



Second Term Test - Grade 12 - 2018

Index No : **Chemistry I** **Two Hours**

Answer all the questions .
 • **In each of the question 1 to 50 ,pick one of the alternatives from (1) , (2) , (3) , (4) , (5) which is correct or most appropriate and mark your response on the answer sheet with a cross (X) in accordance with the instructions given on the back of the answer sheet.**

Universal gas constant	R	=	8.314 JK ⁻¹ mol ⁻¹
Avogadro constant	N _A	=	6.022×10 ²³ mol ⁻¹
Plank's constant	h	=	6.626 ×10 ⁻³⁴ J.s
Velocity of light	c	=	3×10 ⁸ ms ⁻¹

- The gold foil experiment of Rutherford was assisted by,
 - James Chadwick and Arnest Marsdon
 - J.J. Thompson and James Chadwick
 - Arnest Marsdon and J.H.W. Geiger
 - H.G.J. Morsely and J.H.W. Geiger
 - N.H.D. Bhor and Arnest Marsdon.
- Energy of a purple coloured radiation of light with wave length 410 nm is ?
 - $\frac{6.626 \times 10^{-34} \times 3 \times 10^8}{410}$ J
 - $\frac{6.626 \times 10^{-34} \times 3 \times 10^8}{410 \times 10^{-6}}$ J
 - $\frac{6.626 \times 10^{-31} \times 3 \times 10^8}{410 \times 10^{-6}}$ J
 - $\frac{6.626 \times 10^{-34} \times 3 \times 10^8}{410 \times 10^{-9}}$ J
 - $\frac{6.626 \times 10^{-31} \times 3 \times 10^8}{410 \times 10^{-9}}$ J
- The correct ascending order of the radius of given ions is represented by?
 - $Na^+ < Mg^{2+} < Al^{3+} < N^{3-} < O^{2-}$
 - $Al^{3+} < Mg^{2+} < Na^+ < O^{2-} < N^{3-}$
 - $Mg^{2+} < Na^+ < Al^{3+} < N^{3-} < O^{2-}$
 - $Na^+ < Mg^{2+} < Al^{3+} < N^{3-} < O^{2-}$
 - $Mg^{2+} < Al^{3+} < Na^+ < N^{3-} < O^{2-}$
- Which of the following compound has the incorrect IUPAC name.

Compound	ICPAC name
1. N ₂ O ₃	dinitrogen trioxide
2. Na ₂ O	disodium oxide
3. NaH ₂ PO ₄	Sodium dihydrogen phosphate
4. KClO	Potassium hypochlorite
5. NaHCO ₃	Sodium hydrogen carbonate

5. 10.0 g of contaminated sample of $CaCO_3$ was heated throughly. At standard temperature and pressure volume of gas evolved was $1.792 dm^3$. Mass percentage of $CaCO_3$ in the sample is ?

(At standard temperature and pressure volume of 1 mol of a gas is $22.4 dm^3$,
 $Ca = 40$, $C = 12$, $O = 16$)

1. 20% 2. 75% 3. 80% 4. 25% 5. 90%

6. Oxidation state of Nitrogen is -2 in ?

1. NH_2OH 2. NF_3 3. N_2O_4 4. N_2H_4 5. NO_2F

7. The election pair geometry and the shape of $XeOF_4$ respectively is,

1. Octahedral, square pyramidal. 2. Square pyramidal, Octahedral
 3. Triangular pyramidal, Sea - Saw 4. Sea Saw, triangular bipyramidal
 5. Octahedral, square planner

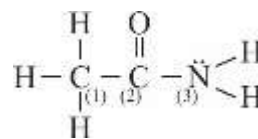
8. 26.5 mg of Na_2CO_3 was dissolved in $500 cm^3$ of water. Molality of the solution are?

