

Name _____

Chemistry 11100

Section _____

EXAM III

Total Points = 150

TA _____

Thursday, 8:00 PM

November 15, 2012

Directions:

1. Each student is responsible for following directions. Read this page carefully.
2. Write your name and other requested information on this page and on the separate answer sheet.
3. CODE your name on the answer sheet using an ordinary (#2) pencil.
4. CODE your correct *10-digit* identification number (PUID) on the answer sheet. THIS IS VERY IMPORTANT!
5. CODE your section number on the answer sheet. Please use all four digits, 0034, 0035, 0036, etc. This is also very important!
6. CODE the test number shown in the upper right-hand corner on the answer sheet in the block labeled "Test/Quiz Number". This is Test 66.
7. Put all calculations on the examination pages. DO NOT PUT ANY EXTRA MARKS ON THE COMPUTER ANSWER SHEET!
8. This exam consists of 24 multiple-choice questions worth 6.25 points each. Choose the one best or correct answer for each question and write it both on your exam paper and on the computer answer sheet. The computer answer sheet is the only one that will be graded!
9. This exam consists of 7 pages plus a page of Useful Information, Solubility Rules, a Periodic Table and a sheet of scratch paper. Please check to be sure that you have them all!

END OF EXAM

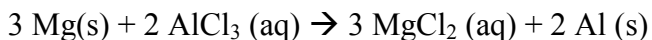
- 1) Please make sure that you have entered 24 answers on your scan sheet.
- 2) Make sure that you have entered your name, ID number, and lab section number (4 digits).
- 3) You MUST turn the scan sheet in to your TA before leaving the exam!

KEEP YOUR ANSWERS AND WORK COVERED TO PROTECT
THE INTEGRITY OF YOUR WORK!!

_____ 1. Bohr's model for the atom explained

- (a) why light can be modeled as a wave and a particle (photon).
- (b) why electrons never emit energy.
- (c) the existence of isotopes.
- (d) the line spectrum for hydrogen.

_____ 2. Which element is **reduced** in the following oxidation-reduction reaction?

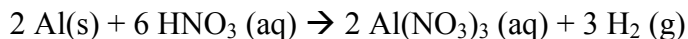


- (a) Mg
- (b) Al
- (c) Cl
- (d) H₂O

_____ 3. For each of the following pairs of ions, indicate which pair would form a precipitate when solutions containing these ions are mixed.

- (a) Ba²⁺ and I⁻
- (b) Ag⁺ and NO₃³⁻
- (c) Cu²⁺ and PO₄³⁻
- (d) K⁺ and SO₄²⁻
- (e) Na⁺ and OH⁻

_____ 4. Aluminum reacts with nitric acid according to the following balanced chemical equation. How many moles of hydrogen gas can be produced from 12 moles of aluminum?
(Al = 26.98 g/mole; HNO₃ = 63.09 g/mole; H₂ = 2.016 g/mol)



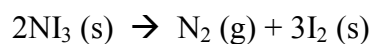
- (a) 12
- (b) 24
- (c) 36
- (d) 18
- (e) 5

- _____ 5. Calcium carbonate, CaCO_3 , is often used in commercial antacids. It acts to reduce the acidity in the stomach by neutralizing stomach acid, which is mostly HCl, by the following reaction:



What mass of CaCO_3 is needed to neutralize 0.020 mol HCl? ($\text{CaCO}_3 = 100.09 \text{ g/mole}$; $\text{HCl} = 36.461 \text{ g/mol}$)

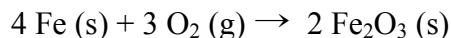
- (a) $1.0 \times 10^2 \text{ g}$
 (b) 2.0 g
 (c) 1.0 g
 (d) 0.010 g
- _____ 6. Which color of visible light is most energetic?
 (a) Red
 (b) Yellow
 (c) Green
 (d) Blue
 (e) Violet
- _____ 7. Nitrogen triiodide decomposes to give nitrogen and iodine according to the following balanced equation.



How many grams of reactant, NI_3 , would be required to produce 6.25 g iodine?
 ($\text{NI}_3 = 394.71 \text{ g/mol}$; $\text{N}_2 = 28.02 \text{ g/mole}$; $\text{I}_2 = 253.8 \text{ g/mole}$)

- (a) 6.48 g
 (b) 9.72 g
 (c) 13.0 g
 (d) 58.7 g

_____ 8. Iron and oxygen react to form iron(III) oxide



What is the limiting reactant in a mixture of 6.0 moles of Fe and 6.0 moles of O₂?

