BITS PILANI -DUBAI CAMPUS,KNOWLEDGE VILLAGE ,DUBAI

I YEAR FIRST SEMESTER,2003-2004

COMPREHENSIVE EXAMINATION

Course Title :Chemistry-1 (CHEM UC141)

Date: 4.1.2004
Time:3 hours

Total Marks:80
Weightage:40%

1.Answer all questions
2.Show stepwise calculation indicating the units wherever its required
3.Useful data : h = 6.626 x 10^{-34} J.sec ,c = 3 x 10^{10} cm/s,m_e = 9.110 x 10^{-31} Kg, 1ev = 1.602 X 10^{-19} C,R = 8.314 J/K/mol, R =0.082 L atm /K/mol.

SECTION - A

I Multiple choice questions: [2M x10 =20]

1)Stopped flow method is an experimental technique to study the chemical reactions in the time range of
(a)10^{-15} s (b)10^{-12} s (c)10^{-3} s (d)10^{2}s

2)If x mol/L is the solubility of potassium aluminium sulphate ,K_{sp} is equal to
(a) x^3 (b) $4x^4$ (c) x^4 (d) $4x^3$

3)The decomposition of ozone proceeds as

$$O_3 \rightleftharpoons O_2 + O \quad \text{(fast)}$$
$$O + O_3 \longrightarrow 2O_2 \quad \text{(slow)}$$

the rate expression should be
(a)Rate = $k[O_3]^2$ (b) Rate = $k[O_3]^2 [O_2]^{-1}$ (c) Rate = $k[O_3] [O_2]$ (d) Rate = $k[O_3] [O_2]^{-1}$

4)The standard reduction potential values of three metallic cations X,Y and Z are 0.52, –3.03 and —1.18 V respectively
(a)Y>Z>X (b) X>Y>Z (c) Z>Y>X (d)Z>X>Y

5) At 200 °C ,the velocity of hydrogen molecule is 2.4 x 10^5 cm/sec.In this case the de-Broglie wavelength is about
(a)1Å (b) 1000Å (c)100Å (d)10Å

6)What is the correct sequence of bond order
(a)$O_2^+ > O_2^- > O_2$ (b) $O_2 > O_2^- > O_2^+$ (c) $O_2^+ > O_2 > O_2^-$ (d)$O_2^- > O_2^+ > O_2$

7)Which of the following sets of quantum numbers is not allowable
(a) n = 3, l = 2, m=0, s = –1/2 (b)n = 3,l = 2,m =, s = –1/2
(c)n = 3,l = 3 ,m = –3, s = –1/2 (d)n = 3,l = 0, m = 0, s = –1/2

8)For a reversible process at equilibrium , the change in entropy may be expressed as (a)$\Delta S = T q_{rev}$ (b)$\Delta S = \Delta H / T$ (c) $\Delta S = q_{rev} / T$ (d) $\Delta S = T\Delta H$

9)Which of the following liquid pairs shows a negative deviation from Raoult ' s law
(a)Acetone - ethanol (b)Carbon tetra chloride - chloroform
(c)Water - methanol (d)Water - nitric acid

10)Which of the following molecule is rotationally Raman inactive
(a) C_2H_6 (b) NH_3 (c) CH_4 (d) CO

II Fill in the blanks:

1)The zero point energy for a particle of mass m confined in an one dimensional box of length L is---------- . [1M]

2)The value of pre exponential factor A which can be calculated from the kinetic theory of gases is given as ----------. [2M]

3)For a molecule A—B the energies (E_J) of the rotational levels are given by the formula----------. [1M]

4)For the liquid vapour equilibrium the Clausius – Clapeyron equation is given as----------. [1M]

5)The debye T^3 law for the heat capacity of a substance at low temperature is----------. [1M]

6)The lattice enthalpy given by the Born Mayer equation is ΔH_L = ----------[2M]

7)The triple point of Carbon dioxide occurs at a pressure of ---------- torr and temperature of ----------°C. [2M]

8)The pH at the stoichiometric point of hypochlorous acid versus sodium hydroxide titration is on the basic side of neutrality (pH > 7) due to the presence of ---------- ions. [1M]

9) The electronegativity difference ($\Delta \chi$) for the diatomic molecule A — B based on Pauling scale is given as ---------- and --------- [2M]

10)The mathematical form of a 1s orbital (the wavefunction with n=1,l = 0 and m_l = 0) for a hydrogen atom is----------and ----------. [2M]

SECTION B

I)(i)Draw the MO energy level diagram for N_2 clearly labeling all the orbitals showing electronic arrangements in the molecular orbitals .Determine the bond order and the magnetic behaviour.

