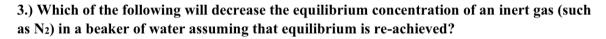
1.) Palladium crystallizes in the face-centered cubic lattice with a density of 12.0 g/cm³. From this information, estimate the edge length of the cubic lattice in pm.

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 H_{vap}{}^{\circ} = 33.9 \text{ kJ/mol} \qquad C_{P,liq} = 1.73 \text{ J/g}{}^{\circ}C \qquad C_{P,s} = 1.51 \text{ J/g}{}^{\circ}C \qquad \text{Normal $T_{melting} = 5.5$}{}^{\circ}C$

 $\Delta H_{fus}{}^{\circ} = 9.8 \text{ kJ/mol} \qquad C_{P,gas} = 1.06 \text{ J/g}{}^{\circ}C \qquad \rho = 0.879 \text{ g/cm}^{3} \qquad \text{Normal $T_{boiling} = 80.1}{}^{\circ}C$



- 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) $SiH_4 < SF_6 < SF_4$

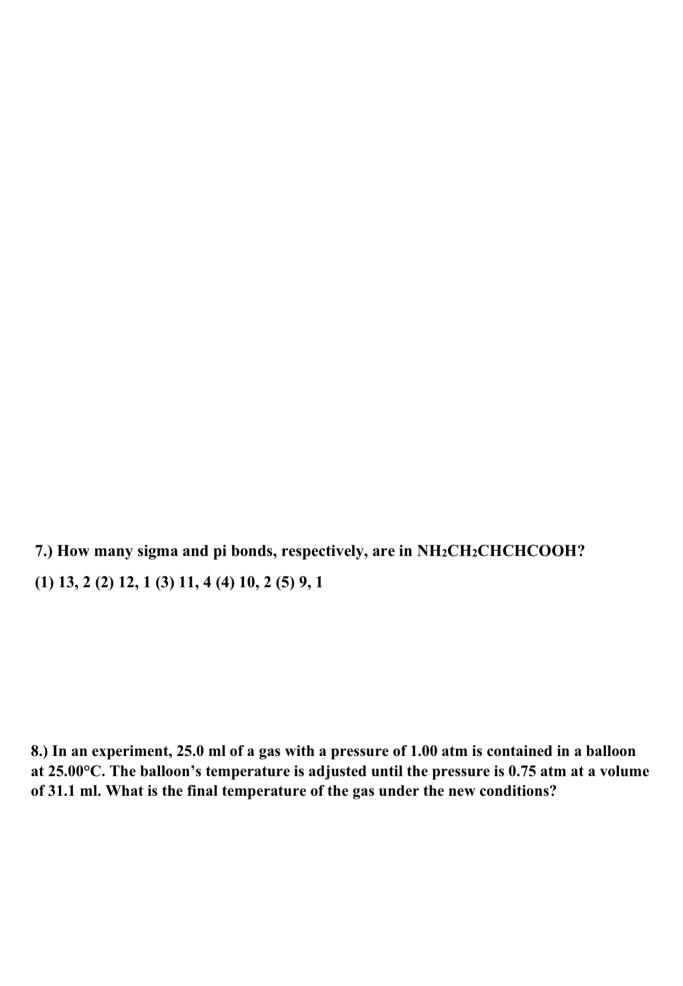
(4) $SiH_4 < SF_4 < SF_6$ (5) $SF_4 < SF_6 < SiH_4$

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

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

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

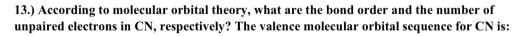
- (1) Beryllium (2) Lithium (3) Nitrogen (4) Oxygen (5) Neon
- 6.) When the chlorite ion is oxidized to form the chlorate ion, which of the following occurs?
- (1) The Cl-O bond order changes from 1.50 to 1.33
- (2) The formal charge on the chlorine atom changes from 0 to +1
- (3) The oxidation state of the chlorine atom changes from +4 to +6
- (4) The hybridization of the chlorine atom remains as sp3
- (5) The geometry of the anion changes from linear to trigonal planar



9.) How many resonance structures does the oxalate dianion $[O_2CCO_2]^{2-}$ have?

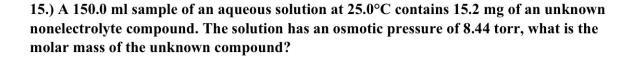
- 10.) Compare the ionic sizes of Cl- and K+. (Zeff = effective nuclear charge)
- (1) K+ will have a larger ionic size because its outer electrons experience a higher Zeff
- (2) K+ will have a larger ionic size because its outer electrons experience a smaller Zeff
- (3) K+ will have a smaller ionic size because its outer electrons experience a higher Zeff
- (4) K+ will have a smaller ionic size because its outer electrons experience a smaller Zeff
- (5) K+ will have the same ionic size because it and Cl- experience the same Zeff





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

14.) When 50.0 ml of 0.200 M AgNO₃ and 50.0 ml of 0.100 M CaCl₂, 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/ml and the specific heat capacity of the solution is 4.20 J/g°C.



16.) Benzene (C_6H_6 , 78.11 g/mol) is a liquid at room temperature with a normal boiling point of 80°C, and its molal boiling point elevation constant K_b is 2.65 °C kg/mol. Anthracene ($C_{14}H_{10}$, 178.23 g/mol) is a solid at room temperature but is quite soluble in liquid benzene. Predict the boiling point of a solution that is 25%-by-mass anthracene dissolved in benzene.