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	Seco	nd Term Test - Grade 13 - 2018	
Index No	o :	Chemistry I	Two Hours
Importa • Perio • Answ • Use c • Write • In eaconst instru	nt dic Table is provided. ver all the questions. of calculator is not allowed. e your Index number in the sp ch of the questions 1 to 50, pi appropriate and mark your re- actions given on the back of t	bace provided in the answer sheet. tick one of the alternatives form (1), (2), (3), esponse on the answer sheet with a cross (x) the answer sheet.	(4), (5) which is correct or in accordance with the

Universal gas constant $R = 8.314 \text{ JK}^{-1} \text{ mol}^{-1}$ | Avogadro constant $N_A = 6.022 \text{ x} 10^{23} \text{ mol}^{-1}$ Planck's constant $h = 6.626 \text{ x} 10^{-34} \text{ Js}$ | Velocity of light $C = 3 \text{ x} 10^8 \text{ ms}^{-1}$

- 1. Frequency of a yellow light ray in hydrogen emission spectrum is $5.09 \times 10^{14} \text{ s}^{-1}$ Wave length of this yellow light is,
 - 1. 589 m 2. 589 nm 3. 337 m 4. 337 nm 5. 203 m
- 2. Which of the following statement is false,
 - 1. First ionization energy of Nitrogen is higher than the first ionization energy of Oxygen.
 - 2. Radii of all ions are smaller than the radii of their neutral atoms.
 - 3 Second ionization energies of all atoms are larger than their first ionization energies.
 - 4. Shielding effect influence on the atomic radius as well as on ionization energy.
 - 5. Electronegativity of certain element atom changes with its environment.
- 3. What is the IUPAC name of following compound.

$$\begin{array}{cccccc} CHO & CH_2CH_3 & O \\ | & | & || \\ CH_3CH_2 - C &= C - CH - C - NH_2 \\ & | \\ NH_2 \end{array}$$

- 1. 2 ammine 3 ethyl 4 formylpent 3 enamide
- 2. 2 amino 3, 4 diethyl 4 formylbut 3 enamide
- 3. 2 amino 3, 4 diethyl 5 oxopent 3 enamide
- 4. 2 amino 3 ethyl 4 formylhex 3 enamide
- 5. 2 ammine 3, 4 diethyl 5 oxopent 3 enamide
- 4. Which of following set of molecules / ions are with the same electron pair geometry, but different shape,

1. NH_3 , CCl_4 , NO_3^- 2. CCl_4 , NO_3^- , H_2S 3. NH_3 , CCl_4 , NO_2^- 4. NH_3 , CCl_4 , H_2S 5. NH_3 , NO_2^- , NO_3^-

- 5. possible quantum number combination of an unpaired valence electron of ${}_{4}Ag$ atom in its ground state is,
 - 1. 5, 0, 0, $+\frac{1}{2}$ 2. 4, 0, 0, $+\frac{1}{2}$ 3. 5, 1, +1, $+\frac{1}{2}$

 4. 5, 1, 0, $+\frac{1}{2}$ 5. 4, 2, 0, $+\frac{1}{2}$
- 6. Dilute H_2SO_4 and excess of H_2O_2 are added to an aqueous solution containing 3.04 g of $FeSO_4$. Then H_2O_2 turns in to H_2O and $FeSO_4$ turns in to $Fe_2(SO_4)_3$. Needed volume of 0.1 mol dm⁻³ NaOH to convert all of $Fe_2(SO_4)_3$ in to $Fe(OH)_3$ is, (Fe = 56, S = 32, O = 16)
 - 1. $300 \ cm^3$ 2. $30 \ cm^3$ 3. $600 \ cm^3$ 4. $60 \ cm^3$ 5. $150 \ cm^3$
- 7. Consider the following equilibrium produces at 727⁰ C. $A(s) \rightleftharpoons B(s) + C(g)$

Total pressure of the system at $727^{\circ} C$ is $4.157 \times 10^{5} Pa$. What is equilibrium constant K_{C} for above equilibrium?

1. $50 \mod dm^{-3}$ 2. $4.157 \ge 10^5 \mod dm^{-3}$ 3. $4.157 \ge 10^2 \mod dm^{-3}$ 4. $50 \mod m^{-3}$ 5. $500 \mod m^{-3}$

8. Relative molecular mass of a an inorganic compound X is 250, 25.6% of Cu, 12.8% of S 57.6% of O and 4% of H by mass are included in this compound. If all H atoms in X present as water, the formula of anhydrous salt is, (Cu = 64, S = 32, O = 16, H = 1)

