NAME: _____ CHEM 207 EXAM1
STUDENT ID#: _____ 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_2
B) CO_3^{2-}
C) CO
D) CH_4
E) CH_3OH

7. A student transfers 25 mL of a 5.0×10^{-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) 1.6×10^{-5}M
B) 2.5×10^{-4}M
C) 4.0×10^{-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_2CO_3 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:

$$Cu\,(s) + 4HNO_3\,(aq) \rightarrow Cu(NO_3)_2\,(aq) + 2H_2O + 2NO_2\,(g)$$

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 6.5×10^{-5}M solution of $KMnO_4$ 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 Na_2CO_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 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 it's the $[H^+]$ 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:

$$Cu\,(s) + 4HNO_3\,(aq) \rightarrow Cu(NO_3)_2\,(aq) + 2H_2O + 2NO_2\,(g)$$

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

A) This reaction is already in its net ionic form.
B) $Cu + 4HNO_3 \rightarrow Cu(NO_3)_2 + 2H_2O + 2NO_2$
C) $Cu\,(s) + 4H^+ + 4NO_3^- \rightarrow Cu^{2+} + 2NO_3^- + 2H_2O + 2NO_2\,(g)$
D) $Cu\,(s) + 2H^+ + 2\,NO_3^- \rightarrow Cu^{2+} + H_2O + 2NO_2\,(g)$
E) $Cu\,(s) + 4H^+ + 2\,NO_3^- \rightarrow Cu^{2+} + 2H_2O + 2NO_2\,(g)$

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.