

NAME: \_\_\_\_\_  
STUDENT ID#: \_\_\_\_\_

CHEM 207 EXAM1  
10/12/15

Print your **NAME**, your **STUDENT ID#**, and the **COLOR OF YOUR TEST** on your Scantron answer sheet. Also, **SIGN THE SCANTRON SHEET** as well. Record your answers on the **FRONT ("PART 1")** side of the answer sheet. Note that **the correct response to some of the questions may require you to black out more than one answer on a single line.**

1. Consider the following data that were obtained when an unknown sample was analyzed five times: 7.292%, 7.284%, 7.388%, 7.292%, and 7.295%. Which of these results should be rejected (90% confidence level)?

- A) 7.284% only
- B) 7.388% only
- C) 7.284% and 7.292%
- D) 7.284% and 7.388%
- E) none of the data should be rejected

2. A student performs an experiment four times and gets the following individual results: 2.06, 1.93, 2.12, and 2.16. All of these data are acceptable according to the Q test. It happens that the true value for the student's unknown is 2.00. What is the % RELATIVE ERROR for this experiment?

- A) 3.5%
- B) 7.0%
- C) 11.5%
- D) 23%
- E) none of the above

3. Suppose that you want to use a buret to measure out 5.0 mL of a solution and that you want to have an absolute error of no more than 0.10 mL. Which of the following would allow you to do this successfully?

- A) 10 mL buret
- B) 25 mL buret
- C) 50 mL buret
- D) 100 mL buret
- E) none of the above

4. Suppose that you need to measure out exactly 9 mL with the smallest error possible. However, you notice that there is no piece of glassware that has exactly this volume. Which of the following devices would you choose?

- A) 10 mL graduated cylinder
- B) 10 mL measuring pipet
- C) 10 mL buret
- D) 10 mL volumetric flask
- E) 10 mL transfer pipet

5. Which of the following terms appears in Beer's Law?

- A) %T
- b) molar absorptivity
- c) wavelength
- d) sample concentration
- e) absorbance

6. In which of the following molecules is the oxidation number of the C atom -4?

- A) CO<sub>2</sub>
- B) CO<sub>3</sub><sup>2-</sup>
- C) CO
- D) CH<sub>4</sub>
- E) CH<sub>3</sub>OH

7. A student transfers 25 mL of a  $5.0 \times 10^{-3}$  M NaOH stock solution into a 500 mL volumetric flask and fills it to the mark with deionized water. What is the molarity of the new solution? (Formula weight of NaOH = 40.00 g/mole)

- A)  $1.6 \times 10^{-5}$  M
- B)  $2.5 \times 10^{-4}$  M
- C)  $4.0 \times 10^{-4}$  M
- D) 0.10 M
- E) none of the above

8. You prepared 200 mL of an HCl solution and are standardizing it by using it to titrate 25 mL of a 0.1250 M Na<sub>2</sub>CO<sub>3</sub> solution. 25.00 mL of the HCl titrant is required to reach the modified methyl orange end point. What is the HCl concentration?

- A) 0.0625 M
- B) 0.100 M
- C) 0.125 M
- D) 0.250 M
- E) none of the above

9. What is the absorbance (A) of a solution whose % transmittance (%T) is 20%?

- A) -0.70
- B) 0.20
- C) 0.70
- D) 2.0
- E) none of the above

10. What is the transmittance (T) of a solution whose absorbance is 0.2?

- A) 0.20
- B) 0.63
- C) 0.80
- D) 1.22
- E) 1.58

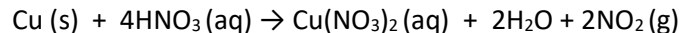
11. In Experiment 3, the absorbance of four standard Congo Red solutions were measured to obtain a calibration curve that gave the following best fit line:

$$y = 0.144x + 0.0014$$

250 mL of a Congo Red unknown was obtained from the TA. Then 20 mL of this solution was removed and diluted to 100 mL in a volumetric flask. The absorbance of this solution was measured to be 0.85. What is the concentration of the Congo Red **in the 250 mL volumetric flask**? (Don't worry about the units.)

- A) 0.12
- B) 0.62
- C) 1.2
- D) 5.9
- E) 29.5

12. Consider the following reaction that you carried out in Experiment 4:



Which of the following statements is true?

- A) this is a precipitation reaction.
- B) this is an oxidation-reduction reaction.
- C) this reaction is balanced.
- D) this reaction is a net ionic reaction.
- E) none of the above statements is true.