- 1. $CuSO_3.3H_2O$ 2. $CuSO_4.2H_2O$ 3 $CuSO_4$
- 4. $CuSO_4.5H_2O$ 5. CuS

- 9. Which of the following statement is false about the chemistry of *Al* and its compounds.
 - 1. Basicity of $Al(OH)_3$ is higher than the basicity of $Mg(OH)_2$
 - 2. H_2 gas is released by the reaction between aluminium and dilute $Ba(OH)_2$
 - 3. H_2 gas is released by the reaction between aluminium and dil. H_2SO_4 .
 - 4. $AlCl_3$ exist as a dimer in its anhydrous form.
 - 5. A white precipitate is produced when *HCl* is drop wisely added in to a solution obtained by the reaction of *Al* with excess *NaOH*.
- 11. Consider the following equilibria produce at 1100 K.
 - $\begin{array}{rcl} 1. \ C(S) + \ CO_2(g) &\rightleftharpoons \ 2CO(g) &; \ K_{P_1 = 1.0 \times 10^{14} \ Pa} \\ 2. \ CO(g) + \ Cl_2(g) &\rightleftharpoons \ COCl_2(g) &; \ K_{P_2 = 6.0 \times 10^{-3} \ Pa^{-1}} \\ K_p & \text{value of the following reaction at } 1100 \ K & \text{is,} \\ C(S) + \ CO_2(g) + 2 \ Cl_2 &\rightleftharpoons \ 2COCl_2(g) \\ 1. \ 6 \times 10^{11} \ Pa^{-1} & 2. \ 3.6 \times 10^9 \ Pa^{-1} & 3. \ 3.6 \times 10^{-6} \ Pa^{-1} \\ 4. \ 6 \times 10^8 \ Pa^{-1} & 5. \ 3.6 \times 10^7 \ Pa^{-1} \end{array}$
- According to the IUPAC rules, chemical formula of Tetraamminedicyanidoiron(III) nitrate is,
 [Fe(NH₃)₄(CN)₂] NO₃
 [Fe(CN)₂(NH₃)₄] NO₃
 [Fe(NH₃)₂(CN)₂] NO₂
 [Fe(CN)₂(NH₃)₄] NO₂
 [Fe(NH₃)₄(CN)₂] (NO₃)₂
- 13. 50 cm^3 of *HCl* solution with pH = 1 and 200 cm^3 of *HCl* solution with pH = 2 are mixed together. pH value of the new solution is,
 - 1. 2.442. 3.843. 1.554. 3.55. 2.15
- 14. Sparingly soluble electrolyte MX_3 produces M^{3+} and X^- ions in an aqueous solution. At *TK* temperature if K_{sp} of MX_3 is $x \mod^4 dm^{-12}$ then concentration of X^- ions is,

1.
$$\left(\frac{x}{27}\right)^{\frac{1}{4}} \mod dm^{-3}$$

2. $\left(\frac{x}{108}\right)^{\frac{1}{4}} \mod dm^{-3}$
3. $\left(\frac{3x}{27}\right)^{\frac{1}{4}} \mod dm^{-3}$
4. $3\left(\frac{x}{27}\right)^{\frac{1}{4}} \mod dm^{-3}$
5. $3\left(\frac{x}{108}\right)^{\frac{1}{4}} \mod dm^{-3}$

15. An ideal solution is prepared by mixing heptane and octane together. At $25^{\circ}C$ saturated vapour pressures of these are respectively 4.5×10^{5} Pa and 1.4×10^{5} Pa. At 25° C what is the total vapour pressure of a mixture containing 2 *mol* of heptane and & 3 *mol* of octane.

1. $13.2 \times 10^5 Pa$ 2. $2.64 \times 10^5 Pa$ 3. $5.9 \times 10^5 Pa$ 4. $1.18 \times 10^5 Pa$ 5. $2.36 \times 10^5 Pa$

16. Which of the following is not a resonance structure of phonate ion,



17. Which of the following statement is true about a catalyst.

- 1. A catalyst decrease the value of equilibrium constant.
- 2. A catalyst increase the value of equilibrium constant.
- 3. A catalyst decrease the enthalpy change.
- 4. A catalyst decrease the activation energy.
- 5. A catalyst gives more yield by changing the composition of equilibrium mixture.
- 18. Consider the following given electrode.

0.4500.0

$Zn^{2+}(aq, 1.0M)/Zn(s)$;	$E^{\theta} Z n^{2+} / Z n = -0.76 V$
$Cu^{2+}(aq, 1.0M)/Cu(s)$;	$E^{\theta} C u^{2+} / C u = + 0.34 V$
$Fe^{2+}(aq, 1.0M)/Fe(s)$;	$E^{\theta} F e^{2+} / F e = -0.44 V$

Electrochemical cells can be prepared by connecting above electrodes using a salt bridge and a voltmeter. Which of following gives the correct cell reaction and voltmeter reading of a cell prepared by above.