(ii)Predict the hybrid state of central atom in the following species NO_2^-,XeF_4 [6+2M]

2)For a chemisorption reaction,show that θ is related to p_A and rates of adsorption and desorption .Derive the Eley –Rideal mechanism of heterogeneous catalysis.Write all assumptions. [6M]

3)(i)The pure rotational (microwave)spectrum of gaseous HCl consists of a series of equally spaced lines separated by 20.80 cm^{-1}. Calculate the internuclear distance of the molecule. The atomic masses are :
^1H = 1.673 X 10^{-27} Kg, ^{35}Cl = 58.06 x 10^{-27} Kg.

(ii)Calculate and represent the number of normal modes of vibrations for carbondioxide molecule.

(iii)Predict the proton - NMR spectra of acetone (indicate the number of signals obtained) [5 + 2+ 1M]

4)(i)Estimate the wavelength of electrons that have been accelerated from rest through a potential difference of 1.00 kV.

(ii)Write balanced nuclear equation
$^{215}_{84}Po$ emits one α particle followed by the emission of one β particle. [5+2M]

5)Construct an electrochemical cell (diagram is compulsory)by combining a calomel electrode with a hydrogen electrode and show how this combination can be used to measure the pH of a solution. [5M]

6)Calculate the maximum work that can be obtained from the cell

$Zn / Zn^{2+}(1M) // Ag^{+}(1M) / Ag$

Given that $E° Zn^{2} / Zn = -0.76 V$ $E° Ag^{+} / Ag = +0.80 V$ [3M]

7)(i)Determine the fraction of solute protonated in 0.150 M hydrazine $NH_2 NH_2(aq)$.($K_b = 1.7 \times 10^{-6}$)

(ii)Calculate the pH of a solution of sodium hydrogen oxalate. ($pK_{a1} = 1.23$, $pK_{a2} = 4.19$). [3.5 + 1.5M]

8)When 3.0 mol $O_{2(g)}$ is heated at a constant pressure of 3.25 atm ,its temperature increases from 260 K to 285K .Given that the molar heat capacity of O_2 at constant pressure is 29.4 J/K/mol.Calculate q , ΔH and ΔU. [3 M]

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BITS PILANI -DUBAI CAMPUS

FIRST SEMESTER 2003-2004 COURSE :Chemistry -1

CHEM UC141 MAKE UP TEST -1(closed book)

Date: 3.11.2003

Time:50 min

Max Marks:40

weightage:20%

1.Answer all questions

2.Use the periodic table attached for atomic masses.

3.Show stepwise caculation indicating the units wherever its required.

SECTION-A Multiple choice questions [6]

1.For which of the following equations is the enthalpy change is likely to be negative

(a)$Cl^-(g) + aq \longrightarrow Cl^-(aq)$

(b)$Cl(g) \longrightarrow Cl^+(g) + e^-$

(c)$1/2Cl_2(g) \longrightarrow Cl(g)$

(d) $Cl_2(l) \longrightarrow Cl_2(g)$

2.For which of the reaction $q_p = q_v$

(a)$CaCO_3 \longrightarrow CaO + CO_2$

(b)$N_2 + H_2 \longrightarrow NH_3$

(c)$NaCl + aq \longrightarrow NaCl\ (aq)$

(d)$Ca(OH)_2 \longrightarrow CaO + H_2O$

3.The enthalpies of formation of N_2O and NO_2 are 82 and 90 kJ/mole.The enthalpy for the reaction in kJ is

$$N_2O + O_2 \longrightarrow NO_2$$

(a)8

(b)88

(c)16

(d)196

4.Given that

$$O(g) + e^- \longrightarrow O^-(g) \quad \Delta H = -142 kJ/mol$$

$$O(g) + 2e^- \longrightarrow O^{2-}(g) \quad \Delta H = +712\ kJ/mol$$

The heat change for the reaction

$$O^-(g) + e^- \longrightarrow O^{2-}(g) \text{ is}$$

(a)−570kJ

(b)+570kJ

(c)+854kJ

(d)−854kJ

5.Latent heat of vaporisation of a liquid at 500K and 1atm pressure is 10kcal/mol.What will be the change in ΔU of 3 mole of liquid at same temperature .

