

**City College, Chemistry Department
Chemistry 10301, sections T and T2, Prof. T. Lazaridis
Final exam, Dec 22, 2005**

Name (last name first): _____

I.D. Number: _____

Workshop leader: _____

Note: There are 17 questions in this exam. Fill in your answer in the blank space provided immediately following each question. 1/2 point will be subtracted every time you report a numerical result with an incorrect number of significant figures.

A Data Sheet with useful information is at the end.

1. (4) Write the names of the elements below next to their atomic symbols:

Ti

Mg

Al

Kr

2. (4) Write the molecular formula next to the names of the following compounds:

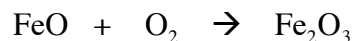
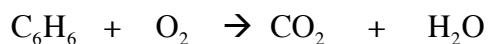
Magnesium Sulfate

Sodium Carbonate

Barium Hydroxide

Potassium Nitrate

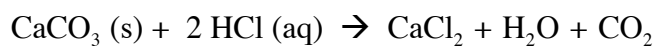
3. (8) Balance the following chemical equations:



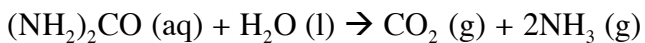
4. (8) How many grams of phosphoric acid will form when 30.0 g of P_4O_{10} is mixed with 75.0 g of water? The reaction is



5. (5) It was found that 35.45 mL of a HCl solution was needed to dissolve 1.110 g of pure $CaCO_3$. What was the molarity of the HCl solution? The reaction is:



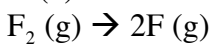
6. The enzyme-catalyzed reaction of urea with water is represented by the equation:



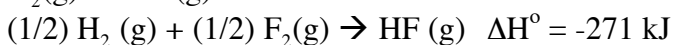
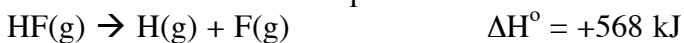
a) (3) How many mL of NH_3 , measured at 37°C and 755 torr, will be produced when 5.00 g of urea reacts with excess water?

b) (3) What will be the total volume, in mL, of gaseous products produced during the reaction of part (a)?

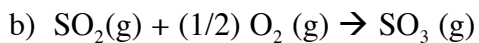
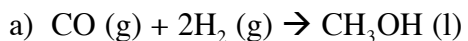
7. (7) Use Hess's law to calculate the standard enthalpy for the reaction



from the thermochemical equations:



8. (6) Use enthalpy of formation data to compute standard enthalpy changes for the following reactions at 25 °C. State whether the reactions are endothermic or exothermic.



9. (3) Calculate and compare the de Broglie wavelengths of an electron, a proton, and a 0.40 Kg ball each traveling at 50 m/sec.

10. (5) What is the wavelength of a photon emitted when a hydrogen atom falls from the $n=3$ state to the ground state? What type of electromagnetic radiation does this correspond to?

11. (4) Write an abbreviated (noble gas core) electron configuration for the following:

Sr

I

F⁻

Zn²⁺

12. (2) Rank the atoms O, B, In in terms of electronegativity.

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13. (4) How many unpaired electrons does each of the following atoms have?

N

Zn

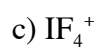
Fe

Ag

14. (a) (5) Write down the best Lewis structure for phosphorus oxychloride (POCl₃) (i.e., the one with the lowest formal charges).

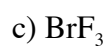
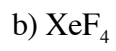
(b) (3) What is the molecular geometry of this compound?

15. (12) Use Lewis structures and the VSEPR method to predict the molecular geometry and the bond angles of the following ions:

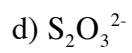
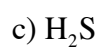


16. (9) Draw Lewis structures and give the molecular geometry and type of hybridization around each central atom:





17. (5) Give the oxidation number of S in each of the following molecules and ions:



DATA SHEET

Speed of light : 2.9979×10^8 m/s

Planck's constant : 6.626×10^{-34} Js

$E_n = -2.179 \times 10^{-18}$ J/n²

Mass of a proton: 1.67262×10^{-24} g

Mass of an electron: 9.10939×10^{-28} g

$R = 0.082058$ L atm / (mol K) = 62.364 L torr / (mol K) = 8.3145 J / (mol K)

Substance ΔH_f° , kJ/mol

CO(g) -110.5

CO₂ (g) -393.5

CH₄ (g) -74.81

CH₃OH (l) -238.7

SO₂ (g) -296.8

SO₃ (g) -395.7