1. Cu (S) + $Fe^{2+}(aq) \rightleftharpoons Fe(S) + Cu^{2+}(aq)$; +0.10 V 2. Fe (S) + $Cu^{2+}(aq) \rightleftharpoons Fe^{2+}(aq) + Cu(S)$; +0.78 V 3. Fe (S) + $Zn^{2+}(aq) \rightleftharpoons Zn(S) + Fe^{2+}(aq)$; +0.31 V 4. Zn(S) + $Fe^{2+}(aq) \rightleftharpoons Fe(S) + Zn^{2+}(aq)$; +1.20 V 5. Cu(S) + $Zn^{2+}(aq) \rightleftharpoons Zn(S) + Cu^{2+}(aq)$; +1.10 V

19. 0.5 A electric current is passed through a fused *NaCl* solution for 1 hour. Mass of *Na* (*l*) release at the cathode is,

(1F = 96500 C, Na = 23)		
1. 0.00012g	2. 0.000238g	3. 0.429 g
4. 0.000429 g	5. 0.0002145 g	

- 20. Which of the following statement is false about the H_2O_2 .
 - 1. H_2O_2 acts as an oxidizing agent as well as a reducing agent.
 - 2. In an acid medium, H_2O_2 reacts with $KMnO_4$ and O_2 give gas as a product.
 - 3. In an acidic medium H_2O_2 reacts with MnO_2 and give O_2 gas as a product.
 - 4. In an acidic medium H_2O_2 reacts with KI and give O_2 gas as a product.
 - 5. H_2O_2 reacts with $SO_2(g)$ and give H_2SO_4 as the product.
- 21. Standard combustion enthalpies of $CH_3CHO(g), H_2(g)$ and $CH_3CH_2OH(l)$ are respectively $^{\circ}$ -1167 $kJmol^{-1}$, -286 $kJmol^{-1}$ and -1368 $kJmol^{-1}$ Standard enthalpy change of following reaction $CH_3CHO(g) + H_2(g) \rightarrow CH_3CH_2OH(l)$ in $kJmol^{-1}$ is, 1. -85 2. +85 3. -409 4. +409 5. -1082
- 22. Which of the following statement is false about the complex ions of 3d series.

1. $[CuCl_4]^{2-}$ Produces by Cu^{2+} with cone *HCl* is yellow coloured.

- 2. $[Ni(NH_3)_6]^{2+}$ poduces by Ni^{2+} with NH_3 is dark blue coloured.
- 3. $[Cr(NH_3)_6]^{3+}$ produces by Cr^{3+} with liquid NH_3 is violet coloured.
- 4. $[MnCl_4]^{2-}$ produces by Mn^{2+} , with conc. *HCl* is greenish yellow coloured.
- 5. $[Co(NH_3)_6]^{2+}$ produces by Co^{2+} , with NH_3 is yellowish brown coloured.

23.
$$N_2(g) + 3H_2(g) \Leftrightarrow 2NH_3(g)$$

24.

Following thermochemical data are given for the above reaction.

 $\Delta H_f^{\theta} [NH_3(g)] = -46 \, kJ \, mol^{-1}$

Standard entropy change of reaction $-232 \ J \ mol^{-1} \ K^{-1}$ which of the following is true about above reaction.

- 1. Above reaction is spontaneous at any temperature.
- 2. Above reaction is non spontaneous at any temperatures.
- 3. Above reaction is spontaneous above 396.55*K* temerature.
- 4. Above reaction is non-spontaneous below 396.55K temperature.
- 5. Above reaction is spontaneous at 496.55K temperature.





- 26. Which of following statement is false.
 - 1. $CaCl_2$ is added to decrease the melting point of NaCl in manufacturing sodium by the Down's cell method.
 - 2. In manufacturing sodium by Down's cell method, large electric current is passed under a low potential difference.
 - 3. $CaSO_4$ is precipitated at first tank in the manufacturing process of salt.
 - 4. Ni cathode and a Ti anode are used in manufacturing process of sodium hydroxide by the membrane cell method.
 - 5. Saponification is the first step in manufacturing process of soap.
- 27. Which of following statement is true.
 - 1. O_2 is released at anode when electrolyze acidified water using graphite electrodes.
 - 2. Cu is deposited on anode when electrolyze an aqueous $CuSO_4$ solution using Cu electrodes.
 - 3. $H_2(g)$ is released at cathode when electrolyze an aqueous $CuSO_4$ solution using inert electrodes.
 - 4. $H_2(g)$ is released at anode when electrolyze an aqueous Nacl solution using innert electrodes.
 - 5. Na(l) is given at anode when electrolyze of a Nacl solution using innert electrodes.