(Density of water is $1 g cm^{-3}$, $Na = 23$, $C = 12$, $O = 16$)

1. $0.25 mol kg^{-1}$ 2. $5 \times 10^{-4} mmol kg^{-1}$ 3. $0.25 mmol kg^{-1}$
 4. $5 \times 10^{-4} mol kg^{-1}$ 5. $5 \times 10^{-5} mol kg^{-1}$

9. Hybridization of atoms numbered as (1), (2), (3) in the following molecule respectively is ?

1. SP^2 , SP^2 , SP^3 2. SP^3 , SP^2 , SP^3
 3. SP^3 , SP , SP^3 4. SP^2 , SP^3 , SP^2
 5. SP^3 , SP , SP^2



10. $100 cm^3$ of $0.1 moldm^{-3} NaCl$ solution was mixed with $100 cm^3$ of $0.05 moldm^{-3}$, $CaCl_2$ solution and it was diluted with water till the total volume is $250 cm^3$. Concentration of chloride ions in the new solution in $moldm^{-3}$?

1. 0.02 2. 0.08 3. 0.01
 4. 0.06 5. 0.1

11. Total pressure of the mixture containing two gases X and Y is $8 \times 10^5 Pa$, while partial pressure of gas X is $5 \times 10^5 Pa$ Total number of gaseous moles in the mixture was 1.6 mol. If molar mass of Y is $4 g mol^{-1}$, mass of the gas Y in the mixture is?

1. 0.24 g 2. 2g 3. 1.2 g
 4. 4 g 5. 2.4 g

12. Standard formation enthalpies of ethane ($C_2H_6(g)$), $CO_2(g)$ and $H_2O(l)$ are -84.7 kJmol^{-1} , -394 kJmol^{-1} and -286 kJmol^{-1} respectively. The standard combustion enthalpy of ethane [$C_2H_6(g)$] in kJmol^{-1} is,
1. -680 2. +1561.3 3. -1561.3 4. -595.3 5. -1444.7
13. Which of the following statement is false?
1. Rest of the universe other than the portion selected for study is called, the environment.
 2. Systems where there is an exchange of energy matter and work across the boundary are called open system.
 3. Boundary of closed system is permeable to matter.
 4. Systems where there is no exchange of energy matter or work across the boundary are called isolated systems.
 5. The surface that separates the system and the environment is called the boundary.
14. Which of the following statement is false regarding emission spectrum of atomic hydrogen.
1. Wave length difference among the first two lines of lyman series is lower than the wave length difference among first two lines of Bhamer series.
 2. Wave length difference of first two lines of Bhamer series is higher than the wave length difference among the first two lines of paschen series.
 3. Energy difference between first two lines of Bhamer series is lower than the energy difference among first two lines of lyman series.
 4. Energy difference between first two lines if Bhamer series is equal to the energy difference between 2nd and 3rd lines in lyman series.
 5. Frequency difference between the first two lines of Bhamer series is lower than the frequency difference between first two lines of lyman series.
15. Which of the following set of quantum numbers is not possible?
1. 1, 0, -1, $+\frac{1}{2}$ 2. 2, 1, 0, $-\frac{1}{2}$ 3. 3, 2, -1, $-\frac{1}{2}$
4. 4, 3, -2, $+\frac{1}{2}$ 5. 2, 1, -1, $+\frac{1}{2}$
16. 0.0053 g of solid Na_2CO_3 was dissolved in water and diluted till the total volume is 500 cm^3 . Concentration of Na^+ ions in the solution, in ppm? (Na = 23, C = 12, O = 16) ($1 \text{ ppm} = 1 \text{ mgdm}^{-3}$)
1. 4.6 2. 2.3 3. 46 4. 23 5. 230
17. Metal M react with dilute $HCl(aq)$ as well as with dil $NaOH(aq)$ and evolve a gas $X_2(g)$. The metal M and the gas $X_2(g)$ respectively are?
1. Mg, H_2 2. Ba, O_2 3. Al, H_2 4. Al, O_2 5. Ba, H_2
18. Total number of d electrons in the +3 cation formed by an element with the atomic number 42 is?
1. 15 2. 2 3. 3 4. 12 5. 13

