ALL THE FORMULAS YOU NEED IN CHEM 151

$\pi V = nRT$

PAST EXAMINATION QUESTIONS AND ANSWERS

PAST TEST QUESTIONS AND ANSWERS

SELF EXPLANATORY

CHEM 151 AT YOUR FINGER TIP

COMPILED BY DR-SMOKE

ALL THE FORMULARS YOU NEED IN CHM 151

S/N	LAW	FORMULA

1.	**Boyles law**	**$P_1V_1 = P_2V_2$ (Temp is constant)**
2.	**Charles law**	**$\frac{V_1}{T_1} = \frac{V_2}{T_2}$ (Pressure is Constant)**
3.	**Combined Gas law**	$\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$
4.	**Avogadros law**	**V=Kn (T and P are constant)**
5.	**Ideal Gas Equation 1** **(n= number of moles)** **(P = Pressure)** **(T = Temperature)** **(V = Volume)**	**PV=nRT** **R=0.082atm.dm^3/k (When the unit of P is atm and that of V is dm^3 or Liters)** **R= 8.314J/k/mol (When the unit of P is in N/m^2 or mmHg and V in m^3)**
6.	**Ideal gas equation 2** **(Determining density and molecular weight)**	**PM_m= dRT** **(d=density and M_m=molec. wgt)**
7.	**Daltons law of partial pressure** **Note: Ideal gas equation 1 is also used in Daltons law of partial pressure to get the partial pressure of the required element**	**(a) $P_{total} = P_A + P_B + P_C$** **(b) Mole fraction =** $\frac{\text{Partial Pressure}}{\text{Total Pressure}}$ **(c) % Mole fraction = mole fraction x 100**
8.	**Grahams law of diffusion**	$\frac{R_1}{R_1} = \sqrt{\frac{M_2}{M_1}} = \sqrt{\frac{d_2}{d_1}} = \sqrt{\frac{t_1}{t_2}}$ **R= rate of diffusion** **M= Molar mass** **d= Density** **t= time for the gas to diffuse**
9.	**Compressibility Factor (Z)**	**$Z = \frac{PV}{nRT}$ for an ideal gas Z = 1** **For real gases $Z \neq 1$**

10.	**Vander Waals Equation** **Note: This equation is gotten from ideal gas equation 1** **Replacing the V with (V - nb) and P with** $(P + \frac{an^2}{V^2})$ **a and b are constants that will be given to you in the question.**	$(P + \frac{an^2}{V^2})(V - nb) = nRT$ **(Derived from PV=nRT)**
11.	**ClausiusClapeyron's Equation** **(It gives a relationship between vapor pressure and temp.)**	$\ln\left(\frac{P_1}{P_2}\right) = -\frac{\Delta H_{vap}}{R}\left[\frac{1}{T_2} - \frac{1}{T_1}\right]$ ΔH_{vap} **= Molar Heat of vaporization**
12.	**Phase Rule**	**F = C – P + 2** **F = degree of freedom** **P = Number of phases** **C = Number of components**
13.	**Henry's Law** **(It gives a relationship between Concentration/solubility and Pressure)**	**C = KP (K is constant)** **C = Concentration or Solubility** **P = Pressure of the gas above the soln** $\frac{C_1}{P_1} = \frac{C_2}{P_2}$
14.	**Nerst Distribution Law**	$\frac{\text{Concentration of X in Solvent A}}{\text{Concentration of X in Solvent B}} = K_b$ **X is the solute** K_b **is the distribution coefficient** **A is the first solvent e.g Benzene**

		B is the second solvent e.g water
15a	Roultz law (A)	$$\frac{P-P_s}{P} = \frac{n}{n+N}$$ P = Vapor pressure of the pure solvent P_s = vapor pressure of the solution n = no. of moles of solute N = no. of moles of solvent No. of moles = $\frac{\text{mass}}{\text{molar mass}}$
15b	Lowering of vapor pressure	$P - P_s$
15c	Relative Lowering of Vapor pressure	$\frac{P-P_s}{P}$
15d	Roultz law (B) (Determining molar mass from roultz law)	$$\frac{P-P_s}{P} = \frac{wM}{mW}$$ w = mass of solute A W = mass of solvent m = molar mass of solute M = molar mass of Solvent
16.	Boiling Point Elevation (For determining the molar mass of a solute)	(A) $m = \frac{1000 \times K_b \times w}{\Delta T \times W}$