(a) 13.0 kcal
(b) –13kcal
(c) 27.0 kcal
(d) –27.0kcal

6.Identify the intensive quantity from the following

(a)Enthalpy and temperature
(b)Volume and temperature
(c)Enthalpy and volume
(d)Temperature and refractive index

SECTION -B

1.A chemical reaction takes place in a container of cross sectional area 55.0cm^2 , the container has a piston of mass 250g at one end.As a result of the reaction piston is pushed out (a) horizontally (b)vertically through 155 cm against an external pressure of 105kPa.Calculate the work done by the system in each case. [8]

2.The standard enthalpy of decomposition of the yellow complex NH_3SO_2 into NH_3 and SO_2 is + 40 kJ/mol .Calculate the standard enthalpy of formation of NH_3SO_2. Heat of formation of ammonia and sulphurdioxide are –46.11 and –296.83kJ/mol respectively. [6]

3.Calculate the heat of formation of anhydrous Al_2Cl_6 from the following data

(i) $Al(s) + HCl(aq) \longrightarrow Al_2Cl_6(aq) + H_2(g)$ $\Delta H = -240$kcal
(ii) $H_2(g) + Cl_2(g) \longrightarrow 2HCl(g)$ $\Delta H = -44$kcal
(iii) $HCl(g) + aq \longrightarrow HCl(aq)$ $\Delta H = -17.5$kcal
(iv) $Al_2Cl_6(s) + aq \longrightarrow Al_2Cl_6(aq)$ $\Delta H = -153.7$kcal [15]

4.The molar heat of formation of ammonium nitrate(s) is ---367 .54kJ and those of nitrous oxide(g) and water(l) are 81.46 and --285.8Kj respectively at 25°C and 1 atmospheric pressure.Calculate ΔH and ΔU of the reaction. [5]

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BITS PILANI -DUBAI CAMPUS,KNOWLEDGE VILLAGE ,DUBAI
I YEAR FIRST SEMESTER,2003-2003

Course Title : Chemistry-1 (CHEM UC141)
Date:29.10.2003
Time:30 min

TEST- 2 QUIZ (closed book)
Total Marks:10
Weightage:10%

1.Answer all questions
2.Marks will be given only for completely correct answers.
3.For multiple choice questions underline the correct answer choosing from the options given.

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1)If $\Delta_r G^{\ominus}$ is zero for a reaction,then [1 x 10 = 10]
(a) $\Delta H = 0$ (b) $\Delta S = 0$ (c) $K = 0$ (d) $K = 1$

2)If $\Delta_r G^{\ominus}$[HI(g)] = 1.7 kJ ,the equilibrium constant for the reaction

$$2HI(g) \rightleftharpoons H_2(g) + I_2(g)$$

at 25°C is
(a) 24.0 (b) 3.9 (c) 2.0 (d) 0.5

3)The enthalpy and entropy of a reaction are – 5.0 kJ/mol and – 20 J/K/mol respectively and independent of temperature.The highest temperature upto which the reaction is feasible is
(a)275 K (b)250 K (c)300K (d) None of these

4)For most pure substances the freezing point is higher than the triple point which have a _____ slope of the _____ in the phase diagram (fill in the blank).

5)The triple point of carbondioxide occurs at a pressure of _____ torr and temperature of _____ °C (fill in the blank).

6)A scientist uses carbondioxide to extract an organic compound from a rock bed.He carried out the experiment at a pressure of 10 atm and 320 K. What phase of carbondioxide is the scientist using?

BITS PILANI -DUBAI CAMPUS,KNOWLEDGE VILLAGE ,DUBAI
I YEAR FIRST SEMESTER,2003-2003

MAKE UP TEST

Course Title : Chemistry-1 (CHEM UC141)
Date: 22.12.2003
Time:50 min

TEST- 2 (openbook)
Total Marks:40
Weightage:20%

-1.Answer all questions
2.Show stepwise calculation indicating the units wherever its required

SECTION - A

Multiple choice questions: [1 x 5 = 5]

1)The pH of an aqueous solution of magnesium hydroxide is 9.0.If the solubility product of magnesium hydroxide is 1×10^{-11}.What is $[Mg^{2+}]$?
(a) 1×10^{-5} (b)1×10^{-4} (c)1×10^{-2} (d)0.1

2)50 ml of 0.1M HCl and 50 ml of 0.2M NaOH are mixed.The pH of the resulting solution is
(a)1.30 (b)4.2 (c)12.70 (d) 11.70

3)The vapour pressure of a pure liquid A is 70 torr at 27°C .It forms an ideal solution with another liquid B.The mole fraction of B is 0.2 and total vapour pressure of the solution is 84 torr at 27°C.The vapour pressure of pure liquid B at 27°C is
a)14 (b) 56(c)140(d)70

4)The correct sequence of increasing order of osmotic pressure of 0.01M aqueous solution of the following compounds:
1.Aluminium sulphate 2.Sodium phosphate 3.Barium chloride 4.Glucose
(a)4,3,2,1(b)4,2,3,1 (c)3,4,2,1 (d)3,4,1,2

