

Chemistry 101 Final Exam Guide (DO NOT LIMIT YOUR REVIEW TO THESE QUESTIONS!)

The 230 pt test is on Monday, March 15, 2010 at 8-10:30 am. The final exam is cumulative and will assume you have reviewed chapters 1-7 with greater emphasis placed on material after chapter 5. (for chapters 1-5, look at previous midterm exam review guides)

Chapter 6: Thermochemistry

- Be able to state and to apply the first law of thermodynamics.
- Calculate enthalpy & energy using constant pressure & constant volume calorimetry.
- Do calculations using Hess' Law and ΔH_f° 's on problems resembling the questions at the end of the experiments on calorimetry (see lab manual for these questions). KNOW these VERY WELL.
- calculate heat changes for a substance undergoing heating both with and without phase.

Chapt 7. Quantum Theory:

- Do calculations involving photon energy, frequency and wavelength for electromagnetic radiation.
- Do calculations involving the energy levels of the hydrogen atom. What is the balmer series and how is it different from the Lyman and Paschen series?
- Know the rules for allowable quantum numbers of the electron's wave function.
- Be able to write the electron configuration of elements and their ions.(also using core notation).
- Be able to explain the periodic trends of: atomic radii, ionic radii, electron affinity and ionization potential

Below are some practice review question.

1) An acidic compound composed of 2.1%H, 29.8% N and 68.1% O has a molecular mass of 47 g/mol. a) What is the empirical formula of the compound? b) What is the name of the compound? **HNO₂ Nitrous acid**

2) Explain the periodic trends: atomic radii, ionization energy, electron affinity. Explain "anomalies" in the ionization energy trend involving 2nd row elements.

3) a) Using "box" notation, draw the occupied orbitals of neutral vanadium. How many unpaired electrons is in V? b) Explain why nitrogen has a higher first ionization energy than oxygen. Explain why it has a higher first ionization energy than carbon.

4) Periodic trends: Arrange following in order of a) increasing size: Ar, S²⁻, K²⁺, b) increasing ionization energy: F, S, Al, He c) increasing electronegativity: Se, Ne, O

5) Consider the following molecules and fill in the information requested below each molecular formula:(note that some may violate the octet rule) H₂O, XeF₄, PCl₅, SO₄²⁻

6) Consider the reaction of oxalic acid (H₂C₂O₄) with nitrous acid (HNO₂) to form carbon dioxide gas, nitrogen monoxide, and water. a) write the balanced equation. b) what type of reactions is this?

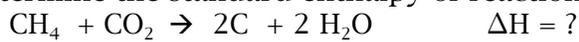
7) Thermochemistry:

a) Suppose you react 50.0mls of 2.0 M HCl with 50.0mLs of 1.0M NaOH in a calorimeter containing 100. mLs of water at 20.0°C and the temperature rises to 25.0°C, what is the ΔH_{rxn}° (in kJ/mol) for the neutralization reaction:

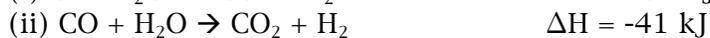


$8.36 \times 10^4 \text{ J/mol}$

b) Determine the standard enthalpy of reaction for the following equation



from the following given standard enthalpies of reaction:



-15 kJ/mole

8) Describe or explain scientific contributions made by Dalton, Mendeleev, Planck, Einstein, Thomson, Bohr, Schrodinger, de Broglie & Heisenberg in our modern understanding of the atom. What is the wavelength of a proton ($1.67 \times 10^{-27} \text{ kg}$) travelling at $1.2 \times 10^5 \text{ m/s}$?

$3.3 \times 10^{-12} \text{ m}$

9) The energy required to convert O_2 molecules to O atoms is 496 kJ/mol . If electronic radiation of 180 nm is absorbed by 1 mole of O_2 molecules, how much kinetic energy will be present in the O atoms (in kJ/mole and J/molecule)? What wavelength photons are required to "split" O_2 molecules to O atoms?

169 kJ/mol or $2.81 \times 10^{-19} \text{ J/molec.}$; 241 nm

10) a) Name the following when pure and when in an aqueous solution: i) HClO_3 , ii) HClO_2 , & iii) H_2S

b) Name the compounds: K_3PO_4 ; BaCl_2 ; Give the formulas for aluminum dichromate, magnesium phosphate

11) Give the number of electrons, protons and neutrons in: ferrous ion; mercuric ion or $^{195}_{78}\text{Pt}^{4+}$. Write down the corresponding electron configurations for these ions.

12). The density of a hydrochloric acid (HCl) solution is 1.19 g/mL . If its concentration is 37% (mass percent). How many mLs of the solution would contain 3.01×10^{22} molecules of hydrogen chloride? 4.14 mL

13) Consider the reaction of iron(II) chloride with potassium permanganate in an acidic solution. The balanced net ionic equation is given below: $5\text{Fe}^{2+}(\text{aq}) + \text{MnO}_4^-(\text{aq}) + 8\text{H}^+(\text{aq}) \rightarrow 5\text{Fe}^{3+}(\text{aq}) + \text{Mn}^{2+}(\text{aq}) + 4\text{H}_2\text{O}$

a) Suppose you titrate 35.0 mLs of iron(II) chloride solution with 0.0500 M potassium permanganate, and the equivalence point is reached at 24.0 mLs , what is the original concentration of the iron(II) chloride solution?

b) What is the concentration of the iron(II) chloride in the solution 10.0 mLs before the equivalence point? 0.17 M ; 0.050 M

14) Be able to do very well and very clearly all the questions at the end of experiment #20.