		(B) $m = \dfrac{100 \times K_b \times w}{\Delta T \times W}$ **K_b = Boiling point constant** **Note: when K_b is given in per 1kg or 1000g, then you will use (A)** **When K_b is given in per 0.1kg or 100g, you will use (B)** **ΔT = Elevation of boiling point**
17.	**Freezing Point Depression** **(For determining the molar mass of a solute)**	**(A)** $m = \dfrac{1000 \times K_f \times w}{\Delta T_f \times W}$ **(B)** $m = \dfrac{100 \times K_f \times w}{\Delta T_f \times W}$ **K_f = Freezing point constant** **Note: when K_f is given in per 1kg or 1000g, then you will use (A)** **When K_f is given in per 0.1kg or 100g, you will use (B)** **ΔT_f = Depression of freezing point**
18.	**Osmotic pressure**	**$\pi V = nRT$** **π = Osmotic Pressure**
19.	**Enthalpy of a reaction**	$\Delta H_{reaction} = \sum_n \Delta H_p - \sum_m \Delta H_r$ **n = coefficients of the substance** **H_p = Enthalpies of products**

		H_r = Enthalpies of reactants
20.	**Entropy of a reaction**	$\Delta S_{reaction} = \sum_n \Delta S_p - \sum_m \Delta S_r$ **n = coefficients of the substance** **S_p = Entropies of products** **S_r = Entropies of reactants**
21a	**Gibbs free energy**	**$\Delta G = \Delta H - T\Delta S$** **$\Delta H$ = Change in Enthalpy** **ΔS = Change in Entropy** **T = Temperature**

All other Thermochemical Equations and Calculations are applied

UNIVERSITY OF ABUJA
FACULTY OF SCIENCE
DEPARTMENT OF CHEMISTRY

2016/2017 SECOND SEMESTER EXAMINATION OCTOBER 2017
CHM 151: FOUNDATION CHEMISTRY II UNIT: 3 TIME ALLOWED $2^{1/2}$ HRS

INSTRUCTIONS:
Attempt all questions
Write the correct answers ONLY
Constants: R= 0.08211atm/K.mol, R= 8.314J/K.mol
H=1, C=12, O=16, Na=23, Cl=35.5

1. Given that 6.39 moles of Cl occupy 3.66L at 38°C, Calculate the pressure of the gas for the Vander Waals equation [given a=3.25atmL^2/mol^2. b=0.0231L/mol]
2. Compressibility property of a gas is as a result of__________
3. _________ is the mathematical expression for boyles law
4. Liquid Nitrogen boils at -296°C, what is the temperature on the Kelvin scale?
5. The CompressibilityFactor Z is given by the relation _______

6. The pressure on a 25.5ml volume of a gas is increased from 695mmHg to 755mmHg while constant temperature is maintained. What is the new volume of the gas?
7. For one mole of gas, the ideal equation is__________
8. Give the mathematical expression for grahams law of diffusion__________
9. An Oxygen gas O_2 diffuses 2 times faster than an unknown gas, what is the molar mass of the unknown gas?
10. For two component system, the phase rule is___________
11. A sample of Neon gas at 30^0C and 1atm has a volume of 4.68L, what is the volume at 0^0C and 760mmHg of pressure?
12. The pressure "P" in the ideal gas equation is replaced in Vander waals equation with______

Which of the gas laws can best be identified with each of these statement below? (Q13-17)