5)When 1g of arsenic is added to 80g of benzene the freezing point of benzene is lowered by 0.19°C (K_f = 4.9).The formula of arsenic is
(a)As (b)As_2 (c)As_3 (d)As_4

SECTION – B

1)Calculate the change in pH of 1 litre of buffer solution containing 0.10 mole each of ammonia and ammonium chloride upon addition of 0.02 mole of dissolved gaseous HCl.Assume no change in solution volume. [6]

2)Equal volumes of 250 cm^3 of 5.0×10^{-2}M barium nitrate and 2.0×10^{-2}M sodium fluoride are mixed.Predict whether precipitation of barium fluoride will occur or not. [8]

3)In a cold climate water gets frozen causing damage to the radiator of a car. Ethylene glycol is used as an anti freezing agent.Calculate the amount of ethylene glycol to be added to 4 Kg of water to prevent it from freezing at $-6\,^{\circ}C$. [3]

4)The vapour pressure of water at 293 K is 17.54 mm of mercury and the vapour pressure of a solution of 108.24g of a compound in 1000g of water at the same temperature is 17.354 mm of mercury. Calculate the molar mass of the solute.[5]

5)30 ml of methanol (density =0.7980 g/ml) is mixed with 70 ml of water (density = 0.9984 g/ml) at 25°C to give a solution of density 0 .9575 g/ml. Calculate the (i) mole fraction (ii)molarity (iii)molality and (iv) freezing point of the solution. [13]

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Period	1	2	3	4	5	6	7	8	9	10	11	12	13/III	14/IV	15/V	16/VI	17/VII	18/VIII
	1 H 1.0079																	2 He 4.003
2	3 Li 6.941	4 Be 9.012											5 B 10.81	6 C 12.01	7 N 14.01	8 O 16.00	9 F 19.00	10 Ne 20.18
3	11 Na 22.99	12 Mg 24.31											13 Al 26.98	14 Si 28.09	15 P 30.97	16 S 32.07	17 Cl 35.04	18 Ar 39.95
4	19 K 39.10	20 Ca 40.08	21 Sc 44.96	22 Ti 47.88	23 V 50.94	24 Cr 52.00	25 Mn 54.94	26 Fe 55.85	27 Co 58.93	28 Ni 58.71	29 Cu 63.54	30 Zn 65.37	31 Ga 69.72	32 Ge 72.59	33 As 74.92	34 Se 78.96	35 Br 79.91	36 Kr 83.80
5	37 Rb 85.47	38 Sr 87.62	39 Y 88.91	40 Zr 91.22	41 Nb 92.91	42 Mo 95.94	43 Tc 98.91	44 Ru 101.07	45 Rh 102.91	46 Pd 106.4	47 Ag 107.87	48 Cd 112.40	49 In 114.82	50 Sn 118.69	51 Sb 121.75	52 Te 127.60	53 I 126.90	54 Xe 131.30
6	55 Cs 132.91	56 Ba 137.34	La-Lu	72 Hf 178.49	73 Ta 180.95	74 W 183.85	75 Re 186.2	76 Os 190.2	77 Ir 192.2	78 Pt 195.09	79 Au 196.97	80 Hg 200.59	81 Tl 204.37	82 Pb 207.19	83 Bi 208.98	84 Po 210.0	85 At 210.0	86 Rn 222.0
7	87 Fr 223.0	88 Ra 226.0	Ac-Lr	104 Rf 261	105 Db 262	106 Sg 263	107 Bh 262	108 Hs 265	109 Mt 266	110 Uun	111 Uuu	112 Uub	113 Uut	114 Uuq				

s block — d block — p block

Lanthanides	57 La 138.91	58 Ce 140.12	59 Pr 140.91	60 Nd 144.24	61 Pm 146.92	62 Sm 150.35	63 Eu 151.96	64 Gd 157.25	65 Tb 158.92	66 Dy 162.50	67 Ho 164.93	68 Er 167.26	69 Tm 168.93	70 Yb 173.04	71 Lu 174.97
Actinides	89 Ac 227.03	90 Th 232.04	91 Pa 231.04	92 U 238.03	93 Np 237.05	94 Pu 239.05	95 Am 241.06	96 Cm 247.07	97 Bk 249.08	98 Cf 251.08	99 Es 254.09	100 Fm 257.10	101 Md 258.1	102 No 259.10	103 Lr 262.1

f block

BITS PILANI -DUBAI CAMPUS,KNOWLEDGE VILLAGE ,DUBAI
I YEAR FIRST SEMESTER,2003-2003

Course Title : Chemistry-1 (CHEM UC141)
Date:23.11.2003
Time:50 min

TEST- 2 (openbook)
Total Marks:40
Weightage:20%

1.Answer all questions
2.Show stepwise calculation indicating the units wherever its required