13. A  $6.5 \times 10^{-5}\text{M}$  solution of  $\text{KMnO}_4$  has a % transmittance of 27.3% when measured in a 1.15-cm cuvette at a wavelength of 525 nm. Calculate the absorbance of this solution.

- A) 0.039
- B) 0.44
- C) 0.56
- D) 1.44
- E) none of the above

14. The pH of a  $\text{Na}_2\text{CO}_3$  solution is determined to be 9.5. Which of the following statements is true?

- A) This solution is acidic.
- B) This solution is basic.
- C) This solution could be titrated with HCl.
- D) The  $\text{H}^+$  molarity of this solution can be calculated.
- E) The pOH of this solution can be calculated.

15. The pH of a test solution is found to be 3.3. What is the  $[\text{H}^+]$  in molarity?

- A) 0.00050 M
- B) 0.0010 M
- C) 3.3 M
- D) 10.7 M
- E) none of the above

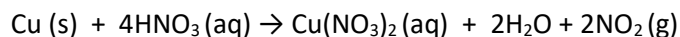
16. An unknown KHP sample weighing 0.500 g is titrated to the phenolphthalein equivalence point with 12.45 mL of 0.100 M NaOH. What is the %KHP in the unknown? (Formula weight of NaOH = 40.00 g/mole; formula weight of KHP = 204.23 g/mole)

- A) 1.27%
- B) 9.96%
- C) 25.4%
- D) 50.8%
- E) none of the above

17. The pH of a solution is found to be 4.0. What is the pOH of this solution?

- A) 0
- B) 4.0
- C) 7.0
- D) 10
- E) 14

18. Consider the following chemical reaction from Experiment 4:



Which of the following corresponds to the correct **net ionic reaction**?

- A) This reaction is already in its net ionic form.
- B)  $\text{Cu} + 4\text{HNO}_3 \rightarrow \text{Cu}(\text{NO}_3)_2 + 2\text{H}_2\text{O} + 2\text{NO}_2$
- C)  $\text{Cu (s)} + 4\text{H}^+ + 4\text{NO}_3^- \rightarrow \text{Cu}^{2+} + 2\text{NO}_3^- + 2\text{H}_2\text{O} + 2\text{NO}_2(\text{g})$
- D)  $\text{Cu (s)} + 2\text{H}^+ + 2\text{NO}_3^- \rightarrow \text{Cu}^{2+} + \text{H}_2\text{O} + 2\text{NO}_2(\text{g})$
- E)  $\text{Cu (s)} + 4\text{H}^+ + 2\text{NO}_3^- \rightarrow \text{Cu}^{2+} + 2\text{H}_2\text{O} + 2\text{NO}_2(\text{g})$

**BONUS QUESTION (2 BIG POINTS!):** What is your favorite indicator and why?

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t Table

Number of trials N	Value of t for desired confidence			
	80%	90%	95%	99%
2	3.08	6.31	12.7	63.7
3	1.89	2.92	4.30	9.92
4	1.64	2.35	3.18	5.84
5	1.53	2.13	2.78	4.60
6	1.48	2.02	2.57	4.03
7	1.44	1.94	2.45	3.71
8	1.42	1.90	2.36	3.50
9	1.40	1.86	2.31	3.36
10	1.38	1.83	2.26	3.25

Q Table

Number of trials N	Value of Q for desired confidence		
	90%	96%	99%
3	.94	.98	.99
4	.76	.85	.93
5	.64	.73	.82
6	.56	.64	.74
7	.51	.59	.68
8	.47	.54	.63
9	.44	.51	.60
10 or higher	.41	.48	.57

% TOLERANCE OF VOLUMETRIC APPARATUS

VOLUME (ML)	GRADUATED CYLINDER*	MEASURING PIPET*	BURET*	VOLUMETRIC FLASK	TRANSFER PIPET
0.1					
0.1		5			
0.2		4			
0.5		4			
1		2		1	0.6
2		1		0.8	0.35
3				0.4	0.37
4					0.3
5	2	0.8			0.2
6					0.17
7					0.15
8					0.25
10	1	0.6	0.2	0.2	0.2
15					0.15
20					0.12
25	1.5	0.4	0.12	0.12	0.1
30					0.12
40					0.1
50	0.8		0.10	0.1	0.08
75					0.08
100	0.7		0.08	0.08	0.06
200					
250	0.6			0.06	
500	0.55			0.04	
1000	0.5			0.035	
2000	0.5			0.03	

\*NOTE: The tolerance given on the graduated equipment in the first three columns is % of full capacity.