13. The product of pressure and volume is always constant
14. Equal volume of gasses at the same temperature and pressure contains same number of molecules
15. When the volume of a gas is halved, the absolute temperature is also halved
16. The rate of diffusion of a gas is inversely proportional to the square root of its density provided temperature and pressure are kept constant.
17. At constant temperature, the concentration of a gas that dissolves in the solvent is directly proportional to the gas pressure
18. A certain liquid has a vapor pressure of 2.31mmHg at 0^0C. if the liquid has a normal boiling point of 56^0C, what is the liquid heat of vaporization in kj/mol
19. The rigid character of solid is caused by _______
20. For ideal gasses at all temperature and pressure the compressibility factor is _________
21. The change of state of matter from gas to solid is called______
22. The phase rule is applicable to _________ system
23. How many grams of O_2 are there in a 500ml gas cylinder at 42^0C when the oxygen pressure is 31.4atm?
24. Daltons law of partial pressure can be mathematically expressed as ___
25. The collision of gas molecules with the walls of the container results in___
26. A solution that obeys roultz law strictly is known as_____
27. What is the degree of freedom for a three component system when two phase are in equilibrium?
28. For the study of distribution law, the two solvent should be______
29. In the phase diagram of carbondioxide, the solid-liquid boundary line has a___
30. The molecular mass of solute (m) can be calculated by measuring the lowering of vapour pressure using the formula ____
31. The vapour pressure of a pure solvent ____________ when non-volatile solutes dissolve in it.
32. A non-ideal solution where the solvent and solute interaction is greater than the solvent interaction is said to exhibit_____
33. A system with two degree of freedom is known as _____

34. The nerst distribution law equation $\frac{C_1}{C_2} = K_D$ applies when ____
35. The Henry's law gives the relationship between________
36. At triple point, ________ phases coexist in equilibrium
37. The flat portion on aheating curve of water where the temperature is constant is called_____
38. Determine the heat released when 3 moles react for the reaction below
    $N_{2(g)} + 3H_{2(g)}$ --------------------$2NH_{2(g)}$ $\Delta H = -28.5KJ/mol$
39. A chemical reaction that absorbs heat from the surroundings is known as ________
40. Catalyst increases the rate of a reaction by ________
41. If the rate law of the reaction 2A + 3B------------ products, is first order in A and second order in B, then the rate law expression is _________
42. Using the following equation $2NO_{2(g)}$------------$2NO_{(g)} + O_{2(g)} \Delta H = 114KJ$
    Determine the enthalpy of the reaction:
    $NO_{(g)} + 1/2O_{2(g)}$--------$NO_{2(g)} \Delta H = ?$
43. If the rate law of a reaction $r = k|A||B|^2$ the overall order of the reaction will be____
44. For the elementary reaction $NO_3 + CO$-------- $NO_2 + CO_2$ the molecularity of the reaction is__________

How many phases and components are present in each of the following (Q45-47)

45. A piece of molten placed in a beaker covered with a watch glass
46. Mixture of Ar, H_2, O_2 and N_2
47. Water = water vapor

Answer true or false for Q48-62

48. Properties that depend on the size or chemical nature of particles in a solution are known as colligative properties
49. The pressure due to the process of osmosis is known as osmotic pressure
50. According to the kinetic theory of gasses, all molecular collision is inelastic
51. Real gasses nearly obey ideal gas law at low temperature and high pressure
52. At triple point, both the temperature and pressure are equal
53. Freezing point of a liquid increases on addition of non-volatile solutes
54. The particular state of aggregation of matter is determined by the temperature and pressure under which the substance exist
55. The phase rule can be expressed mathematically as $P = C - F + 2$
56. Real gas particles have volume
57. Increasing the pressure of a gas is exactly the same as increasing its concentration
58. When thermochemical equation is reversed, the sign of the heat of formation remains
59. Density of reactants is one factor that affects reaction rate
60. In exothermic reaction, final energy content of product is lower than energy content of reactants
61. The rate determining step of a reaction mechanism is the average reaction rate for all the elementary steps
62. The rate of a reaction is independent of the number of collision
63. The unit of cryoscopic constant is __
64. Calculate the solubility of carbon dioxide in water at 0^0C and a pressure of 3.00atm. the

solubility of carbon dioxide is 0.348g/L water at 0^0C and 1.00atm

65. Gases that do not obey henry's law are gases that show ____________ when dissolved in water
66. While studying the distribution law, _________ should be constant throughout
67. An unknown solvent was found to boil at 27.1^0C after adding 30.0g of NaCl (Mol.Wt = 58.5g/mol) to 500g of the solvent, its boiling point was measured to be 29.2^0C what is K_b for the solvent?
68. Solutions which shows positive or negative deviation from roultz law are called¬¬¬¬¬¬__________
69. Calculate the osmotic pressure of 5% solution of glucose (Molecular weight 180g/mol) at 36^0C
70. During Osmosis, solvent flows from a dilute solution to a concentrated solution through_____