28.
$$CH_3 - C - O - C_2H_5$$

(i) excess CH_3MgBr / dry Ether
(ii) H_2O
 $A \xrightarrow{Na} B \xrightarrow{CH_3CH_2Br} D$

Respectively, structures of A,B and D, in above reaction scheme given by

- 298 K $25cm^3$ of $0.05 moldm^{-3} HCl(aq)$ solution 29. At is added 25 cm³ to of $0.1 \, moldm^{-3} NH_4OH(aq)$ solution. pH value of the producing solution is, (at 298 K $K_{b}(NH_{4}OH) = 1.8 \times 10^{-5} \, mol \, dm^{-3})$ 9.26 2. 4.74 3. 3.2 4. 10.8 1. 5.11.2
- 30. X is more soluble in $CHCl_3$ than in water and the relevant distribution coefficient is 10. 10g of X is contained in $100 \ cm^3$ of water. This aqueous solution is extracted for three times using three $10 \ cm^3$ portions of $CHCl_3$. Total mass of X extracted to the $CHCl_3$ is,
 - 1. 8.125 g 2. 9.25 g 3. 0.125 g 4. 8.75 g 5. 9.875 g
- For each of the questions 31 to 40, one or more responses out of the four responses (a), (b), (c) and (d) given is /are correct. Select the correct response/responses in accordance with the instructions given on your answer sheet, mark
 - (1) If only (a) and (b) are correct.
 (2) If only (b) and (c) are correct.
 (3) If only (c) and (d) are correct.

- (4) If only (d) and (a) are correct.
- (5) If any other number or combination of responses is correct.

Summary of above Instructions,

1	2	3	4	5
Only (a) and (b)	Only (b) and (c)	Only (c) and (d)	Only (a) and (d)	Any other number or
are correct	are correct	are correct	are correct	combination of
				responses is correct

31. Following equilibrium exists in a closed vessel at a constant temperature.

 $2A(g) + 2B(g) \rightleftharpoons C(g) + 2D(g)$

Gas C is introduced to the vessel from outside and allowed to attain the equilibrium again under the earlier temperature. Which of following statements is / are true about the new equilibrium.

- a) Partial pressures of D gas is increased.
- b) Amount of B(g) is decreased.
- c) Total pressures in the vessel is increased.
- d) Partial pressure of C(g) is increased.
- 32. CO_2 releases by reaction with aqueous Na_2CO_3
 - Give a yellow precipitate with 2,4 DNP
 - Silver mirror is given with the ammonical silver nitrate,

Which of followings give all above observations.

(a)
$$\begin{array}{ccc} OH \\ O \\ C - H \end{array}$$
(b) $\begin{array}{c} COOH \\ O \\ H_3C - C = O \end{array}$
(c) $\begin{array}{c} COOH \\ O \\ C - H \end{array}$
(d) $\begin{array}{c} CH_2COOH \\ O \\ CH_2 - C - H \end{array}$
(e) $\begin{array}{c} OOH \\ O \\ C - H \end{array}$
(f) $\begin{array}{c} OH \\ O \\ C - H \end{array}$
(h) $\begin{array}{c} CH_2COOH \\ O \\ CH_2 - C - H \end{array}$

- 33. Following statements are about some industrial processes. Which of those statement / s is / are correct.
 - (a) Ca^{2+}, Mg^{2+} and SO_4^{2-} are possible as impurities in salt collected as crystals.
 - (b) (NaCl(s)) is used to reduce the melting point of ice.
 - (c) Anions can exchange through the ion selective membrane in the production of *NaOH* by membrane cell method.
 - (d) In manufacturing Na_2CO_3 by Solvay process, high temperature is suitable because dissolution of $NH_3(g)$ in brine solution is endothermic.

34. Following plot illustrates the variation of vapor pressure with temperature of some compounds. According to the plot, which of following/s is / are true.



- (a) Because intermolecular forces are weak boiling point of A is low.
- (b) Intermolecular forces of B are stronger than intermolecular forces of C.
- (c) Boiling point of D high, because inter-molecular forces are strong.
- (d) At a constant temperature, saturated vapour pressure of A is higher than the saturated vapour pressure of D.
- 35. Which of following mechanism steps are not feasible.

(a)
$$CH_3CH = CH_2$$
 $H^{8+} - Br \rightarrow CH_3^+ CHCH_3 + Br$

(b)
$$H - C \xrightarrow{H} C1 \longrightarrow CH_3 + HC1$$

11

(c)
$$CH_3CH = CH_2$$
 Br $GR = CH_3C^+H CH_2Br + \overline{Br}$

- $(d) \qquad CH_3 \overset{H}{\overset{L}{\overset{}_{c}}} \longrightarrow CH_3 C^+_{H_2} + \overline{Br} \xrightarrow{OH} CH_3 CH_2 OH + \overline{Br}$
- 36. Which of following statement / s is / are correct about the aqueous solutions of given salts.
 - (a) In $CH_3COO Na(aq)$ solution $[H_3O^+(aq)] > [\overline{OH}(aq)] OH^-$
 - (b) In $CH_3COO\ Li\ (aq)$ solution $[H_3O^+(aq)] < [\overline{OH}\ (aq)]\ OH^-$
 - (c) In NH_4Cl (aq) solution $[H_3O^+(aq)] > [\overline{OH}(aq)] OH^-$
 - (d) In $CH_3N^+H_3NO_3^-$ solution (aq) $\left[\overline{OH}(aq)\right] > [H_3O^+(aq)] OH^-$

