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.) Which of the following will decrease the equilibrium concentration of an inert gas (such as N_2) in a beaker of water assuming that equilibrium is re-achieved?

I. Decreasing the temperature of the water

II. Increasing the volume of the water

III. Decreasing the pressure of the gas above the liquid

(1) I only (2) II only (III) III only (IV) I and III (V) I, II, and III

4.) 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) $SF_4 < SF_6 < SiH_4$

5.) 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

6.) 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

7.) 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

8.) 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?

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

10.) 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}

11.) A sample of a hydrocarbon produced 3.14 grams of CO_2 and 1.28 grams of H_2O during combustion analysis. If the hydrocarbon has a molar mass between 50 and 60 g/mol, what is its molecular formula?

12.) 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?

13.) 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:

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

14.) 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.

15.) Rate data have been determined at a particular temperature for the reaction

$2\ NO(g) + Cl_2(g) \rightarrow 2\ NOCl(g)$. What is the numerical value for the rate constant?

Experiment	[NO] (M)	[Cl_2] (M)	Rate (M/s)
1	0.0300	0.0100	3.4×10^{-4}
2	0.0150	0.0100	8.5×10^{-5}
3	0.0150	0.0400	3.4×10^{-4}