

CHEM. 1BL LAB FINAL MONDAY MARCH 16, 4:00 – 6:00 PM* Rooms: Go to the room where your TA will be (See Room Assignments below).

*If you have a foreign language final at this time, you can take the lab final Friday, March 13, 4:00-6:00 PM, CHEM. 1179.

SCANTRON FORMS will be PROVIDED. You must BRING:

- 1) **Reg. Card (Picture ID), PERM number**
- 2) **PENCIL (and an extra pencil)**
- 3) **CALCULATOR (no sharing calculators)**

BROIDA 1640 : Frank Proa, Ash Wright

CHEM. 1171: Elizabeth Flynn, Katie Meihaus

CHEM. 1179: Brendan Beahm, Duc Duong, Jerry LaRue, Richard Lewis, Zhisheng Li, Lauren Spencer

NORTH HALL 1006: Dan Engelhart, Wade Grabow

GIRVETZ 1004: Jessica Brown, Kiel Nikolakakis, Jin Kuen Park

PHELP 1260: Brian Lin, Jason Lin, Yen-ping Lin

Harold Frank Hall 1104: Andrew Benkovich, Tyler Shropshire, Yichi Zhang

BUCHANAN 1910: JJ Cowart, Kim Dinh, Greg Dolan, Danielle Schultz

QUESTIONS FROM LAST YEAR'S LAB FINAL ARE GIVEN BELOW. The Periodic Table, Equations, Constants, and Conversion factors will be given on the exam. No other notes are allowed. The final will have 20 multiple choice questions.

WORK PROBLEMS IN THE LAB MANUAL!!!!!! Answers to the following questions are at the end.

NOTE: Taking the lab final is required to complete the course. If you do not take the lab final you will fail the course. **SHOW ALL YOUR WORK ON THE EXAM.** If there is a problem with your exam, we can evaluate your answers **ONLY IF YOUR WORK IS SHOWN.**

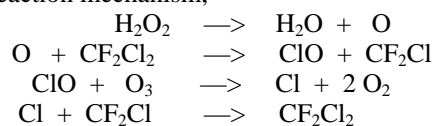
1. If a solution is made by mixing 30.0 mL 0.3 M NaCH₃COO with 20 mL 0.4 M CH₃COOH, calculate the pH of the solution? For acetic acid, $K_a = 1.76 \times 10^{-5}$.
2. A weak acid, HA, is titrated with a strong base. At the equivalence point
a) pH = 7 b) [HA] = [A⁻] c) pH > 7 d) pH < 7
3. Consider the following reaction at equilibrium: $\text{CH}_3\text{COOH (aq)} \rightleftharpoons \text{H}^+ \text{(aq)} + \text{CH}_3\text{COO}^- \text{(aq)}$
If NaCH₃COO is added to the solution, will each of the following quantities increase, decrease or stay the same.
a) [CH₃COOH] b) [H⁺] c) [OH⁻] d) pH e) pKa
4. For 100.0 mL of buffer that is 0.50 M HClO and 0.40 M NaOCl, what is the pH after 10.0 mL of 1.0 M NaOH is added. $K_a = 3.0 \times 10^{-8}$ for HClO.
5. Consider the following reaction: $\text{CH}_4 \text{(g)} + 2 \text{O}_2 \text{(g)} \rightarrow \text{CO}_2 \text{(g)} + 2 \text{H}_2\text{O (g)}$ $\Delta H = - 802 \text{ kJ}$
Calculate the enthalpy change for the combustion of 50 g of methane.
6. The heat of combustion for a sample of coal is 24.0 kJ/g. What quantity of coal (in grams) must be burned to heat 300.0 g of water from 20.0°C to 75.0°C. Specific heat capacity of water is 4.184 J °C⁻¹ g⁻¹.
7. Calculate the mass of chromium produced in 1.0 hour by the electrolysis of molten CrO₃ with an electrical current of 15 A.