19. De – Broglie wave length of a ball moving in 10 ms^{-1} , with the mass of 200g .
1. $1.100 \times 10^{-35} \text{ m}$
 2. $3.313 \times 10^{-34} \text{ m}$
 3. $3.313 \times 10^{-35} \text{ m}$
 4. $1.100 \times 10^{-34} \text{ m}$
 5. $6.626 \times 10^{-34} \text{ m}$
20. Five standard enthalpies and five processes were given as pair. In which of the following pair does not explain the relevant standard enthalpy by given process.

	Standard Enthalpy	Process
1	Standard formation enthalpy of $\text{CH}_3\text{OH}(l)$ at 298 K	$\text{C}(s)\text{graphite} + 2\text{H}_2(g) + \frac{1}{2}\text{O}_2(g) \rightarrow \text{CH}_3\text{OH}(l)$
2	Standard second electron affinity of Oxygen	$\text{O}^-(g) + e \rightarrow \text{O}^{2-}(g)$
3	Standard lattice enthalpy of $\text{MgCl}_2(s)$	$\text{Mg}^{2+}(g) + 2\text{Cl}^-(g) \rightarrow \text{MgCl}_2(s)$
4	Standard second ionization enthalpy of Ca	$\text{Ca}(g) \rightarrow \text{Ca}^{2+}(g) + 2e$
5	Standard sublimation enthalpy of Na	$\text{Na}(s) \rightarrow \text{Na}(g)$

21. Which of the following statement is incorrect?
1. Polarizing power of Li^+ is higher than that of Na^+
 2. Polarizability of Cl^- is lower than that of F^-
 3. Polarizing power increases when decreasing the radius of cation.
 4. Polarizability increases when increasing the radius of anion.
 5. Ionic property of NaF is higher than the ionic property of NaCl .
22. Which of the following atom emits the highest amount of energy when gaining an electron?
1. Li
 2. Na
 3. F
 4. Cl
 5. N
23. Standard mean bond dissociation enthalpy values of $\text{C} - \text{C}$, $\text{C} - \text{H}$ and $\text{H} - \text{H}$ bonds at 298K are $+348 \text{ kJmol}^{-1}$, $+412 \text{ kJmol}^{-1}$ and $+436 \text{ kJmol}^{-1}$ respectively. Standard sublimation enthalpy of $\text{C}(s, \text{graphite})$ is $+790 \text{ kJmol}^{-1}$ Standard formation enthalpy of $\text{C}_2\text{H}_6(g)$ in kJmol^{-1} is?
1. -14
 2. +14
 3. +68
 4. -68
 5. +82
24. Which of the following statement is false ?
1. Non of the elements of d – block, exist as liquids in room temperature.
 2. Non of the elements of p – block exist as liquids in room temperature.
 3. The number of elements in gaseous state as diatomic form at room temperature in p – block is 4.
 4. All the bicarbonates formed by the elements of group I exist in solid state.
 5. Aqueous solutions of bicarbonates formed by the elements of group II produce their oxides in the presence of heat.