<u>TEST QUESTIONS ON CHM 151 FOR ALL DEPARTMENTS</u>

Time Allowed: 30 mins (The 30 mins here is equivalent to 10 mins, you have to be smart and fast)

Date:14th August 2017

1. State Hess law of constant heat of summation_______________
2. Calculate the mole fraction of C_2H_5OH in a solution containing 128grams of ethanol

(C_2H_5OH) and 92grams of methanol CH_2OH___________________

3. Henry's law gives the relationship between ________________________
4. Write the rate law expression for the equation below _____________

   H_2 + I_2--------------- 2HI

5. When three phases are present in one component system, the degree of freedom is

   ____

6. According to the distribution law, ____________ should be kept constant throughout
7. The change of state of matter from gas to solid is ___________
8. Express the given statement using thermochemical equation. 890.4KJ of heat is released for every one mole of methane that is combusted at 25^0C and 1atm

   ____

9. In the study of distribution law, the two solvent should not be _______________
10. The normal boiling point of argon is 67.6K and its latent heat of vaporization is 6.28kj/mol. Calculate its boiling point at 4.8atm [R=8.314J/K.mol]
11. ________________ is the mathematical expression for roultz law
12. Determine the order of this reaction________________

    2NO + O_2------------------------------- $2NO_2$

13. The vapour pressure of a solution containing a non-volatile solute is directly proportional to ___
14. A gas has a solubility of 0.043g/L at a pressure of 2.5atm, at what pressure will the solubility be 1.2g/L
15. Colligative property of a solution depends on_____________
16. Avogadros law is mathematically expressed as ________________________
17. Calculate the pressure in 1228ml cylinder that contains 0.104kg of oxygen, O_2 at 48^0C [R=0.0821]

Answer <u>true</u> or <u>false</u>

18. When thermochemical equation is reversed, the sign of the heat of the reaction remains
19. At high pressure and low temperature, real gases deviate from ideal behavior
20. The rate determining step of a reaction mechanism is the fastest elementary step.

SOLUTIONS TO EXAM QUESTIONS

1. Number of moles (n) = 6.39, Volume (V) = 3.66L, Temperature (T) = $38^0C + 273 = 311K$, a = $3.25atmL^2/mol^2$, b = 0.0231L/mol and R = 0.0821atm/K.mol (Because volume is in liters and pressure will also be in atm)

   Using vanderwaals equation (Formula 10)

$$(P + \frac{an^2}{V^2}) (V - nb) = nRT \;=\; (P + \frac{3.25 \times 6.39^2}{3.66^2}) (3.66 - 6.39 \times 0.0231) = 6.39 \times 0.0821 \times 311$$

   (P + 9.91) (3.51) =162.96 (Open the brackets)
   3.51P + 34.78 = 162.96 (Collect like terms)
   3.51P = 162.96 – 34.78

   3.51P = 128.18 (Divide both sides by 3.51)

   3.51P/3.51 = 128.18/3.51

   P = 36.52atm

2. Pressure
3. $P_1V_1 = P_2V_2$ Temperature is constant
4. -296 + 273 = -23K
5. Compressibility factor (Z) = $\frac{PV}{nRT}$
6. $P_1V_1 = P_2V_2$ (Temp is constant)

   P_1= 695mmHg, P_2 = 755mmHg, V_1= 25.5ml, V_2=?

   695 x 25.5 = 755 x V_2
   36487.5 = $755V_2$ (Divide both sides by 755)
   36487.5/755 = $755V_2/755$
   V_2 = 23.47ml
7. Ideal gas equation is given as PV = nRT, but for one mole of gas i.e (n=1)

   Then the ideal gas equation will be PV = 1 x RT

   Therefore, the equation will be PV=RT

8. $\frac{R_1}{R_1} = \sqrt{\frac{M_2}{M_1}} = \sqrt{\frac{d_2}{d_1}} = \sqrt{\frac{t_1}{t_2}}$

   R= rate of diffusion, M= Molar mass, d= Density, t= time for the gas to diffuse
9. Rate of diffusion of oxygen = 2, Rate of diffusion of unknown gas = 1, Molar mass of unknown gas = M_x, Molar mass of Oxygen = 16. Using the relationship between R and M we will have:

   $\frac{R_1}{R_1} = \sqrt{\frac{M_2}{M_1}} = \frac{2}{1} = \sqrt{\frac{M_x}{16}}$

$2 = \sqrt{\frac{M_x}{16}}$ (Square both sides to eliminate the root)

$2^2 = \frac{M_x}{16}$ this will be $4 = \frac{M_x}{16}$(By cross multiplying, M_x = 64g/mol)

M_x= 64.0g/mol

10. Phase rule is given by F = C – P + 2
    But if C = 2, the rule will become F = 2 – p + 2
    By collecting like terms, we will have F = 2 + 2 – P
    Therefore, F = 4 – P
11. Note: 1atm is equivalent to 760mmHg.
    In this question, Pressure is constant (P_1 = 1atm and P_2 = 760mmHg (1 atm))
    Therefore, this is a Charles law question.
    Using $V_1/T_1 = V_2/T_2$
    Where V_1 = 4.68L, T_1 = 30^0C + 273 = 303K, V_2= ? and T_2 = 0^0C + 273 = 273K
    $\frac{4.68}{303} = \frac{V_2}{273}$ (Cross multiply)
    4.68 x 273 = 303 x V_2
    1277.64 = 303V_2 (Divide both sides by 303)
    1277.64/303 = 303V_2/303
    V_2 = 4.22L
12. $(P + \frac{an^2}{V^2})$
13. Boyles law
14. Avogadro's law
15. Charles law
16. Grahams law of diffusion
17. Henrys law
18. We are using clausiusclapeyrons equation here $\ln\left(\frac{P_1}{P_2}\right) = -\frac{\Delta H_{vap}}{R}\left[\frac{1}{T_2} - \frac{1}{T_1}\right]$
    P_1 = 2.31mmHg, P_2=1atm (Not given but note that under normal condition everything boils at a pressure of 1atm) R = 8.314, T_1= 0^0C + 273 = 273 K and T_2=56_0C + 273 = 329
    $\ln\left(\frac{2.31}{1}\right) = \frac{-\Delta H_{vap}}{R}\left[\frac{1}{T_2} - \frac{1}{T_1}\right]$ will be $\ln(2.31) = -\frac{\Delta H_{vap}}{8.314}\left[\frac{1}{329} - \frac{1}{273}\right]$ (Substituting all the data)
    $0.837 = -\frac{\Delta H_{vap}}{8.314}$ [0.0030 - 0.0037] will be $0.837 = -\frac{\Delta H_{vap}}{8.314}$ [- 0.0007]
    $0.837 = \frac{0.0007\Delta H_{vap}}{8.314}$ (Cross multiply) we will have 0.837 x 8.314 = 0.0007ΔH_{vap}
    6.959 = 0.0007ΔH_{vap} (Divide both sides by 0.0007)
    6.959/0.0007 = 0.0007ΔH_{vap}/0.0007
    ΔH_{vap} = 9941.4J/mol
    But remember, our answer is supposed to be in KJ, therefore, we will divide our answer by 1000.
    ΔH_{vap} 9941.4/1000 = 9.94KJ/mol

ΔH_{vap} = 9.94KJ/mol

19. High intermolecular force of attraction between the atoms
20. Compressibility factor Z = 1 for an ideal gas
21. Deposition
22. Homogenous system
23. From ideal gas equation PV = nRT ………..Eqn 1

    Where P = 31.4atm, V= 500ml /1000 = 0.5L, R = 0.0821, T = 42^0C + 273 = 315K and n = ?