- (a) O₂
- (b) Fe
- (c) Fe₂O₃
- (d) Impossible to determine

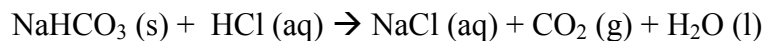
_____ 9. What is the abbreviated electron configuration for nitrogen?

- (a) [Ne] 2s² 2p³
- (b) [He] 2s² 2p³
- (c) [Ar] 2s² 2p³
- (d) [He] 2p³
- (e) [He] 2p⁵

_____ 10. Which group in the periodic table has 2 valence electrons?

- (a) Alkali metals
- (b) Alkaline earth metals
- (c) Transition metals
- (d) Halogens
- (e) Noble gases

_____ 11. Given the following balanced chemical equation, what mass of CO₂ gas is produced when 8.00 g NaHCO₃ is added to a solution that contains 4.00 g HCl? (NaHCO₃ = 64.008 g/mole; HCl = 36.461 g/mol; CO₂ = 44.01 g/mole)



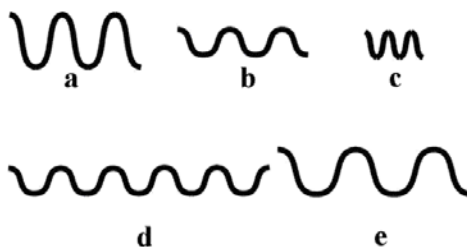
- (a) 352 g
- (b) 176 g
- (c) 10.3 g
- (d) 4.83 g

- _____ 12. A student synthesized aspirin in the laboratory. Using the amount of limiting reactant, she calculated the mass of aspirin that should form as 10.15 g. When she weighed her aspirin product on the balance, its mass was 8.95 g. What was the percent yield?
- (a) 88.2%
(b) 11.8%
(c) 8.95%
(d) 1.2%

- _____ 13. What is the energy of a photon with a wavelength of 125 nm?
- (a) 8.28×10^{-41} J
(b) 1.59×10^{-27} J
(c) 1.59×10^{-18} J
(d) 2.4×10^{15} J

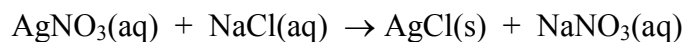
- _____ 14. Which of the waves shown below has the highest frequency?

- (a) a
(b) b
(c) c
(d) d
(e) e



- _____ 15. Methylhydrazine, $C_6H_6N_2$, is a rocket fuel that releases -1.30×10^3 kJ/mole when burned. How much energy is released when 1545 g is burned? ($C_6H_6N_2 = 106.128$ g/mole)
- (a) -0.841 kJ
(b) -89.3 kJ
(c) -126 kJ
(d) -1.89×10^4 kJ
(e) -2.00×10^6 kJ
- _____ 16. The frequency of microwave radiation in a common microwave oven that you might have in your kitchen is 2.46×10^9 s⁻¹. What is the wavelength of this radiation?
- (a) 2.46×10^9 m
(b) 3.00×10^8 m
(c) 1.22×10^{-1} m
(d) 7.38×10^{17} m
(e) 1.20×10^{17} m

- _____ 17. What is the abbreviated electron configuration for the chloride ion?
- [Ne]
 - [Ar]
 - [Kr]
 - [Ne] $3s^2 3p^5$
 - [Ne] $3p^7$
- _____ 18. Which will be the same for the ions K^+ , Ca^{2+} , S^{2-} , Cl^- ?
- Number of protons
 - Electron configuration
 - Number of electrons
 - Atomic mass
 - B and C
- _____ 19. Dissolving ammonium nitrate in water is an endothermic process. Which of the following statements is correct about the temperature of the resulting ammonium nitrate solution?
- The temperature of the resulting solution will be lower than the initial temperature of the pure water.
 - The temperature of the resulting solution will be higher than the initial temperature of the pure water.
 - The temperature of the resulting solution will be the same as the initial temperature of the pure water.
 - The temperature of the water is not dependent on what is dissolved in it.
 - There is not enough information about this process to determine how the temperature will change.
- _____ 20. Mixing a solution of silver nitrate with a solution of sodium chloride results in the formation of solid, white silver chloride, as shown in the equation below. What is the net ionic equation for this reaction?