25. 0.60 g of $C_2H_4(g)$ in a vessel of $V\text{ dm}^3$ 1.52 g of gas M in another vessel of same volume at same temperature M would be ? (Assume C_2H_4 and gas M behave ideally.) (C - 12, H -1)
1. O_2
 2. Cl_2
 3. CH_4
 4. CO_2
 5. SO_2
26. Standard enthalpy change of the reaction $X + Y \rightarrow Z$ is $+30\text{ kJ mol}^{-1}$ While the standard entropy change is $+60\text{ J mol}^{-1}K^{-1}$ This reaction is,
1. Spontaneous in all temperatures
 2. Non spontaneous in all temperatures.
 3. Spontaneous in temperatures higher than 500K
 4. Non spontaneous in temperatures lower than 500 K.
 5. Can't predict anything because nothing is known about the above reaction.
27. The correct ascending order of the electronegativity of nitrogen in the species NO_2^+ , NO_3^- , NH_4^+ , and NO_3^- is?
1. $NO_3^- < NH_4^+ < NO_2^- < NO_2^+$
 2. $NH_4^+ < NO_2^- < NO_3^- < NO_2^+$
 3. $NO_3^- < NO_2^- < NO_2^+ < NH_4^+$
 4. $NO_2^+ < NO_3^- < NO_2^- < NH_4^+$
 5. $NO_2^- < NO_3^- < NH_4^+ < NO_2^+$
28. The mass of $Na_2CO_3 \cdot 10 H_2O$ should be taken to prepare 250 cm^3 of 0.1 mol dm^{-3} Na_2CO_3 solution is ? ($Na = 23, C = 12, O = 16, H = 1$)
1. 7.15 g
 2. 71.5 g
 3. 2.65 g
 4. 26.5 g
 5. 2.86 g
29. 30 cm^3 of H_2SO_4 solution was required to neutralized 25 cm^3 of 0.05 mol dm^{-3} $NaOH$ solution. The concentration of H_2SO_4 solution in mol dm^{-3} is?
1. 9.34×10^{-2}
 2. 4.17×10^{-2}
 3. 4.17×10^{-1}
 4. 2.08×10^{-2}
 5. 2.08×10^{-1}
30. Root mean square speed of an ideal gas X at 300 K is $V_1\text{ ms}^{-1}$. What is the temperature, where the root mean square speed of X is twice ?
1. 600 K
 2. 927°C
 3. 1200°C
 4. 1473 K
 5. 927 K

- 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.

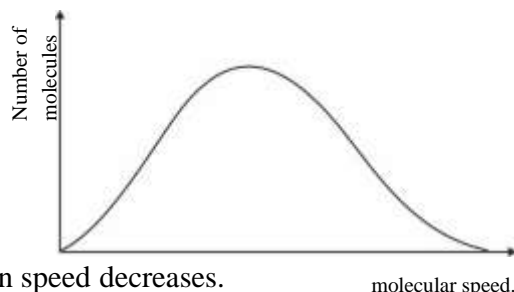
(4) If only (d) and (a) are correct.

(5) If any other number or combination of responses is correct.

Summary of above Instructions,

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

31. Which of the following statement / (s) is / are true?
- At constant temperature and constant pressure volume of gas proportional to number of gaseous moles.
 - At constant temperature density of a given gas proportional to the pressure.
 - At same temperature root mean square speed for any gas possess a same value.
 - Mean speed of a gas is a constant at constant temperature.
32. Which of the following statement / s is / are false.
- Enthalpy is thermodynamic property and function of state.
 - The change in a function of state depends on its initial state, final state and the root followed.
 - Entropy of a system is a measure of the randomness of the system.
 - Spontaneity of constant entropy system ($\Delta S = 0$) is determined by ΔH
33. Which of the following statement / s is / are true regarding the reactions of S block elements with water.
- Mg reacts with cold water evolving H_2 gas.
 - Be reacts with hot water evolving H_2 gas.
 - Li reacts with cold water evolving H_2 gas.
 - K reacts with cold water rapidly evolving H_2 gas.
34. At particular temperature distribution of the speeds of molecules in a gas is represented by the curve.
If the temperature decreases,
- Area under the curve does not change.
 - Maxima of the curve decrease.
 - Maxima of the curve shift to right.
 - Fraction of molecules with higher speed than the given speed decreases.