Answer questions 7 through 10 below using the following data:

Half Reaction	E° (V)
$\text{Au}^{3+} + 3 \text{e}^- \rightarrow \text{Au (s)}$	1.50
$\text{Ag}^+ + \text{e}^- \rightarrow \text{Ag (s)}$	0.80
$\text{Ni}^{2+} + 2 \text{e}^- \rightarrow \text{Ni (s)}$	- 0.23
$\text{Al}^{3+} + 3 \text{e}^- \rightarrow \text{Al (s)}$	- 1.66

8. Which is the strongest reducing agent? a) Au b) Al c) Au³⁺ d) Al³⁺
9. Can Ag⁺ oxidize Al (s) ? a) yes b) no
10. Can Ag (s) reduce Ni²⁺ ? a) yes b) no
11. A galvanic cell is constructed in which an Ag⁺/Ag half-cell is connected to a Ni²⁺/Ni half-cell. Calculate ΔG° for this reaction at 25°C.
 $2 \text{Ag}^+ \text{(aq)} + \text{Ni (s)} \rightarrow 2 \text{Ag (s)} + \text{Ni}^{2+} \text{(aq)}$

12. Given the following reaction mechanism,



Identify the catalyst.

- a) O b) CF_2Cl_2 c) ClO d) CF_2Cl e) Cl
13. The reaction, $\text{A} + \text{B} \longrightarrow \text{products}$, has the rate law, $\text{rate} = k[\text{A}][\text{B}]^2$. If the concentration of B is doubled while the concentration of A is kept constant, how will this affect the rate of reaction?
- a) The rate increases by a factor of two.
 b) The rate stays the same
 c) The rate increases by a factor of three.
 d) The rate increases by a factor of four.

14. The activation energy for an exothermic reaction is 10 kJ/mol. What effect will an increase in temperature have on the activation energy?

a) Increases E_a b) Decreases E_a c) No effect on E_a

15. Suppose the following data is obtained for the reaction $\text{A} \longrightarrow \text{products}$:

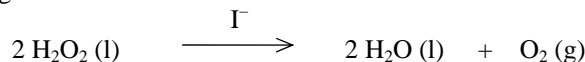
[A] (mol L ⁻¹)	Rate (mol L ⁻¹ s ⁻¹)
0.90	1.9×10^{-4}
0.30	2.1×10^{-5}

What is the rate law for this reaction?

a) $\text{rate} = k[\text{A}]$ b) $\text{rate} = k[\text{A}]^2$ c) $\text{rate} = k[\text{A}]^3$

16. If a solution is 6 % H_2O_2 by mass calculate its molarity. Assume the density of this solution is 1.0 g/mL.

17. Consider the following reaction.



A solution contains 15 mL 0.1 M KI, 15 mL of DI water and 5 mL of 3% H_2O_2 . After the decomposition of H_2O_2 is complete, you titrate the solution with 0.1 M AgNO_3 . If the catalyst, I^- , is not consumed in the reaction and is completely recovered, what volume of the 0.1 M AgNO_3 is required to reach the end point?

18. Suppose the following data is obtained at 25 °C for the following reaction. $\text{A} + \text{B} + \text{C} \longrightarrow \text{products}$:

[A] (mol L ⁻¹)	[B] (mol L ⁻¹)	[C] (mol L ⁻¹)	Rate (mol L ⁻¹ s ⁻¹)
0.2	0.3	0.1	0.063
0.4	0.2	0.3	0.084
0.4	0.2	0.6	0.168
0.4	0.1	0.3	0.021
0.2	0.2	0.6	0.168

Write the rate law for this reaction.

19. Calculate the rate constant for the reaction in problem 17.
20. Consider the following electron transitions in the hydrogen atom. For which transition is the emission line observed at longer wavelength.
- a) $n = 2 \longrightarrow n = 3$ c) $n = 4 \longrightarrow n = 2$
 b) $n = 3 \longrightarrow n = 2$ d) $n = 2 \longrightarrow n = 4$
21. For the hydrogen atom, calculate the wavelength of light emitted when an electron makes the transition from $n = 3$ to the ground state.

Remember to work problems in the lab manual as well. It is also important to review acid-base chemistry and buffer solutions. There is an acid-base buffer review the Chem. 1BL course web page. The review includes example problems.

ANSWERS: 1. pH = 4.80 2. c 3. a) $[\text{CH}_3\text{COOH}]$ increases b) $[\text{H}^+]$ decreases c) $[\text{OH}^-]$ increases d) pH increases
 e) pKa, no change 4. 7.6 5. -2506 kJ 6. 2.88 g 7. 4.85 g 8. b 9. a 10. b
 11. -198.8 kJ 12. b 13. d 14. c 15. b 16. 1.76 M 17. 15 mL
 18. $\text{rate} = k[\text{B}]^2[\text{C}]$ 19. $7 \text{ L}^2 \text{ mol}^{-2} \text{ s}^{-1}$ 20. b 21. 102 nm