37. The indicator *HIn* with $p_{KIn} = 4.0$ at 298K, is dissociated in an aqueous solution as given below. $HIn(aq) + H_2O(l) \rightleftharpoons H_3O^+(aq) + In^-(aq)$ yellow red

Which of following statement / s is / are correct

- (a) This indicator shows yellow colour in solution with pH = 7
- (b) This indicator is suitable for a titration between a weak acid and a strong base.
- (c) This indicator is suitable for a titration between a strong acid and a weak base.
- (d) This indicator is not suitable for a titration between 1×10^{-4} mol dm⁻³ HCl (aq) and 1×10^{-4} mol dm⁻³ NaOH (aq)

- 38. Which of following /s not base assumption of molecular kinetic theory of gasses.
 - (a) Total kinetic energy of a system remains constant when taking place collisions among gas molecules.
 - (b) Collisions of gas molecules on the wall of container produce the pressure of gas.
 - (c) In gas, the molecules move in equal speeds and are with continuous random motions.
 - (d) Attraction forces are possible among gas molecules.

39. Which of following statement / s are true about the Limonene.

CH₃ CH₂ (a) All carbon atoms lie on same plane. (b) All C – C bond distances are same (c) Four carbon atoms are with sp^2 hybridization. (d) All C – C – C bond angles are same.

40. Which of following pair / pairs (is / are) act as buffer solutions.

(a) NH_4OH / NH_4Cl	(b) $HClO_4$ / $NaClO_4$
(c) HNO ₃ / KNO ₃₀	(d) HCOOH/ HCOONa

• In question numbers 41 to 50, two statements are given in respect of each question. From the table given below, select the response out of the responses (1), (2), (3), (4) and (5) that best fits the two statements and mark appropriately on your answer sheet.

1 st Statement	2 nd Statement	Response
True	True and 1 st statement is explained correctly	1
True	True and 1 st statement is not explained correctly	2
True	False	3
False	True	4
False	False	5

	1 st Statement	2 nd Statement
41.	$0-0$ bond distance of H_2O_2 molecule is less than the $0-0$ bonds distance of O_3 molecules.	Both H_2O_2 and O_3 are with two stable resonance structures.
42.	All carboxylic acids are well soluble in water.	All carboxylic acids produce inter-molecular hydrogen bonds with water.
43.	At a constant temperature, entropy decreases when pressure increases in the equilibrium system. $2SO_2(g) + O_2(g) \rightleftharpoons 2SO_3(g)$	According to Le-Chateliers principle, equilibrium shifts to right side to reduce the pressure.
44.	$MgCO_3(s)$ decomposes on heating, but $Na_2CO_3(s)$ does not decomposes on heating.	Decomposition ability increases when ionic character of a compound increases.

45.	Reactivity of tertiary alkyl halides with nucleophiles is less than the reactivity of secondary alkyl halides.	Tertiary carbocation is more stable than the secondary carbocation.
46.	Maximum temperature at which an equilibrium can be produce between liquid water and water vapour is the critical temperature.	No attraction forces among water molecules at higher temperatures than the critical temperature.
47.	In second step of soap manufacturing process, part of glycerin is kept with soap without removing all glycerin.	Glycerin is used to manufacture cosmetic products.
48.	3 – bromo-1-butene shows the enantiomerism.	3 - bromo - 1 - butene is with a pair of isomers that are mirror images of each other.
49.	Needed S^{2-} ion concentration for the precipitation of <i>NiS</i> from aqueous Ni^{2+} solution is higher than the S^{2-} ion concentration needed to precipitate <i>CuS</i> from <i>Cu</i> ²⁺ solution.	Solubility product of <i>NiS</i> less than the solubility product of <i>CuS</i>
50.	Aqueous hydrogen flouride is a weak acid. $(HF(aq))$	H - F bond is a strong bond.

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ஆவர்த்தன அட்டவணை Periodic Table

	1 H												22207					2 He
	3	4											5	6	7	8	9	10
	ц	Be											в	C	N	0	F	Ne
1	11	12											13	14	15	16	17	18
	Na	Mg											AL	Si	P	S	a	Ar
	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
1	K	Ca	Sc	π	v	Cr	Mn	Fe	Co	Ni	Cu	Zn	Ga	Ge	As	Se	Br	K
	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54
5	Rb	Sr	Y	Zr	Nb	Mo	Tc	Ru	Rh	Pd	Ag	Cđ	In	Sn	Sb	Te	1	Xe
	55	56	La-	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86
5	Cs	Ba	Lu	Hſ	Ta	W	Re	Os	Ir	Pt	Au	Hg	11	15	Bi	Po	At	R
	87	88	Ac-	104	105	106	107	108	109	110	111	112	113					
	Fr	Rs	Lr	Rf	Db	Sg	Bh	Hs	Mt	Uun	Uuu	Uub	Uut	1				

57	58	59	60	61	62	63	64	65	66	67	68	69	70	71
La	Ce	Pr	Nd	Pm	Sm	Eu	Gd	ТЪ	Dy	Ho	Er	Tm	Yb	Lu
89	90	91	92	93	94	95	96	97	98	99	100	101	102	103
Ac	Th	Pa	U	Np	Pu	Am	Cm	Bk	Cr	Es	Fm	Md	No	Lr

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	Secon	d Term Test - Grade 13- 2018			

- Periodic Table is provided.
- Use of calculations is not allowed.
- Part A Structures Essay
- Answer all the questions on the question paper itself'
- Write your answer in the space provided for each question. Please note that the space provided is
- sufficient for the answer and that extensive are not expected.
- Part B and Part C Essay
- Answer four questions selecting two questions from each part. Use the paper supplied for this purpose.