35. White solid compound X completely soluble in water. White precipitate is given when aqueous solution of $BaCl_2$ is added to an aqueous solution of X.
 (a) $NaOH$ (b) Na_2CO_3 (c) K_2SO_4 (d) KBr
36. Which of the following response has / have identical electron pair geometries.
 (a) CH_4, NH_3, H_2S (b) BCl_3, NH_3, PCl_3
 (c) PCl_3, NH_3, CO_2 (d) $BeCl_2, HCN, CO_2$
37. Which of the following is / are extensive property ?
 (a) Molr volume (b) Density (c) Volume (d) Heat capacity
38. Entropy increases in,
 (a) $CaCO_3(s) \rightarrow CaO(s) + CO_2(g)$
 (b) $N_2(g) + 3H_2(g) \rightarrow 2NH_3(g)$
 (c) $Li_2CO_3(s) \rightarrow Li_2O(s) + CO_2(g)$
 (d) $Na_2CO_3(s) + 2HCl(aq) \rightarrow 2NaCl(aq) + CO_2(g) + H_2O(l)$
39. Concentration of a very dilute aqueous solution is represented by ?
 (a) $mL L^{-1}$ (b) $mg kg^{-1}$ (c) $\mu L L^{-1}$ (d) $\mu g kg^{-1}$
40. Inter molecular attractions contain in an aqueous solution of KCl is / are ?
 (a) H Bonds (b) dipole – dipole attractions
 (c) Ionic bonds (d) Ion – dipole attractions.

- 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 explains the 1 st statement correctly	1
True	True but does not explain the first statement correctly	2
True	False	3
False	True	4
False	False	5

	1 st Statement	2 nd Statement
41.	Second ionization of $Na >$ second ionization of Mg	Nuclear charge of $Na^+ >$ Nuclear charge of Mg^+
42.	Emission spectrums for all elements with an unpaired electron can be explained using Bhor theory.	According to the Bohr theory there are definite energy levels around the nucleus that the electrons can travel.
43.	PH_3 has the minimum boiling point among NH_3 , PH_3 , AsH_3 and SbH_3	Relative molecular mass of NH_3 is lower than that of PH_3
44.	Compressibility factor reaches to zero, when decreasing the pressure of any real gas.	Strength of inter molecular attractions among gaseous molecules decreases when decreasing the pressure.
45.	At particular temperature root mean square speed of H_2 gas is higher than that of He	Molar mass of H_2 gas is lower than the molar mass of He gas.
46.	Melting points of alkali metals increases with increasing atomic number.	Atomic radius increases when going down a group.
47.	Enthalpy of a compound at standard conditions is equal to its standard formation enthalpy.	Enthalpy of the most stable state of elements under standard conditions is zero.
48.	Graphite conduct electricity while diamond is not.	There are delocalized electrons in diamonds.
49.	Both Al and Al_2O_3 show amphoteric, properties.	Both Al and Al_2O_3 react with acids as well as bases.
50.	When there is an oxidation, the reduction takes place simultaneously.	Electrons are gained in as oxidation while electrons are removed during reductions.