    Also remember that n = mass/molar mass

    Making "n" the subject formula we will have n = $\frac{PV}{RT}$ (Substituting the data)

    $n = \frac{31.4 \times 0.5}{0.0821 \times 315} = \frac{15.7}{25.83} = 0.61$ moles

    moles = mass/molar mass ………………Eqn 2

    mass = ?, molar mass of O_2 is 16 x 2 = 32g/mol

    making mass the subject formula, we will have mass = moles x molar mass

    Therefore, mass = 0.61 x 32 = 19.52 gramms

    Mass = 19.52g
24. $P_{total} = P_A + P_B + P_C$
25. Increase in pressure of the gas
26. Ideal Solution
27. Using Phase Rule (F = C – P + 2) where C= 3, P = 2

    Therefore, F = C – P + 2 will be F = 3 – 2 + 2

    F = 3
28. Non-miscible
29. Positive slope
30. $\frac{P-P_s}{P} = \frac{wM}{mW}$
31. Reduces
32. Negative deviation from roultz law
33. Bi-Variant
34. When a solute distribute itself between two non-miscible solvents
35. Solubility and gas pressure
36. 3 phases (Solid, Liquid and gas)
37. Equilibrium point
38. 1 mole of N_2 = -28.5kj/mol

    Then 3 moles of N_2 = 3 x -28.5 = -85.5kj/mol
39. Endothermic reaction
40. Lowering the activation energy
41. $R = k[A]^2[B]^3$
42. $2NO_{2(g)}$ ----------------------- $2NO_{(g)}$ + $O_{2(g)}$ ΔH = 114KJ ……………eqn 1

    $NO_{(g)}$ + $1/2O_{2(g)}$ ---------------$NO_{2(g)}$ ΔH = ? …………….eqn 2

    We have to reverse the equation 1 and multiply it by1/2 (The sign for ΔH will change due to reversing)

$2NO + O_2$ -------------------- $2NO_2$ (Reversing the equation) ΔH= -144

½ x 2NO + ½ x O_2 -------------------------- ½ x $2NO_2$ (multiply by 1/2) ΔH= -144 x ½

$NO + 1/2O_2$ ----------------- NO_2 ΔH = 72KJ

43. 3 (Three)
44. Bi-molecular
45. P = 2, C = 2
46. P = 1, C = 4
47. P = 2 , C = 1
48. False
49. True
50. False
51. True
52. True
53. False
54. True
55. True
56. True
57. True
58. True
59. True
60. True
61. True
62. False
63. K.kg/mol (Kelvin kilogram per mol)
64. Using Henry's law

    $\frac{C_1}{P_1} = \frac{C_2}{P_2}$ where C_1= ?, C_2= 0.348, P_1=3.0atm and P_2= 1.0atm

    $\frac{C_1}{P_1} = \frac{C_2}{P_2}$ will be $\frac{C_1}{3.0} = \frac{0.348}{1.0}$ by cross multiplying, we will have C_1 x 1.0 = 3.0 x 0.348

    C_1 = 1.02g/l
65. High solubility
66. Temperature
67. Using boiling point elevation formula $m = \frac{1000 \times K_b \times w}{\Delta T \times W}$ where w=30g, W=500g, m=58.5g/mol, $\Delta T = 29.2^0 - 27.1^0C = 2.1^0C + 273 = 275.1K$ and K_b = ?

    Making Kb the subject formula, we will have $K_b = \frac{mW\Delta T}{1000w} = \frac{58.5 \times 500 \times 275.1}{1000 \times 30} =$

    $$\frac{8046675}{30000}$$

    Therefore, K_b = 268.2K/mol
68. Real or non – ideal solution
69. The formula for osmotic pressure is given by πV = nRT, Where mass of glucose is 5gramms, Molar mass of glucose is 180g/mol, Volume = 100ml (From the 5%) which will be converted to liters by dividing it by 1000, V = 0.1L, Temperature = $36^0C + 273 =$

309K, (Osmotic pres)π= ??
Note, number of moles n = mass/molar mass = 5/180 = 0.03moles, R = 0.0821
Therefore, πV = nRT will be π x 0.1 = 0.03 x 0.0821 x 309
0.1π = 0.76 (Divide both sides by 0.1) then 0.1π/ 0.1 = 0.76/0.1
π = 7.6 atm