Part A - Structured Essay

Answer all four questions on this paper itself. (Each question carries 10 marks)

- 01. (a) Cyanic acid (*HCNO*) is a monobasic weak acid
 - (i) Draw the most acceptable Lewis structure for cyanic acid (HCNO)

(ii) Draw the resonance structures for this cyanic acid

(iii) Based on the Lewis structure drawn in (i) above, complete the table is given below.

Atom	0	С	N
1. Hybridization			
2. VSEPR pairs			
3. Electron pair geometry			
4. oxidation number			

(b) Consider the following chemical species

$H_3O^+\,,\;NO_2$, CH_2O , $CO_2,\;BF_3$, N_2O

Which one of the above species is more suitable for the given property in the table

i	Linear polar molecule	
ii	Trigonal planer non - polar molecule	
iii	Having with zero oxidation state for central atom	
iv	Electron pair geometry of central atom is tetrahedral	
v	can dimerize when reacts with water	
vi	Weakly acidic	

- (C) Explain by giving reasons
 - i. NaCl is soluble in water but CCl_4 is not soluble in water

ii. Reactivity of Na is greater than that of Mg

••••••			
•••••••••••••••••••••••••••••••••••••••	•••••••••••••••••••••••••••••••••••••••	•••••••••••••••••••••••••••••••••••••••	•••••••••••••••••••••••••••••••••••••••

iii. Ionic property of AgF is less than that of AgI

(02) (a) A and B are the third period elements. By reacting A and B can form a non - polar covalent compound (X) having with A as the central atom. The shape and electron pair geometry of X is trigonal bipyramidal X can react with water to produce two acids as a strong acid D and a weak acid C

(i) Identify element A and B by giving chemical symbols

Α -

В -

- (ii) Draw the Lewis structures for X, C and D
 - X C D

(iii) By reacting A and B can form a polar - covalent compound write the molecular formula for this polar compound.

(b) M is a solid element which can react with water at room temperature but It is not a d - block element. M does not form solid bicarbonate. Hydroxide of M is basic and its sulphate is completely dissolved in water.

- (i) Identify element M
- (ii) Write the balanced chemical equation for the reaction of *M* with water

- (iii) Write the balanced chemical equation for the thermal decomposition of the nitrate of M
- (iv) What is the Flame color for M when doing the Flame test
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(c) *A* and *B* are sodium containing compounds. See the given reaction and observations regarding with A and B



(iv) PH value of the 0.1 mol dm^{-3} HA solution at $25^{\circ}C$ is 4. Calculate the dissociation constant of HA at $25^{\circ}C$

- (b) Saturated vapour pressure of pure liquid A is $80 \ mmHg$ at 300K. When liquid A and liquid B are mixed $300 \ K$ the resulting mixture is an ideal solution (liquid B is also volatile) mole fraction of B in liquid phase is 0.4 at 300k total pressure of the vapour phase is $88 \ mmHg$ at 300k
 - (i) Calculate the saturated vapour pressure of pure B at 300k and state the assumptions that you made when doing this calculation.



(i) Draw an appropriate vapour pressure composition phase diagram for the above system and should be completely labeled it.

(C) Rate constant for $2N_2O_5 \rightarrow 4NO_2 + O_2$ is $3.0 \times 10^{-5} \text{S}^{-1}$ at 300k When rate of the reaction at 300k is $2.4 \times 10^{-5} \text{ moldm}^{-3} \text{S}^{-1}$ Calculate the concentration of N_2O_4 at 300k

(04) (a)	А	is an organic compound which contains only C, H and O
	1.	A reacts with Na_2CO_3 to evolve CO_2
	2.	One mole of A can react with excess Na to give 2.0 mole of H_2
	3.	A is an optically active compound
	(i)	Draw the structure for A by considering minimum number of atoms.
	(ii)	Write the IUPAC name of A
	(iii)	Show how compound A could be synthesized by using CH_3Br as the staring compound in less than 6 steps.

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(b) (i) Draw the structure of the major product of following reactions.



(iii) i. Complete the conversion is given below.



ii. Write the name of the reaction type of step 01 and 03

	Step 1
	Step 3
(c) i.	Write the reaction mechanism for the reaction of CH_3COCl with C_2H_5OH
ii.	According to the reaction mechanism respectively the acid chloride, Name the reaction type.

