1.) Metallic gold crystallizes in the face-centered cubic lattice with an edge length of 407 pm. From this information, estimate the density of gold in g/cm^3.

2.) Starting with a 70.8 g sample of benzene (C_6H_6, 78.11 g/mol) at 48.6°C and 1.00 atm of pressure, how much energy should be removed in order to lower its temperature to -68.5°C, at constant pressure?

$\Delta_{vap}H°$ = 33.9 kJ/mol $C_{P,liq}$ = 1.73 J/g°C $C_{P,s}$ = 1.51 J/g°C Normal $T_{melting}$ = 5.5°C $\Delta_{fus}H°$ = 9.8 kJ/mol $C_{P,gas}$ = 1.06 J/g°C ρ = 0.879 g/cm^3 Normal $T_{boiling}$ = 80.1°C

3.) Place the following substances in order of *increasing* normal boiling point: SF_6, SiH_4, SF_4

(1) $SF_6 < SF_4 < SiH_4$ **(2) $SF_6 < SiH_4 < SF_4$** **(3) $SiH_4 < SF_6 < SF_4$**

(4) $SiH_4 < SF_4 < SF_6$ **(5) $SF_4 < SF_6 < SiH_4$**

4.) Identify the Period 2 element which has the following successive ionization energies, in kJ/mol

IE_1 = 520; **IE_2 = 7298;** **IE_3 = 11,815;** **IE_4 = 16,000;**

IE_5 = 22,831; **IE_6 = 27,277;** **IE_7 =32,987;** **IE_8 = 38,235**

(1) Beryllium (2) Lithium (3) Nitrogen (4) Oxygen (5) Neon

5.) When the chlorite ion is oxidized to form the chlorate ion, which of the following occurs?

(1) The Cl-O bond order changes from 1.50 to 1.33
(2) The formal charge on the chlorine atom changes from 0 to +1
(3) The oxidation state of the chlorine atom changes from +4 to +6 (4) The hybridization of the chlorine atom remains as sp^3
(5) The geometry of the anion changes from linear to trigonal planar

6.) How many sigma and pi bonds, respectively, are in $NH_2CH_2CHCHCOOH$?

(1) 13, 2 (2) 12, 1 (3) 11, 4 (4) 10, 2 (5) 9, 1

7.) In an experiment, 25.0 ml of a gas with a pressure of 1.00 atm is contained in a balloon at 25.00°C. The balloon's temperature is adjusted until the pressure is 0.75 atm at a volume of 31.1 ml. What is the final temperature of the gas under the new conditions?

8.) How many resonance structures does the oxalate dianion $[O_2CCO2]^{2-}$ have?

9.) Compare the ionic sizes of Cl^- and K^+. (Z_{eff} = effective nuclear charge)
(1) K^+ will have a larger ionic size because its outer electrons experience a higher Z_{eff}

(2) K^+ will have a larger ionic size because its outer electrons experience a smaller Z_{eff}

(3) K^+ will have a smaller ionic size because its outer electrons experience a higher Z_{eff}

(4) K^+ will have a smaller ionic size because its outer electrons experience a smaller Z_{eff}

(5) K^+ will have the same ionic size because it and Cl^- experience the same Z_{eff}

10.) A mixture of Xe(g) and O_2(g), formed by the complete decomposition of XeO_4(g), is collected over water at 34°C at a total pressure of 760 mmHg. If the vapor pressure of water is 40 mmHg at 34°C, what is the partial pressure of O_2?

11.) According to molecular orbital theory, what are the bond order and the number of unpaired electrons in CN, respectively? The valence molecular orbital sequence for CN is:

$\sigma_{2s}, \sigma^*_{2s}, \pi_{2px} = \pi_{2py}, \sigma_{2p}, \pi^*_{2px} = \pi^*_{2py}, \sigma^*_{2p}$

12.) When 50.0 ml of 0.200 M $AgNO_3$ and 50.0 ml of 0.100 M $CaCl_2$, both at 25.0°C, are reacted in a coffee-cup calorimeter, the temperature of the reacting mixture increases to 26.0°C. Calculate ΔH in kJ/mol of AgCl produced. Assume the density of the solution is 1.05 g/mol and the specific heat capacity of the solution is 4.20 J/g°C.

13.) Rate data have been determined at a particular temperature for the reaction 2 NO(g) + Cl_2(g) → 2 NOCl(g). What is the numerical value for the rate constant?

14.) A sample containing C, H, and O produced 1.5 grams of CO_2 and 0.41 grams of H_2O during combustion analysis. If the this molecule has a molar mass between 170 and 180 g/mol, what is its molecular formula?

15.) C_4H_8 decomposes into 2 molecules of C_2H_4 in an overall first-order reaction with a rate constant of 87 s^{-1}. What is the concentration of C_4H_8 after 10s if the initial concentration is 2M. How long will it take for 70% of the 2M C_4H_8 to decompose?

Experiment 1		
2		
3		
[NO] (M)	**0.0300**	**0.0150**
[Cl_2] (M)	**0.0100**	**0.0100**
Rate (M/s)	**3.4×10^{-4}**	**8.5×10^{-5}**

0.0150

0.0400

3.4×10^{-4}