கால்கிதா வடிவ
ஆவர்த்தன அட்டவணை
Periodic Table

1	2																	10																																																												
1	H																	He																																																												
2	3	4											5	6	7	8	9	10																																																												
2	Li	Be											B	C	N	O	F	Ne																																																												
3	11	12											13	14	15	16	17	18																																																												
3	Na	Mg											Al	Si	P	S	Cl	Ar																																																												
4	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36																																																												
4	K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	Ga	Ge	As	Se	Br	Kr																																																												
5	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	Cd	In	Sn	Sb	Te	I	Xe																																																												
6	55	56	La-	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86																																																												
6	Cs	Ba	Lu	Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg	Tl	Pb	Bi	Po	At	Rn																																																												
7	87	88	Ac-	104	105	106	107	108	109	110	111	112	113																																																																	
7	Fr	Ra	Lr	Rf	Db	Sg	Bh	Hs	Mt	Uun	Uuu	Uub	Uut																																																																	
<table border="1" style="width: 100%; text-align: center;"> <tbody> <tr> <td>57</td><td>58</td><td>59</td><td>60</td><td>61</td><td>62</td><td>63</td><td>64</td><td>65</td><td>66</td><td>67</td><td>68</td><td>69</td><td>70</td><td>71</td> </tr> <tr> <td>La</td><td>Ce</td><td>Pr</td><td>Nd</td><td>Pm</td><td>Sm</td><td>Eu</td><td>Gd</td><td>Tb</td><td>Dy</td><td>Ho</td><td>Er</td><td>Tm</td><td>Yb</td><td>Lu</td> </tr> <tr> <td>89</td><td>90</td><td>91</td><td>92</td><td>93</td><td>94</td><td>95</td><td>96</td><td>97</td><td>98</td><td>99</td><td>100</td><td>101</td><td>102</td><td>103</td> </tr> <tr> <td>Ac</td><td>Th</td><td>Pa</td><td>U</td><td>Np</td><td>Pu</td><td>Am</td><td>Cm</td><td>Bk</td><td>Cf</td><td>Es</td><td>Fm</td><td>Md</td><td>No</td><td>Lr</td> </tr> </tbody> </table>																			57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	La	Ce	Pr	Nd	Pm	Sm	Eu	Gd	Tb	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	Cf	Es	Fm	Md	No	Lr
57	58	59	60	61	62	63	64	65	66	67	68	69	70	71																																																																
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Second Term Test - Grade 12 - 2018

Index No : **Chemistry II** **Three Hours**

- * *A Periodic Table is provided*
- * *Use of calculators is not allowed.*
- * *Universal gas constant, $R = 8.314 \text{ J K}^{-1} \text{ mol}^{-1}$*
- * *Avogadro constant, $N_A = 6.022 \times 10^{23} \text{ mol}^{-1}$*

□ PART A — Structured 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 answers are not expected.*

□ PART B and PART C — Essay

- * *Answer four questions selecting two questions from each part. Use the papers supplied for this purpose.*
- * *At the end of the time allotted for this paper, tie the answers to the three Parts A, B and C together so that Part A is on top and hand them over to the Supervisor.*
- * *You are permitted to remove only Parts B and C of the question paper from the Examination Hall.*

For Examiner's Use Only

Part	Question No.	Marks
A	1	
	2	
	3	
	4	
B	5	
	6	
	7	
C	8	
	9	
	10	
Total		
Percentage		

Final Mark

In Numbers	
In Letters	

Code Numbers

Examiner	
Checked by	1
	2
Supervised by	

Part - A – Structured Essay

(01) a. Arrange the following in the decreasing order of the property indicated in parenthesis.

i. C , N , O , P , Si (first ionization energy)

.....>>>>

ii. NaCl , $MgCl_2$, $AlCl_3$ (melting point)

.....>>

iii. H_2O_2 , O_2 , O_3 (O – O bond length)

.....>>

iv. Si , F , S , Cl (atomic radius)

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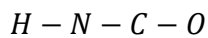
v. $HClO_2$, $HClO_4$, $HClO_3$, $HOCl$ (electronegativity of Cl atom)

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vi. N_2O , N_2O_3 , NO_2 (Number of resonance structures)

.....>>

(b) Questions (i) to (v) are based on the molecule isocyanic acid $HNCO$ Its skeleton is given below.



(i) Draw the most acceptable Lewis structure for this ion.

(ii) Draw possible resonance structures for above molecule and comment on their relative stabilities.

(iii) State the following given in the table below.

- i. Electron pair geometry around the atom
- ii. Shape around the atom
- iii. Hybridization of atoms

		<i>N</i> atom	<i>C</i> atom
i	Electron pair geometry		
ii	shape		
iii	Hybridization		

(iv) Identify the atomic / hybrid orbitals involved in the formation of the following bonds in the lewis structure drawn in part (i) above.

i. *H* and *N* H: N:

ii. *N* and *C* N: C:

(v) Sketch the shape of the lewis structure drawn in part (i) above indicating approximate values of bond angles.