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SET - 1
SECTION –A

Multiple choice questions: [1 x 10 = 10]

1)Which of the following solutions has highest boiling point?
(a)0.1M sodium chloride (b) 0.1M glucose (c)0.1 M barium chloride (d) 0.1 M urea

2)When 0.1 mole of glucose is dissolved in 10 mole of water ,the vapour pressure of water is
(a)increased by 1 % (b)increased by 10 % (c) decreased by 1 % (d) decreased by 10 %

3)The weight of calcium hydroxide in 100 ml of 0.01M solution will be
(a)1.48g (b)74g (c)14.8g (d) 0.074g

4)The vapour pressure of pure benzene and toluene are 160 and 60 torr respectively.The mole fraction of toluene in vapour phase in contact with equimolar solution of benzene and toluene is
(a)0.50 (b) 0.16 (c)0.27 (d) 0.73

5)The osmotic pressure of a 3.5% solution of cane sugar at 150°C is
(a)4 atm (b) 3.4atm(c) 3.55atm (d) 2.45 atm

6)For which of the following solutions pH = pKa
(a)100 ml of 0.1M CH_3COOH + 100 ml of 0.1M NaOH
(b)100 ml of 0.1M CH_3COOH + 50 ml of 0.1M NaOH
(c)100 ml of 0.1M CH_3COOH + 100 ml of 0.1M NH_3
(d)None of the above

7)Let the solubility of silver chloride in water ,in 0.01M calcium chloride,in 0.01M sodium chloride and 0.05M silver nitrate be S_1 ,S_2,S_3 and S_4 respectively.Which of the following relationships between these quantities is correct

(a) $S_1 > S_2 > S_3 > S_4$ (b) $S_1 > S_2 = S_3 > S_4$ (c) $S_4 > S_2 > S_3 > S_1$ (d)$S_1 > S_3 > S_2 > S_4$

8)The pH of a solution obtained by mixing 100ml of 0.2M HCl and 100ml of 0.3M NaOH will be

(a)12 (b) 13 (c) 1 (d) 2

9)During the precipitation of third group of qualitative analysis,ammonium chloride is added before ammonium hydroxide .This results in

(a)increase in concentration of NH_4^+ leading to suppression of degree of dissociation of ammonium chloride.

(b)decrease in concentration of OH^- ions

(c)increase in concentration of metal ions

(d)none of these

10)The pKa of acetyl salicylic acid (aspirin) is 3.5.The pH of gastric juice in human stomach is about 2.3 and the pH in the small intestine is about 8.Aspirin will be

(a)unionised in the small intestine and in the stomach

(b)completely ionised in the small intestine and in the stomach

(c)ionised in the stomach and almost unionised in the small intestine

(d)ionised in the small intestine and almost unionised in the stomach.

SECTION – B

1)8.0575×10^{-2} Kg of Glauber's salt (sodium sulphate decahydrate) is dissolved in water to obtain1dm^3 of a solution of density 1077.2 Kgm^{-3}. Calculate the molarity,molality and mole fraction of sodium sulphate in the solution. [7]

2)Calculate the amount of ammonium sulphate in gms which must be added to 500ml of 0.200M NH_3 to yield a solution with pH 9.35. [5]

3)Two liquids A and B form ideal solutions .At 300K ,the vapour pressure of a solution containing 1 mole of A and 3 moles of B is 550mm of Hg. At the same temperature if one more mole of B is added to this solution ,the vapour pressure of the solution increases by 10 mm of Hg. Determine the vapour pressure of A and B in their pure states. [5]

4)The buffers of (X) and (Y) of pH 4.0 and 6.0 respectively are prepared from acid HA and the salt NaA .Both the buffers are 0.50 M in HA. What would be the pH of the solution obtained by mixing equal volumes of the two buffers($K_{HA} = 1.0 \times 10^{-5}$). [5]

5)A motor vehicle radiator was filled with 8L of water to which 2L of methylalcohol (density = 0.8g/ml) were added.What is the lowest temperature at which the vehicle can be parked outdoors without a danger that water in the radiator will freeze? [4]

6) Calculate the solubility of silver chloride (solid) in pure water and in 0.1M NaCl at 25°C Ksp (silver chloride) = 2.8×10^{-10}.Comment on the influence of chloride ion on the solubility of silver chloride. [4]

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BITS PILANI -DUBAI CAMPUS,KNOWLEDGE VILLAGE ,DUBAI
I YEAR FIRST SEMESTER,2003-2003

