Georgia Institute of Technology

School of Chemistry and Biochemistry

CHEM 1310: General Chemistry

Exam 1 23 September 2009

Print Name: _____ _____

Last Name **First Name**

Teaching Assistant _____ **Section** _____

"Having read the Georgia Institute of Technology Academic Honor code, I understand and accept my responsibility as a member of the Georgia Tech Community to uphold the Academic Honor Code at all times." "Students are expected to act according to the highest ethical standards. The immediate objective of an Academic Honor Code is to prevent any Students from gaining an unfair advantage over other Students through academic misconduct." " Students must sign the Academic Honor Agreement affirming their commitment to uphold the Honor Code before becoming a part of the Georgia Tech community. The Honor Agreement may reappear on exams and other assignments to remind Students of their responsibilities under the Georgia Institute of Technology Academic Honor Code." "In order for an Academic Honor Code to function, members of the Georgia Tech Community must not tolerate violations of it by anyone. Community members are at their discretion to use any of three options to report suspected Honor Code violations "

I have read and understand my responsibilities under the GT Academic Honor code.

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Directions:

1. **The exam has 20 multiple choice questions that are equally weighted at 5 points each.**
2. **A calculator and a crib sheet (8.5 x 11, front only) are permitted for use during the exam.**
3. **Complete the scantron card and include, your name, your TA, your lecture professor, your GT ID (bubble in the appropriate numbers), and the exam version. All of this material must be submitted to receive credit.**
4. **Cell phones must be shut off during the exam.**
5. **A maximum of 50 minutes is allowed for the exam.**
6. **When finished or when time is called, submit your exam to your TA, show your buzz card or other photo ID for identification.**
7. **You may not leave the exam room until 25 minutes have lapsed.**
8. **A periodic table is provided at the end of the exam.**
9. **Only the answers submitted on the scantron card will be graded.**

Georgia Institute of Technology

CHEM 1310: Exam I

23 September 2009

1. Determine the molecular formula of a compound that has a molecular weight of 183 g/mol and an empirical formula of $C_2H_5O_2$.

A) $C_3H_7O_3$
B) $C_6H_{15}O_6$
C) $C_4H_{10}O_4$
D) $C_2H_5O_2$
E) $C_8H_{20}O_8$

Answer: B

2. How many atoms of oxygen are contained in 47.6 grams of $Al_2(CO_3)_3$? The molecular weight of $Al_2(CO_3)_3$ is 234 g/mol.

A) 1.23×10^{23} oxygen atoms
B) 2.96×10^{24} oxygen atoms
C) 1.10×10^{24} oxygen atoms
D) 3.19×10^{24} oxygen atoms
E) 2.87×10^{25} oxygen atoms

Answer: C

3. Identify the limiting reagent (LR) and the mass (in grams) of nitrogen that can form from 50.0 g N_2O_4 and 45.0 grams of N_2H_4. The molecular weight of N_2O_4 is 92.0 g/mol and the molecular weight of N_2H_4 is 32.1 g/mol. The overall reaction is:

N_2O_4 (l) + 2 N_2H_4 (l) → 3 N_2 (g) + 4 H_2O (g)

A) LR = N_2O_4, 105 g N_2
B) LR = N_2H_4, 59.0 g N_2
C) LR = N_2H_4, 13.3 g N_2
D) LR = N_2O_4, 45.7 g N_2
E) No LR, 45.0 g N_2

Answer: D

4. How many liters of a 0.0555 M KCl solution contain 0.163 moles of KCl?

A) 1.12 L
B) 3.37 L
C) 8.98 L
D) 1.48 L
E) 2.95 L

Answer: E

5. Identify the spectator ion(s) in the following molecular equation:

$KBr\ (aq) + AgNO_3\ (aq) \rightarrow AgBr\ (s) + KNO_3\ (aq)$

A) K^+ and NO_3^-
B) K^+ and Br^-
C) Ag^+ and NO_3^-
D) Ag^+ and Br^-
E) NO_3^- only

Answer: A

6. Which of the following solutions will have the highest concentration of chloride ions?

A) 0.10 M $MgCl_2$
B) 0.10 M $AlCl_3$
C) 0.05 M $CaCl_2$
D) 0.10 M NaCl
E) All of these solutions have the same concentration of chloride ions.

Answer: B

7. Which of the following is a precipitation reaction?

A) $2\ LiI\ (aq) + Hg_2(NO_3)_2\ (aq) \rightarrow Hg_2I_2\ (s) + LiNO_3\ (aq)$

B) $HCl\ (aq) + KOH\ (aq) \rightarrow KCl\ (aq) + H_2O\ (l)$

C) $NaCl\ (aq) + LiI\ (aq) \rightarrow NaI\ (aq) + LiCl\ (aq)$

D) $Zn\ (s) + 2\ AgNO_3\ (aq) \rightarrow 2\ Ag\ (s) + Zn(NO_3)_2\ (aq)$

E) $NaCl\ (s) + H_2O\ (l) \rightarrow Na^+\ (aq) + Cl^-\ (aq)$

Answer: A

8. What is the oxidation state of "P" in PO_3^{3-} ?

A) +6
B) -3
C) 0
D) +3
E) +2

Answer: D

9. Which of the following electronic transitions of a hydrogen atom would yield the longest wavelength of light as a result of atomic emission?

