 \text{ V}$
2.  $-1.16 \text{ V}$
3.  $-0.24 \text{ V}$
4.  $+1.50 \text{ V}$
5.  $+0.24 \text{ V}$
6.  $+1.16 \text{ V}$

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**020 5.0 points**

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

1.  $1.74 \times 10^{30}$
2.  $1.45 \times 10^{-12}$
3. 2.94
4.  $1.05 \times 10^{-27}$
5.  $2.1 \times 10^{-24}$