Course Title : Chemistry-1 (CHEM UC141)
Date:23.11.2003
Time:50 min

TEST- 2 (openbook)
Total Marks:40
Weightage:20%

1.Answer all questions
2.Show stepwise calculation indicating the units wherever its required

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SET - 2
SECTION –A

Multiple choice questions: [1 x 10 = 10]

1)Which of the following solutions has highest boiling point?
(a)1M sodium chloride (b)1M magnesium chloride (c)1 M urea (d)1 M glucose

2) The weight of calcium hydroxide in 250 ml of 0.01M solution will be
(a)1.48g (b)0.185g (c)14.8g (d) 1.85g

3) The vapour pressure of pure benzene and toluene are 160 and 60 torr respectively.The mole fraction of toluene in vapour phase in contact with equimolar solution of benzene and toluene is
(a)0.50 (b) 0.27(c)0.16 (c)0.16(d) 0.73

4) The osmotic pressure of a 3.5% solution of cane sugar at 140°C is
(a)4 atm (b) 3.46atm(c) 3.55atm (d) 2.45 atm

5)When 0.1 mole of glucose is dissolved in 10 mole of water ,the vapour pressure of water is
(a)increased by 10 % (b)increased by 1 % (c) decreased by 10 % (d) decreased by 1 %

6)For which of the following solutions pH = pKa
(a)100 ml of 0.1M CH_3COOH + 100 ml of 0.1M N NH_3
(b)100 ml of 0.1M CH_3COOH + 100 ml of 0.1M NaOH
(c)100 ml of 0.1M CH_3COOH + 50 ml of 0.1M NaOH
(d)None of the above

7) The pKa of acetyl salicylic acid (aspirin) is 3.5.The pH of gastric juice in human stomach is about 2.3 and the pH in the small intestine is about 8.Aspirin will be
(a) ionized in the small intestine and almost unionized in the stomach
(b) completely ionized in the small intestine and in the stomach
(c) ionized in the stomach and almost unionized in the small intestine
(d)unionized in the small intestine and in the stomach

8)Let solubility of silver chloride in water ,in 0.01M calcium chloride,in 0.01M sodium chloride and 0.05M silver nitrate be S_1 ,S_2,S_3 and S_4 respectively.Which of the following relationships between these quantities is correct
(a) $S_1 > S_2 > S_3 > S_4$ (b) $S_1 > S_3 > S_2 > S_4$
(c) $S_1 > S_2 = S_3 > S_4$ (d) $S_4 > S_2 > S_3 > S_1$

9)The pH of a solution obtained by mixing 100ml of 0.2M HCl and 100ml of 0.3M NaOH will be
(a)12 (b) 2 (c) 1 (d) 13

10)During the precipitation of second group of qualitative analysis,the solution is made acidic because
(a)the sulphide ion concentration may increase
(b)the sulphide ion concentration may decrease
(c)the hydrogen ion concentration may increase
(d)the degree of dissociation of HCl may decrease

SECTION – B

1)Two liquids A and B form ideal solutions .At 300K ,the vapour pressure of a solution containing 1 mole of A and 3 moles of B is 550mm of Hg. At the same temperature if one more mole of B is added to this solution ,the vapour pressure of the solution increase by 10 mm of Hg.Detemine the vapour pressure of A and B in their pure states [5]

2)Calculate the solubility of silver chloride (solid) in pure water and in 0.1M NaCl at 25°C Ksp (silver chloride) = 2.8×10^{-10}.Comment on the influence of chloride ion on the solubility of silver chloride. [4]

3)8.0575×10^{-2} Kg of Glauber's salt (sodium sulphate decahydrate) is dissolved in water to obtain1dm^3 of a solution of density 1077.2 Kgm^{-3}. Calculate the molarity,molality and mole fraction of sodium sulphate in the solution. [7]

4)The buffers (X) and (Y) of pH 4.0 and 6.0 respectively are prepared from acid HA and the salt NaA .Both the buffers are 0.50 M in HA. What would be the pH of the solution obtained by mixing equal volumes of the two buffers($K_{HA} = 1.0 \times 10^{-5}$). [5]

5)A motor vehicle radiator was filled with 8L of water to which 2L of methylalcohol (density = 0.8g/ml) were added.What is the lowest temperature at which the vehicle can be parked outdoors without a danger that water in the radiator will freeze? [4]

6)Calculate the amount of ammonium sulphate in gms which must be added to 500ml of 0.200M NH_3 to yield a solution with pH 9.35. [5]

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BITS PILANI -DUBAI CAMPUS,KNOWLEDGE VILLAGE ,DUBAI
I YEAR FIRST SEMESTER,2003-2003