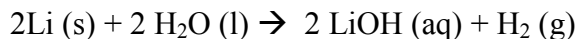


- $AgNO_3(aq) + NaCl(aq) \rightarrow AgCl(s) + NaNO_3(aq)$
- $Ag^+(aq) + NO_3^-(aq) + Na^+(aq) + Cl^-(aq) \rightarrow Ag^+(s) + Cl^-(s) + Na^+(aq) + NO_3^-(aq)$
- $Ag^+(aq) + NO_3^-(aq) + Na^+(aq) + Cl^-(aq) \rightarrow AgCl(s) + Na^+(aq) + NO_3^-(aq)$
- $Na^+(aq) + NO_3^-(aq) \rightarrow NaNO_3(aq)$
- $Ag^+(aq) + Cl^-(aq) \rightarrow AgCl(s)$

- _____ 21. How many valence electrons are in phosphorus?
- (a) 3
 - (b) 5
 - (c) 10
 - (d) 12
 - (e) 15
- _____ 22. The modern model of the atom and Bohr's model of the atom are similar in what way?
- (a) The energies of the electrons are quantized and thus can only have certain energies.
 - (b) They both include circular orbits of electrons with a specific radius.
 - (c) Both indicate that lowest principal energy level an electron can occupy is $n = 0$.
 - (d) Both account for the existence of isotopes.
- _____ 23. Which of the following would have to gain two electrons in order to achieve a noble gas electron configuration _____?

O Sr Na Se Br

- (a) Br
 - (b) Sr
 - (c) Na
 - (d) O, Se
 - (e) Sr, O, Se
- _____ 24. The reaction of lithium metal and water to form lithium hydroxide and hydrogen gas is represented by the following balanced chemical equation.



When Li is mixed with excess water, 0.30 mol of H_2 gas is isolated in the laboratory. If this reaction occurs to give an 85% yield of H_2 , now many moles of Li reacted?

- (a) Insufficient information to answer the question
- (b) 0.18 moles Li
- (c) 0.35 moles Li
- (d) 0.71 moles of Li

Useful Information

$$\% \text{ Error} = \frac{|\text{Actual} - \text{Theoretical}|}{\text{Theoretical}} \times 100\%$$

$$\% \text{ Recovery} = \frac{\text{mass of material recovered}}{\text{mass of material started with}} \times 100\%$$

$$\% \text{ Yield} = \frac{\text{Actual}}{\text{Theoretical}} \times 100$$

$$T_K = T_{o_C} + 273.15 \quad T_{o_F} = 1.8(T_{o_C}) + 32$$

$$M_i V_i = M_f V_f$$

$$1 \text{ ppm} = 1 \text{ g} / 1 \times 10^6 \text{ g} = 1 \text{ mg} / 1 \text{ L}$$

$$\text{Avogadro's number: } 1 \text{ mole} = 6.022 \times 10^{23} \text{ formula units}$$

$$4.184 \text{ J} = 1 \text{ cal}$$

$$1000 \text{ cal} = 1 \text{ Cal}$$

$$q = m \times C \times \Delta T$$

$$c = \lambda \nu \quad E = h\nu = \frac{hc}{\lambda}$$

$$c = 3 \times 10^8 \text{ m/s}$$

$$h = 6.626 \times 10^{-34} \text{ J s}$$

Solubility rules from Table 5.4: Rules used to predict the solubility of ionic compounds.

Ions	Rule
Na^+ , K^+ , NH_4^+ (and all other alkali metal ions)	Most compounds of alkali metal and ammonium ions are soluble.
NO_3^- , CH_3CO_2^-	All nitrates and acetates are soluble.
SO_4^{2-}	Most sulfates are soluble. Exceptions are BaSO_4 , SrSO_4 , PbSO_4 , CaSO_4 , Hg_2SO_4 , and Ag_2SO_4 .
Cl^- , Br^- , I^-	Most chlorides, bromides, and iodides are soluble. Exceptions are AgX , Hg_2X_2 , PbX_2 , and HgI_2 ($X = \text{Cl}, \text{Br}, \text{or I}$).
Ag^+	Silver compounds except AgNO_3 and AgClO_4 are insoluble. AgCH_3CO_2 is slightly soluble.
O^{2-} , OH^-	Oxides and hydroxides are insoluble. Exceptions are alkali metal hydroxides, Ba(OH)_2 , Sr(OH)_2 , and Ca(OH)_2 (somewhat soluble)
S^{2-}	Sulfides are insoluble. Exceptions are compounds of Na^+ , K^+ , NH_4^+ , Mg^{2+} , Ca^{2+} , Al^{3+} , and Ni^{2+}
CO_3^{2-} , PO_4^{3-} , SO_3^{2-}	Most carbonates, phosphates, and sulfites are insoluble. Exceptions are compounds of Na^+ , K^+ , and NH_4^+

Key

- 1.) D
- 2.) B
- 3.) C
- 4.) D
- 5.) C
- 6.) E
- 7.) A
- 8.) B
- 9.) B
- 10.) B
- 11.) D
- 12.) A
- 13.) C
- 14.) C
- 15.) D
- 16.) C
- 17.) B
- 18.) E
- 19.) A
- 20.) E
- 21.) B
- 22.) A
- 23.) D
- 24.) D