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Second Term Test - 2018

Chemisty 2018 - PART B

• Answer two question only (Each question carries 15 mark)

- (05) (a) (i) Derive the mathematical expression for the ostwald's dilution law by considering weak base of B(aq)
 - (ii) Calculate the Degree of dissociation of 5 $moldm^{-3} B(aq)$ solution dissociation constant of B is of $4.5 \times 10^{-5} moldm^{-3}$ at $25^{\circ}C$
 - (iii) Calculate the pH value of the above solution at $25^{\circ}C$
 - (b) (i) Calculate the *pH* value of the mixture of 500 cm^3 of $0.2 \text{ moldm}^{-3} \text{ CH}_3COOH(aq)$ and 500 cm^3 of $0.2 \text{ moldm}^{-3} \text{ HCl cm}^3$ at $25^{\circ}C$ state the assumptions that you made when doing this calculation. Degree of dissociation of $CH_3COOH(aq)$ at $25^{\circ}C \text{ }1.75 \text{ x } 10^{-5} \text{ moldm}^{-3}$.
 - (ii) When 6.0*g* of *NaOH* is added into the above (I) mixture at $25^{\circ}C$ calculate the P^H value of the resulting solution (ignore the changing of volume due to the addition of *NaOH*)
 - (c) (i) CH₃COONH₄ (aq) Can behave as a buffer solution. explain the buffer action of this solution.
 (ii) (NH₄)₂CO₃ (aq) is a basic solution explain this by giving reasons,
- (06) (a) By dissolving 6.5g of a mixture of Na_2CO_3 and $NaHCO_3$ in water It was prepared $1 dm^3$ of the solution. By getting $25 cm^3$ of the prepared solution titrated with $0.1 mol dm^{-3} HCl$ with the presence of methyl orange as an indicator. the end point was $25 cm^3$. calculate the mass percentage of Na_2CO_3
 - (b) Consider the electrochemical cell is given below.



 $Pt(s) / Fe^{2+}(aq), Fe^{3+}(aq) E^{\theta} = +0.75V$ $Pt(s) / I_2(aq), I^-(aq) E^{\theta} = +0.54V$

- (i) Name the anodic and cathode
- (ii) Write the anode and cathodic reactions when the cell is operating
- (iii) Write the cell reaction.
- (iv) calculate the electromotive force of the cell
- (v) Write the cell notation for the give cell
- (c) When A (s) and B (g) were heated in a closed container at $930^{\circ}C$ they reacted as

 $A(s) + B(g) \rightleftharpoons C(g) + D(g)$ given a dynamic equilibrium at the equilibrium 0.2 moles of B was in the container and total pressure of the container was $1 \times 10^7 Pa$ ($RT = 10^4 Jmol^{-1}$)

- (i) Calculate the number of moles of B(g) at the biginig
- (ii) Calculate the K_p at 930^o C
- (iii) Calculate the K_c by using the K_p
- (iv) explain what happens to the total pressure of the container after addition of some amount of solid A into the system at same temperature.
- (07) (a) Show how you would synthesize compound $H C \equiv C CH_2OCH_2 CH = CH_2$ by using $HO CH_2CH_2CH_2Cl$ as the starting organic compound.
 - (b) explain following by giving reasons
 - (i) Acetic acid is more acidic than phenol
 - (ii) Ethyl amine is more basic than ethanol
 - (iii) Phenol does not participate for the nucleophilic substitution reactions.
 - (c) Using only the chemicals given in the list, show how you would carry out the following conversion.

$$CH_{3}CH_{2}CH_{2}Br \rightarrow CH_{3} - \begin{array}{c}Cl & Br\\ | & |\\CH_{3} - C - CH_{2} - C - CH_{3}\\ |\\CH_{3} & H\end{array}$$

list of chemicals. PCC, alcoholic KOH, HBr, PCl₅, NaOH, NaBH₄, H₂SO₄

Part - C ESSAY

• Answer two question only (Each question carries 15 marks)

- (08) (a) M is a s- block element. Sulphate of M is water soluble but its carbonate is insoluble in water. Hydroxide of M is insoluble in NaOH but soluble in HCl M reacts with steam and form its oxide as a product of M
 - (i) Identify element M
 - (ii) Give reasons for the insoluble of hydroxide of M in NaOH but soluble in HCl
 - (iii) Write the balanced chemical equation for the reaction of M with water
 - (iv) If you are provided the two samples as nitrate of M and $NaNO_3$ how to identify these two from each other.
 - (b) X is white solid compound. When X is heated it gave Y as a white solid and colorless gas Z. Y can react with dil. *HCl* to give a brown color gas. When Y is heated with NH_4Cl . It gives colorless gas D and compound E. when X is heated with $(NH_4)_2 SO_4$. it gives colorless gas G and F as a white solid when E and F are tested for flame test both given yellow color flame. When D is heated with Ca it gives H as a white solid. H can react with water to give an alkaline solution (I) and NH_3
 - (i) Give the chemical formulae or symbols for X, Y, Z, E, F, D, H and I
 - (ii) Give balanced chemical equations which took place in the above given procedure.

