

City College, Chemistry Department
Chemistry 10301, sections T and T2, Prof. T. Lazaridis
Final exam, Dec 21, 2006

Name (last name first): _____

I.D. Number: _____

Workshop leader: _____

Note: There are 18 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:

Ga

Co

Sn

Na

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

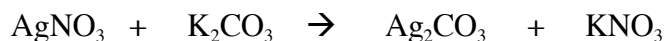
Ammonium Bromide

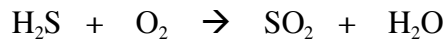
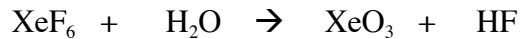
Potassium Chlorate

Magnesium Sulfite

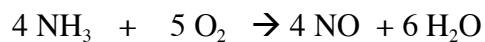
Sodium Phosphate

3. (8) Balance the following chemical equations:





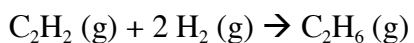
4. (8) How many grams of oxygen are required to burn 75.0 g of ammonia? The reaction is



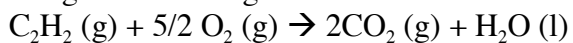
5. (5) A 2.122 g sample of an unknown cobalt compound is dissolved in 50.0 mL of water. The concentration of Co^{2+} (aq) is found to be 0.071 M. Calculate the percentage by mass of cobalt in the unknown compound.

6. (6) How many mL of oxygen, measured at 0 °C and 1.00 atm, are required for the complete combustion of 5.00 g of liquid methanol (CH₃OH)?

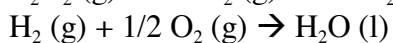
7. (7) Use Hess's law to calculate the standard enthalpy for the reaction



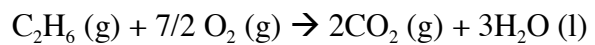
using the following combustion data:



$$\Delta H^\circ = -1300 \text{ kJ}$$

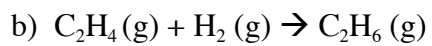


$$\Delta H^\circ = -286 \text{ kJ}$$



$$\Delta H^\circ = -1560 \text{ kJ}$$

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. (4) Which of the following sets of quantum numbers are allowed, and which are not? State what is wrong with each set that is not allowed.

a) $n=0$ $l=0$ $m_l=0$

b) $n=1$ $l=0$ $m_l=0$

a) $n=6$ $l=4$ $m_l=-5$

a) $n=6$ $l=5$ $m_l=-4$

10. (4) A hydrogen electron drops from the $n=4$ level to the $n=1$ level. What is the wavelength of the emitted photon?

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

C

Cl

Te

Ge^{2+}

12. (2) Place the atoms K, N, As in order of increasing atomic radius.

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13. (4) Draw orbital diagrams for the partially filled subshells of the atoms with $Z=17$ and $Z=39$.

14. (9) Draw Lewis structures for the following molecules and give the type of hybridization around each central atom.

a) NF_3

(b) CCl_4

(c) HCN

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

a) ClO_2^-

b) ICl_4^-

16. (5) Use MO theory to determine the bond order for N_2^+ . Is N_2^+ more or less stable than N_2 ?

17. (5) Give the oxidation number of each element in the following compounds or ions:



18. (5) The specific heat of copper is $0.385 \text{ J}/(\text{g } ^\circ\text{C})$ and that of gold $0.129 \text{ J}/(\text{g } ^\circ\text{C})$. A 1.00-g sample of either metal adsorbs 10.0 J of heat. If both metals were originally at $25.0 \text{ }^\circ\text{C}$, what will be their final temperature?

DATA SHEET

Speed of light : 2.9979×10^8 m/s

Planck's constant : 6.626×10^{-34} Js

$E_n = -2.179 \times 10^{-18} \text{ J/n}^2$

Mass of a proton: 1.67262×10^{-24} g

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

$R = 0.082058 \text{ L atm / (mol K)} = 62.364 \text{ L torr / (mol K)} = 8.3145 \text{ J / (mol K)}$

Substance	ΔH_f° , kJ/mol
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NH_3 (g)	-46.11
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NH_4Cl (s)	-314.4
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HCl (g)	-92.31
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C_2H_4 (g)	52.26
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C_2H_6 (g)	-84.68
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