CHEM. 1BL LAB FINAL Saturday June 9 4:00 – 6:00 PM ROOM: BROIDA 1610

You must BRING:

1) **Scantron Form** (Available at the bookstore, ParScore form for Chemistry)
2) **Access Card (Picture ID), PERM number**
3) **PENCIL (and an extra pencil)**
4) **CALCULATOR (no sharing calculators)**

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.**

QUESTIONS FROM PREVIOUS YEAR'S LAB FINAL ARE GIVEN BELOW (Answers are given at the end). 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.

CREDIT for this ASSIGNMENT: Work out the problems on this practice lab final and bring your work to the lab final review the last week of lab. You will receive credit for completing this assignment. As part of the lab final review, you will take a **QUIZ**, which will have questions similar to the questions above.

1. If a solution is made by mixing 30.0 mL 0.3 M $NaCH_3COO$ with 20 mL 0.4 M CH_3COOH, 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: $CH_3COOH\,(aq) \rightleftharpoons H^+\,(aq) + CH_3COO^-\,(aq)$
   If $NaCH_3COO$ is added to the solution, will each of the following quantities increase, decrease or stay the same.
   a) $[CH_3COOH]$ 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. $Ka = 3.0 \times 10^{-8}$ for HClO.

5. Consider the following reaction: $CH_4\,(g) + 2\,O_2\,(g) \rightarrow CO_2\,(g) + H_2O\,(g)$ $\Delta H = -802$ 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 CrO_3 with an electrical current of 15 A.

Answer questions 8 through 11 below using the following data:

Half Reaction	E° (V)	Half Reaction	E° (V)
$Au^{3+} + 3\,e^- \rightarrow Au\,(s)$	1.50	$Zn^{2+} + 2\,e^- \rightarrow Zn\,(s)$	− 0.76
$Ag^+ + e^- \rightarrow Ag\,(s)$	0.80	$Al^{3+} + 3\,e^- \rightarrow Al\,(s)$	− 1.66
$Ni^{2+} + 2\,e^- \rightarrow Ni\,(s)$	− 0.23	$Na^+ + e^- \rightarrow Na\,(s)$	− 2.71

8. Which is the strongest reducing agent?
   a) Na b) Au c) Au^{3+} d) Na^+

9. Can Ag^+ oxidize Al (s) ? a) yes b) no

10. Consider a galvanic cell where Al (s) is oxidized to Al^{3+} and Zn^{2+} is reduced to Zn (s) at 25°C.
    $Al(s)\,|\,Al^{3+}\,||\,Zn^{2+}\,|\,Zn(s)$
    Calculate the cell potential, E_{cell}, when the concentrations are: $[Al^{3+}] = 2.5$ M and $[Zn^{2+}] = 1.2$ M

11. A galvanic cell is constructed in which an Ag^+/Ag half-cell is connected to a Ni^{2+}/Ni half-cell. Calculate $\Delta G°$ for this reaction at 25°C. $2\,Ag^+\,(aq) + Ni\,(s) \rightarrow 2\,Ag\,(s) + Ni^{2+}\,(aq)$

12. Given the following reaction mechanism,

$$H_2O_2 \rightarrow H_2O + O$$
$$O + CF_2Cl_2 \rightarrow ClO + CF_2Cl$$
$$ClO + O_3 \rightarrow Cl + 2\,O_2$$
$$Cl + CF_2Cl \rightarrow CF_2Cl_2$$

Identify the catalyst.
a) O b) CF_2Cl_2 c) ClO d) CF_2Cl e) Cl

13. The reaction, A + B → products, has the rate law, rate = $k[A][B]^2$
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 A → 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) rate = $k[A]$ b) rate = $k[A]^2$ c) rate = $k[A]^3$

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.

$$2\,H_2O_2\,(l) \xrightarrow{I^-} 2\,H_2O\,(l) + O_2\,(g)$$

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. A + B + C → 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 18.

20. Consider the following electron transitions in the hydrogen atom. For which transition is the emission line observed at longer wavelength.
a) n = 2 → n = 3 c) n = 4 → n = 2
b) n = 3 → n = 2 d) n = 2 → 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.

22. Where will you be taking the lab final? What day and time is the lab final?

Remember to work problems in the lab manual as well. It is also important to review acid-base chemistry and buffer solutions.

ANSWERS: 1. pH = 4.80 2. c 3. a) [CH_3COOH] increases b) [H^+] decreases c) [OH^-] increases d) pH increases e) pKa, no change 4. 7.6 5. – 2506 kJ 6. 2.88 g 7. 4.85 g 8. a 9. a 10. 0.89 V 11. –198.8 kJ 12. b 13. d 14. c 15. b 16. 1.76 M 17. 15 mL 18. rate = $k[B]^2[C]$ 19. 7 $L^2\,mol^{-2}\,s^{-1}$ 20. b 21. 102 nm 22. Lab Final Room: BROIDA 1610 Lab Final: Saturday June 9, 4 – 6 PM (the Saturday before the start of finals week).