70. Semi-Permeable membrane.

SOLUTIONS TO TEST QUESTIONS

1. Hess law states that for a chemical reaction that can be written as the sum of two or more steps, the overall enthalpy change for the reaction equal the sum of enthalpy change for the individual steps.
2. Number of moles mass/molar mass
   Where mass of C_2H_5OH = 128g and molar mass = (12x2) + (1x5)+16 + 1 = 24 + 5 + 16 + 1 = 46g/mol, mass of CH_2OH = 92g and molar mass = 12 + (1x2) + 16 + 1 = 31g/mol
   Mole of C_2H_5OH = 128/46 = 2.8moles
   Mole of CH_2OH = 92/31 = 3.0 moles
   Total number of moles = 5.8moles
   Mole fraction of C_2H_5OH = 3.0/5.8
3. Solubility and pressure
4. $R = \frac{k[H_2][I_2]}{[HI]^2}$
5. When P = 3 and C = 1 Using phase rule F = C – P + 2
   F = 1 – 3 + 2, Therefore, F = 0
6. Temperature
7. Deposition
8. $CH_4 + 3O_2$ -------- $CO_2 + 2H_2O$ ΔH = 890.4KJ
9. Should not be miscible
10. We are using clausiusclapeyrons equation here $\ln\left(\frac{P_1}{P_2}\right) = -\frac{\Delta H_{vap}}{R}\left[\frac{1}{T_2} - \frac{1}{T_1}\right]$
    P_1 = 1atm (Not given but note that under normal condition everything boils at a pressure of 1atm), P_2=4.8atm, R = 8.314, T_1= 67.6K and T_2= ?ΔH_{vap}= 6.28KJ/mol (Note: the unit of ΔH_{vap} is in KJ(Kilojoules), so it has to be converted to J(Joules) by multiplying by 1000) ΔH_{vap}=6280KJ/mol
    $\ln\left(\frac{1}{4.8}\right) = -\frac{6280}{8.314}\left[\frac{1}{T_2} - \frac{1}{67.6}\right]$ will be $\ln(0.208) = -\frac{6280}{8.314}\left[\frac{1}{T_2} - \frac{1}{67.6}\right]$ (Substituting all the data)

$-1.57 = -755.35\left[\frac{1}{T_2} - \frac{1}{67.6}\right]$ (Divide both sides by -755.35)

$-1.57/-755.35 = \left[\frac{1}{T_2} - \frac{1}{67.6}\right]$

$0.0021 = \left[\frac{1}{T_2} - 0.015\right]$ (Collect like terms)

$0.0021 + 0.015 = \frac{1}{T_2}$

$0.0171 = \frac{1}{T_2}$ (By cross multiplying)

$T_2 \times 0.0171 = 1$, this will become $0.0171T_2 = 1$ (Dividing both sides by 0.0171)

Therefore, $T_2 = 1/0.0171 = 58.48K$

$0.837 = \frac{0.0007\Delta H_{vap}}{8.314}$ (Cross multiply) we will have $0.837 \times 8.314 = 0.0007\Delta H_{vap}$

$6.959 = 0.0007\Delta H_{vap}$ (Divide both sides by 0.0007)

$6.959/0.0007 = 0.0007\Delta H_{vap}/0.0007$

$\Delta H_{vap} = 9941.4J/mol$

But remember, our answer is supposed to be in KJ, therefore, we will divide our answer by 1000.

ΔH_{vap} 9941.4/1000 = 9.94KJ/mol

ΔH_{vap} = 9.94KJ/mol

11. $\frac{P-P_s}{P} = \frac{n}{n+N}$
12. Three (3)
13. Its mole fraction in a solution
14. Using Henry's law

    $\frac{C_1}{P_1} = \frac{C_2}{P_2}$ where C_1= 0.043, C_2= 1.2, P_1=2.5atm and P_2= ?

    $\frac{C_1}{P_1} = \frac{C_2}{P_2}$ will be $\frac{0.043}{2.5} = \frac{1.2}{P_2}$ by cross multiplying, we will have $P_2 \times 0.043 = 1.2 \times 2.5$

    which will be $0.043P_2=3.0$

    Dividing both sides by 0.043

    $P_2 = 3.0/0.043 = 69.8atm$
15. Number of solute particles
16. V α n
17. From Ideal gas equation PV = nRT

    P = ? V = 1228mL/1000 = 1.228L,

    R = 0.0821, T=46^0C + 273 = 319K

    n= mass/molar mass = 0.104/32

    molar mass of O_2= 16 x 2 = 32

    Therefore, n=0.003moles

    Making P the subject formula

$P = nRT/V = 0.003 \times 0.0821 \times 319/1.228$

$P = 0.064atm$

18. False
19. False
20. False