MAKE UP TEST

Course Title : Chemistry-1 (CHEM UC141)
Date: 22.12.2003
Time:50 min

TEST- 2 (openbook)
Total Marks:40
Weightage:20%

-1.Answer all questions
2.Show stepwise calculation indicating the units wherever its required

SECTION - A

Multiple choice questions: [1 x 5 = 5]

1)The pH of an aqueous solution of magnesium hydroxide is 9.0.If the solubility product of magnesium hydroxide is 1×10^{-11}.What is $[Mg^{2+}]$?
(a) 1×10^{-5} (b)1×10^{-4} (c)1×10^{-2} (d)0.1

2)50 ml of 0.1M HCl and 50 ml of 0.2M NaOH are mixed.The pH of the resulting solution is
(a)1.30 (b)4.2 (c)12.70 (d) 11.70

3)The vapour pressure of a pure liquid A is 70 torr at 27°C .It forms an ideal solution with another liquid B.The mole fraction of B is 0.2 and total vapour pressure of the solution is 84 torr at 27°C.The vapour pressure of pure liquid B at 27°C is
a)14 (b) 56(c)140(d)70

4)The correct sequence of increasing order of osmotic pressure of 0.01M aqueous solution of the following compounds:
1.Aluminium sulphate 2.Sodium phosphate 3.Barium chloride 4.Glucose
(a)4,3,2,1(b)4,2,3,1 (c)3,4,2,1 (d)3,4,1,2

5)When 1g of arsenic is added to 80g of benzene the freezing point of benzene is lowered by 0.19°C (K_f = 4.9).The formula of arsenic is
(a)As (b)As_2 (c)As_3 (d)As_4

SECTION – B

1)Calculate the change in pH of 1 litre of buffer solution containing 0.10 mole each of ammonia and ammonium chloride upon addition of 0.02 mole of dissolved gaseous HCl.Assume no change in solution volume. [6]

2)Equal volumes of 250 cm^3 of 5.0×10^{-2}M barium nitrate and 2.0×10^{-2}M sodium fluoride are mixed.Predict whether precipitation of barium fluoride will occur or not. [8]

3)In a cold climate water gets frozen causing damage to the radiator of a car. Ethylene glycol is used as an anti freezing agent.Calculate the amount of ethylene glycol to be added to 4 Kg of water to prevent it from freezing at $-6\,^{\circ}C$. [3]

4)The vapour pressure of water at 293 K is 17.54 mm of mercury and the vapour pressure of a solution of 108.24g of a compound in 1000g of water at the same temperature is 17.354 mm of mercury. Calculate the molar mass of the solute.[5]

5)30 ml of methanol (density =0.7980 g/ml) is mixed with 70 ml of water (density = 0.9984 g/ml) at 25°C to give a solution of density 0 .9575 g/ml. Calculate the (i) mole fraction (ii)molarity (iii)molality and (iv) freezing point of the solution. [13]

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BITS PILANI -DUBAI CAMPUS

FIRST SEMESTER,2003-2004 COURSE :Chemistry -1

CHEM UC141 TEST -1(closed book)

Date:5.10.2003
Time:50 min

Max Marks:40
weightage:20%

1.Answer all questions
2.Use the periodic table attached for atomic masses.
3.Show stepwise caculation indicating the units wherever its required.

SECTION-A Multiple choice questions [6]

1.In an adiabatic expansion of an ideal gas
(a)$\Delta U = 0$
(b)$w = 0$
(c)$dt = 0$
(d)$q = 0$

2.Predict the sign of ΔH and of ΔS for the reaction

$$2Br_{(g)} \longrightarrow Br_{2(g)}$$

(a) Both are positive
(b) Both are negative
(c) ΔH= positive and ΔS = negative
(d) ΔH = negative and ΔS = positive

3.For the reaction

$$C + O_2 \longrightarrow 2CO_2 \quad \Delta H = -x \text{ kj}$$
$$2CO + O_2 \longrightarrow 2CO_2 \quad \Delta H = -y \text{ kj}$$

The enthalpy of formation of CO will be
(a) $y - 2x$
(b) $2x - y / 2$
(c) $y - 2x / 2$
(d) $2x - y$

4.One mole of methanol burnt in O_2 gives out 723 kJ/mole heat.If one mole of O_2 is used the amount of heat evolved will be
(a)723kJ
(b)964kJ
(c)482kJ
(d)241kJ

5. For the reaction

$$N_2 + H_2 \longrightarrow NH_3$$

(a) $q_p = (q_v)^2$
(b) $q_p = q_v - 2RT$
(c) $q_p = q_v + 2RT$
(d) $q_p = 2q_v - R$

