

Name _____

Student Number: _____

Chem 115
Practice Examination #2

This exam consists of seven (7) pages, including this cover page. Be sure your copy is complete before beginning your work. If this test packet is defective, ask for another one.

A copy of the Periodic Table is attached to the end of this exam. You may remove it and use the back side as scratch paper. No work on scratch paper will be graded or collected.

The following information may be useful:

<u>Constants of nature</u> <i>Avogadro's number</i> $N_A = 6.022 \times 10^{23}$ units = 1 mole of units specific heat of water, $C = 4.184 \text{ J}\cdot\text{g}^{-1}\cdot\text{C}^{-1}$	<u>Conversions/Metric Prefixes</u> $1 \text{ mL} = 1 \text{ cm}^3$
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DO NOT WRITE BELOW THIS LINE

Part I: Multiple-choice Q1-19 _____ (max 57)	Part II: Problems Problem 1 _____ (max 20) Problem 2 _____ (max 10)	Part III: Laboratory <i>omitted from this sample exam since laboratory is now a separate course</i>
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Total (out of 100 points) = *due to Part III omission,
no longer sums to 100*

Disclaimer:

This is a copy of a typical Exam 2 given in Chem 115 during the academic year. Your test will be different. This test is being posted to give you a sense of the format, style, scope and level of a typical test on this material. This test may have questions on topics that may not be covered on your exam. Moreover, your test may have questions on topics not covered in this practice exam. Posting this test in no way limits the format, style, scope and level of the test that you will take. Do not limit your preparation to the material in this practice exam.

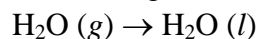
Part I. Multiple-Choice or Short Response

Each multiple-choice question is worth 3 points. This part of the exam is worth 57% of the total points.

1. Manganese has the oxidation number of +5 in

- A)
- $[\text{MnF}_6]^{3-}$
- B)
- Mn_2O_7
- C)
- $[\text{MnO}_4]^{2-}$
- D)
- $[\text{Mn}(\text{CN})_6]^-$

2. Which of the following statements is true about this process at 25 °C and constant pressure?



- A)
- ΔH
- is positive and the process is endothermic.
-
- B)
- ΔH
- is positive and the process is exothermic.
-
- C)
- ΔH
- is negative and the process is endothermic.
-
- D)
- ΔH
- is negative and the process is exothermic.

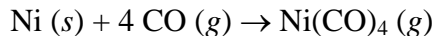
3. When 50 mL of 0.1 M HCl is mixed with 50 mL of 0.2 M NaOH, the resulting solution will be

- A) acidic C) neutral
-
- B) basic D) not enough information to tell

4. A strong acid and a metal carbonate react to form

- A) a salt and hydrogen.
-
- B) a salt and water.
-
- C) a salt, water and carbon dioxide.
-
- D) a salt and a base.
-
- E) another acid and a base.

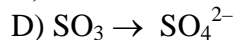
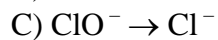
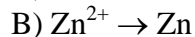
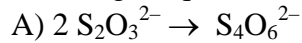
5. If a 17.0 g sample of impure nickel metal reacts under standard conditions with 1.12 mol of CO gas to form 0.279 mol of $\text{Ni}(\text{CO})_4$ gas, what is the percentage of Ni in the metal sample?



Molar Masses	
Ni	58.7 g/mol
$\text{Ni}(\text{CO})_4$	171. g/mol

- A) 24.1% B) 25.0% C) 96.4% D) 100%

6. Which change requires an oxidizing agent to produce the indicated product?



7. To determine experimentally whether the compound MCl_3 is ionic or covalent, one might

A) test the solubility in water.

B) determine the percentage composition.

C) find the valence of **M**.

D) test the electrical conductivity in the fused (molten) state.

E) determine whether the compound has an electrical charge.

8. Which pair represents compounds each of which dissolves in water to give solutions that are good conductors of electricity?

A) CH_3COOH and NaCl

C) HF and HCl

B) NaCl and AgCl

D) NaCl and H_2SO_4

9. The heat required to increase the temperature of 50.0 g of H_2O (*l*) from 25.0 °C to 45.0 °C is

Data for Water	
specific heat, C	4.18 $\text{J}\cdot\text{g}^{-1}\cdot\text{°C}^{-1}$

A) 116. J

B) 209. J

C) 4180 J

D) 4180 kJ

10. A solution that has pH of 8 is

A) very acidic

C) slightly acidic

E) exactly neutral

B) very basic

D) slightly basic

11. Solution **A** was prepared by dissolving 0.60 mol of NaCl in 2.0 L of water. Solution **B** was prepared by dissolving 0.60 mol of Na_2SO_4 in 2.0 L of water. What is the concentration of Na^+ ions in solution **C** which is made by combining equal volumes of solutions **A** and **B**.