(c) A, B, C and D are the aqueous solution having with a single cation. Tests 1, 2, and 3 were carried out to identify the cations. The tests and observations are given below.

Test	А	В	С	D
(1) acidified with dill <i>HCl</i>	-	black ppt	orange ppt	-
and added $H_2S(g)$				
(2) added excess	dark blue color	dark blue	-	gave a white ppt
NH_4OH solution	solution	color solution		then dissolved to
dropwise				give colorless
				solution
(3) alkalized and then	black ppt	black ppt	orange ppt	white ppt
added H_2S				

Identify the cations in A, B, C and D solution.

- (09) (a) When NH_3 and $NaNO_2$ were added in to a $Co_2(SO_4)_3$ solution Co^{3+} ion formed two complex as A and B with NH_3 , NO_2^- and SO_4^{2-} mass percentage of A and B are very same Co = 20.6% H = 5.2% N = 29.4% O = 33.6% S = 11.2%When excess $Bacl_2$ solution was added into the solution having with 3 x 10⁻⁴ moles of A. It gave 0.0816g of solid $Baso_4$ but B does not give precipitation with $Bacl_2$ (Co = 57, S = 32, O = 16, N = 14, H = 1, Ba = 137)
 - (i) Calculate the empirical formula of A or B
 - (ii) By giving reasons, deduce the chemical formulae of A and B
 - (iii) Write the *IUPAC* name of *A* and *B*
 - (b) P and Q are the inorganic compounds having with anions and cations. Test carried out along with observation to identity them are as Follows.

Test	Observations		
(1) mixing of aqueous solution of P and Q and then	gave Z as a white ppt and colured		
filter off	solution of <i>D</i>		
(2) added $K_3[Fe(CN)_6]$ solution in to a portion of	gave blue color solution		
aqueous solution of D			
(3) Z was heated with water and kept to cool	z dissolved in hot water and when it		
	was cold, formed needle shape		
	crystals.		
(4) Added newly prepared $FeSO_4$ to D and then after	gave a brown ring		
added few drops of conc. H_2SO_4			
(5) P and Q heated separatly	gave a brown color gas only by P		
(6) added $Na_2S_2O_3$ solution in to the aqueous solution	gave a white ppt		
of P			
(7) heated white ppt of test (6)	turned in to black ppt		

(i) Write the chemical formulae for P and Q

(ii) What is the species which involve to give blue color

(iii) Write the balanced chemical equations taking place in tests 5, 6 and 7

- (10) (a) In a given aqueous solution contains $0.01 \ moldm^{-3} \ Ag^+$ and $0.01 \ moldm^{-3} \ Ba^{2+}$ at $25\ ^{0}C \ K_2 CrO_4$ Solution is added slowly while mixing the solution at $25\ ^{0}C \ Ag_2 CrO_4$ (s) of $K_{SP} = 1.1 \ x \ 10^{-12} mol^3 dm^{-9} \ BaCrO_4$ (s) of $K_{SP} = 2.2 \ x \ 10^{-10} mol^2 dm^{-6}$
 - (i) Calculate the minimum concentration of CrO_4^{2-} required in solution to initiate the precipitations of Ag_2CrO_4 and $BaCrO_4$ at 25 °C and state assumptions if any you used in the above calculations
 - (ii) According to above calculation which precipitate was able to get at the first.
 - (iii) Calculate the cation concentration that remains in solution of the salt when precipitated first when the second salt begins to precipitate.
 - (iv) Is it successful method, addition of K_2CrO_4 in to the solution to remove Ag^+ ions from Ba^{2+} ions give reasons for your answer.
 - (b) The following procedure was used to determine the concentration of SO_3^{2-} , SO_4^{2-} and $C_2O_4^{2-}$ in the aqueous solution.
 - Step 1 By getting 50 cm^3 of the given aqueous solution. Added excess HNO_3 and $BaCl_2$ and measured dry mass of the precipitate as 0.233 g
 - Step 2 By getting another 50 cm^3 of the given solution it was needed 50 cm^3 of acidified 0.1 mol $dm^{-3}KMnO_4$ to react. When added excess HNO_3 and $BaCl_2$ into the resulting solution it was obtained a precipitate dry mass of the precipitate was 0.699 g

(Ba = 137, S = 32, C = 12, O = 16)

- (i) Write balanced chemical equations for the reactions taking place in step 01 and step 02
- (ii) Calculate the concentration of SO_3^{2-} , SO_4^{2-} and $C_2O_4^{2-}$
- (c) You are provided an aqueous solution having with Ag^+ , Cu^{2+} , Cr^{3+} , Ba^{2+} and Zn^{2+} only. give a procedure to identify each cation in the solution by using your knowledge of group separation.