A) n = 4 to n = 2
B) n = 3 to n = 4
C) n = 3 to n = 1
D) n = 1 to n = 2
E) n = 5 to n = 4

Answer: E

10. Three quantum numbers specify an orbital. Which of the following is a plausible set of quantum numbers for an atomic orbital?

	n	**l**	**m_l**
A)	3	1	-2
B)	4	4	0
C)	3	2	+3
D)	4	0	-1
E)	5	3	-3

Answer: E

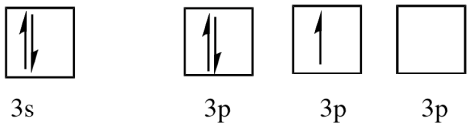
11. How many orbitals are contained in the third shell (n = 3) of a given atom?

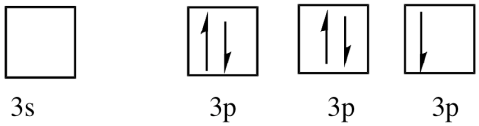
A) 18
B) 9
C) 3
D) 5
E) 7

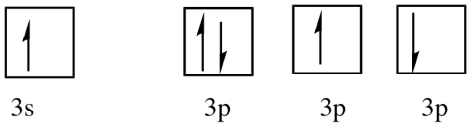
Answer: B

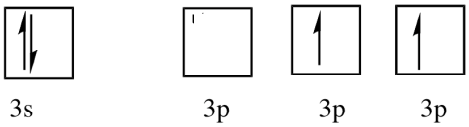
12. Choose the orbital diagram below that best represents the lowest energy state (ground state) of a phosphorus atom. Assume ground state configuration with the 1s, 2s, and 2p subshells being completely filled.

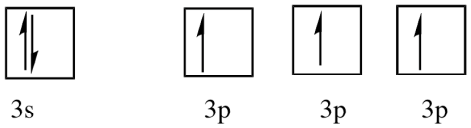
3s $3p_x$ $3p_y$ $3p_z$

A) 

B) 

C) 

D) 

E) 

Answer: E

13. Chlorine, bromine, and other halogen atoms have ___ valence electrons.

A) 6
B) 4
C) 5
D) 7
E) 2

Answer: D

14. Place the following in order of increasing ionic radius:

Br^- Na^+ Rb^+

Smallest to Largest

A) $Rb^+ < Br^- < Na^+$
B) $Br^- < Na^+ < Rb^+$
C) $Na^+ < Rb^+ < Br^-$
D) $Br^- < Rb^+ < Na^+$
E) $Rb^+ < Na^+ < Br^-$

Answer: C

15. Which of the following processes is the first ionization of oxygen?

A) $O\ (g) \rightarrow O^+\ (g) + e^-$
B) $O^+\ (g) + e^- \rightarrow O\ (g)$
C) $O_2\ (g) + 2e^- \rightarrow 2\ O^-\ (g)$
D) $O_2\ (g) \rightarrow 2\ O^+\ (g) + 2e^-$
E) $O^-\ (g) + e^- \rightarrow O^{2-}\ (g)$

Answer: A

16. Using periodic trends, place the following bonds in order of <u>increasing</u> ionic character.

Si – P Si – Cl Si – S

Smallest to Greatest

A) Si-P < Si-S < Si-Cl
B) Si-Cl < Si-S < Si-P
C) Si-Cl < Si-P < Si-S
D) Si-S < Si-Cl < Si-P
E) Si-P < Si-Cl < Si-S

Answer: A

17. Which of the following demonstrate resonance.

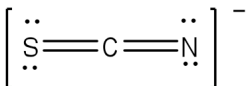
I. OCl^-
II. NO_3^-
III. BF_3

IV. C_2H_2

A) I and II
B) II only
C) II and III
D) III and IV
E) I, II, III, and IV

Answer: B

18. What is the formal charge on the nitrogen atom for the structure below?



A) -2
B) -1
C) 0
D) +1
E) +2

Answer: B

19. Which of the following statements about water is false?
A) It has a high boiling point
B) It density increases when it freezes
C) It has a high surface tension
D) It dissolves many salts and polar molecules.
E) It has high heat capacity

Answer: B

20. Given the following values for periodic trends, answer the following question.

	IE (kJ/mol)	EA (kJ/mol)	EN (Pauling Units)
Atom x	1750	-350	4.0
Atom y	1400	-140	3.5

Atom z	500	-55	1.0

KEY: IE = Ionization Energy

EA = Electron Affinity

EN = Electronegativity

Which combination or combinations listed below will yield an IONIC bond?

I.	Atom x and Atom y	III.	Atom y and Atom z
II.	Atom x and Atom z	IV.	Atom x and Atom x

A) I

B) I and II

C) II and III

D) IV

E) I and IV

Answer: C

21. Identify your exam version—look at the bottom of this page. (0 points but an answer is required)

A) Version A
B) Version B
C) Version C
D) Version D