A) 0.30 M

B) 0.45 M

C) 0.60M

D) 0.90 M

12. Which is an oxidation-reduction reaction?

- A) Iron reacts with sulfur.
 - B) Sodium hydroxide reacts with hydrochloric acid.
 - C) Sodium chloride reacts with silver nitrate solution.
 - D) Calcium oxide reacts with hydrochloric acid.
 - E) Sodium carbonate reacts with hydrochloric acid.
-

13. On the basis of metal reactivities, which pair of substances may be expected to react? (All solutions are of the same molar concentration.)

Metal Reactivity
Mg > Al > Zn > Fe > H > Cu > Hg > Ag

- A) mercury (II) chloride in solution and aluminum metal
 - B) aluminum chloride in solution and silver metal
 - C) zinc sulfate in solution and hydrogen gas
 - D) copper nitrate in solution and silver metal
 - E) magnesium sulfate in solution and iron metal
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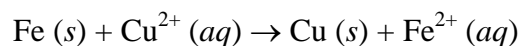
14. A solution contains 0.400 g of NaOH in 20.0 mL of solution. What is its molarity?

- A) 0.250 M B) 0.400 M C) 0.500 M D) 1.00 M E) 2.00 M
-

15. A precipitate will form from an aqueous solution of Fe^{3+} ion upon the addition of

- A) KOH
 - B) NaNO_3
 - C) HCl
 - D) HNO_3
-

16. Which statement is true for the following reaction?



- A) Cu^{2+} is oxidized
- B) Cu^{2+} gains in oxidation state
- C) Cu^{2+} is reduced
- D) $\text{Fe} (s)$ is reduced

17. Which equation best represents the net ionic reaction that occurs when sodium hydroxide and hydrochloric acid solutions are mixed?

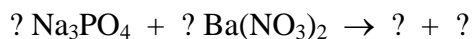
- A) $\text{Na}^+ + \text{HCl} \rightarrow \text{NaCl} + \text{H}^+$
B) $\text{OH}^- + \text{HCl} \rightarrow \text{H}_2\text{O} + \text{Cl}^-$
C) $\text{OH}^- + \text{H}_3\text{O}^+ \rightarrow 2 \text{H}_2\text{O}$
D) $\text{NaOH} + \text{H}_3\text{O}^+ \rightarrow 2 \text{H}_2\text{O} + \text{Na}^+$
-

18. A 10.0 g of silver is heated to 100.0 °C and then added to 20.0 g of water at 23.0 °C in an insulated calorimeter. At thermal equilibrium the temperature of the system was measured as 25.0 °C. What is the specific heat, C, of silver?

Data for Water	
specific heat, C	4.18 J·g ⁻¹ ·°C ⁻¹

- A) 0.11 J·g⁻¹·°C⁻¹ B) 0.22 J·g⁻¹·°C⁻¹ C) 17 J·g⁻¹·°C⁻¹ D) 34 J·g⁻¹·°C⁻¹
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19. Complete and balance the equation for the reaction, where the reactants are in aqueous solution. Use no fractional coefficients.



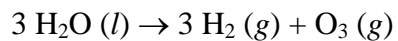
The number of moles and the formula of the product containing Ba are

- A) 3 NaNO₃ B) BaPO₄ C) Ba(PO₄)₂ D) Ba₂P₃ E) Ba₃(PO₄)₂

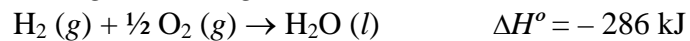
Part II. Problems

Points possible per question and per part are indicated in curly braces {...}.

1. {10 pts} What is the value of ΔH° for this reaction? Show your work.

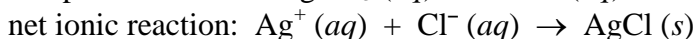


The following reaction enthalpies are given:



2. {20 pts, each part worth 5 pts} Be sure to provide answers with the correct significant digits.

130.0 mL of a 0.110 M AgNO_3 solution are mixed with 90.0 mL of a 0.095 M CaCl_2 solution in an insulated Styrofoam cup (approximating a calorimeter). Both solutions begin at 25.00 °C. The reaction that takes place is



After the reaction is complete and the white precipitate has settled, the temperature of the entire 200.0 mL of solution is 27.00 °C.

Notes: - Parts (b) and (c) are independent of part (a).

- You must show your work to receive credit. Partially correct work will receive partial credit. A correct answer with no work shown will receive no credit.

a) Determine the moles of $\text{AgCl} (s)$ precipitate that form and identify the limiting reagent.

b) How many kilojoules of heat energy were absorbed by the water during the process? (Assume that the solution is dilute enough that its density is the same as pure water: 1.000 g/mL.)

c) Is the net ionic reaction shown above endothermic or exothermic? How do you know?

d) What is the molar enthalpy of reaction (in kJ/mol) for the net ionic reaction shown above? Be sure to indicate the correct sign (+ or -).