6. The molar heat of vaporisation for water is 9.72 kcal/mol. The amount of heat change when 45g of water condense is
(a) 437.4 kcal
(b) 243kcal
(c) 24.3 kcal
(d) 3.89kcal

SECTION - B

1. 28g of N_2 gas at 27°C and 20 atm was allowed to expand isothermally against a constant pressure of 1 atm. Calculate q, w and ΔU for the gas. [5]

2. (i) Derive the relation between heat capacities at constant pressure and at constant volume. [2]
(ii) 1 mole of an ideal gas at 25°C is subjected to expand reversibly ten times of its initial volume. Calculate the change in entropy of expansion.. [4]

3. Calculate the enthalpy change for the combustion of cyclopropane at 298 K. The enthalpy of formation of CO_2 (g), H_2O(l) and propene(g) are – 393.5, –285.8 and 20.42 kJ/mol respectively. The enthalpy of isomerization of cyclopropane to propene is –33.0 kJ/mol. [10]

4. A sample of aluminium of mass 1.25 Kg is cooled at constant pressure from 300K to 260 K. Calculate the energy that must be removed as heat and the change in entropy of the sample. The molar heat capacity of aluminium at constant pressure is 24.35 $JK^{-1}mol^{-1}$ [5]

5. Calculate the electron gain enthalpy of fluorine (present in potassium fluoride) from the data given below by constructing Born Haber cycle.

Steps	ΔH kJ/mol
Sublimation energy of potassium	+87.8 kJ/mol
Dissociation energy of fluorine molecule	+158.9 Kj/mol
Ionisation energy of potassium	+414.2kJ/mol
Lattice energy of potassium fluoride	–807.5kJ/mol
Heat of formation of potassium fluoride	–560.8kJ/mol

[8]

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Period	1	2	3	4	5	6	7	8	9	10	11	12	13/III	14/IV	15/V	16/VI	17/VII	18/VIII
																		1 H 1.0079
2	3 Li 6.941	4 Be 9.012											5 B 10.81	6 C 12.01	7 N 14.01	8 O 16.00	9 F 19.00	2 He 4.003
3	11 Na 22.99	12 Mg 24.31											13 Al 26.98	14 Si 28.09	15 P 30.97	16 S 32.07	17 Cl 35.04	10 Ne 20.18
4	19 K 39.10	20 Ca 40.08	21 Sc 44.96	22 Ti 47.88	23 V 50.94	24 Cr 52.00	25 Mn 54.94	26 Fe 55.85	27 Co 58.93	28 Ni 58.71	29 Cu 63.54	30 Zn 65.37	31 Ga 69.72	32 Ge 72.59	33 As 74.92	34 Se 78.96	35 Br 79.91	18 Ar 39.95
5	37 Rb 85.47	38 Sr 87.62	39 Y 88.91	40 Zr 91.22	41 Nb 92.91	42 Mo 95.94	43 Tc 98.91	44 Ru 101.07	45 Rh 102.91	46 Pd 106.4	47 Ag 107.87	48 Cd 112.40	49 In 114.82	50 Sn 118.69	51 Sb 121.75	52 Te 127.60	53 I 126.90	36 Kr 83.80
6	55 Cs 132.91	56 Ba 137.34	La-Lu	72 Hf 178.49	73 Ta 180.95	74 W 183.85	75 Re 186.2	76 Os 190.2	77 Ir 192.2	78 Pt 195.09	79 Au 196.97	80 Hg 200.59	81 Tl 204.37	82 Pb 207.19	83 Bi 208.98	84 Po 210.0	85 At 210.0	54 Xe 131.30
7	87 Fr 223.0	88 Ra 226.0	Ac-Lr	104 Rf 261	105 Db 262	106 Sg 263	107 Bh 262	108 Hs 265	109 Mt 266	110 Uun	111 Uuu	112 Uub	113 Uut	114 Uuq				86 Rn 222.0

d block

Lanthanid	57 La 138.91	58 Ce 140.12	59 Pr 140.91	60 Nd 144.24	61 Pm 146.92	62 Sm 150.35	63 Eu 151.96	64 Gd 157.25	65 Tb 158.92	66 Dy 162.50	67 Ho 164.93	68 Er 167.26	69 Tm 168.93	70 Yb 173.04	71 Lu 174.97
Actinides	89 Ac 227.03	90 Th 232.04	91 Pa 231.04	92 U 238.03	93 Np 237.05	94 Pu 239.05	95 Am 241.06	96 Cm 247.07	97 Bk 249.08	98 Cf 251.08	99 Es 254.09	100 Fm 257.10	101 Md 258.1	102 No 259.10	103 Lr 262.1