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(c) Mention secondary interaction / (s) in following ions / molecules.

Molecule / Ion	Secondary Interaction / Interactions.
$NaCl$ (aq)	
HF (aq)	
I_3^- (aq)	
CO_2 (g)	
CCl_4 (l)	

(02) (a) (I) Solution of $NaCl$ is prepared by mixing 20 mg of $NaCl$ and 250g of water .

($Na = 23, Cl = 35.5$)

(i) Calculate molality of the solution.

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(ii) Calculate concentration of the solution in ppm.

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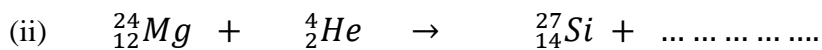
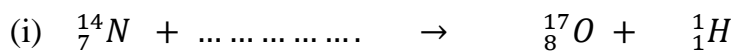
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(II) Complete the following Nuclear reactions.



(b)(I) Only C, K and Oxygen are present in an organic compound, and their mass percentages are 14.46%, C 46.99%, K, 38.55%, respectively. Relative molecular mass of the compound is about 165. (C = 12, K = 39, O = 16)

(i) Determine the molecular formula of the compound.

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.....
.....
.....
.....
.....

(ii) What is the anion of that compound ?

.....

(ii) Draw the Lewis structure of the anion ?

(II) An element Y belong to the S block produce two solid compounds A and B. When compound A reacts with water with formation of solution C, liberating a colour less gas D which turns the nestler reagent brown.

When CO_2 gas is bubbled through the solution C, a white precipitate E is formed which redissolved to give a clear solution. When E is a heated to $900^{\circ}C$ a white solid B is formed liberating a gas G.

When flame test is carried with the white solid E a brick red colouration is obtained.

i. Identify,

A

D

B

E

C

G

ii. Give balanced chemical equations for the reaction of,

1. Y with N_2

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2. A with H_2O

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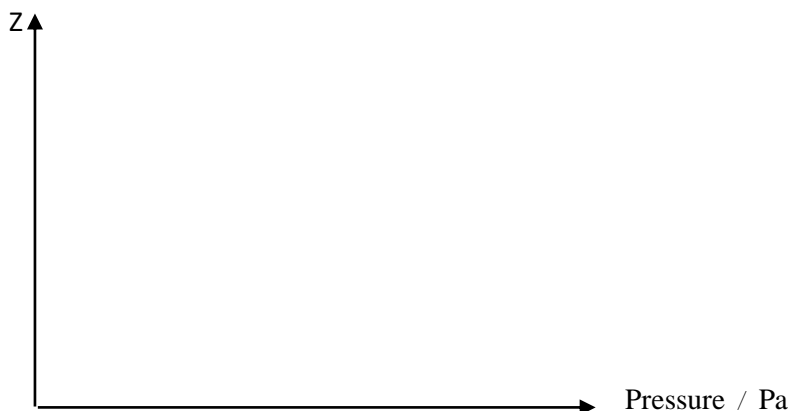
(03) (a) (I) What is meant by the compressibility factor (z) of a gas.

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ii. Draw in the diagram given below the plot showing the variation of the compressibility factor against pressure for each of the gasses NH_3 , He and an ideal gas. Label each of them.



iii. Using ideal gas equation and the equation for kinetic molecular theory, show that $\overline{C^2} = \frac{3RT}{M}$ where, M is the molar mass of the gas.

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iv. The element Y exist as triatomic gas at room temperature. If its root mean square speed at 227° is 500 ms^{-1} What is the relative atomic masses of Y .

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- (b) A gaseous mixture which contains the two gases $C_2H_6(g)$ and $C_3H_8(g)$ occupies a volume of 11.2 dm^3 , under STP conditions. When the mixture was subjected to complete combustion, 950 kJ amount of heat was evolved. Enthalpies of combustion of $C_2H_6(g)$ and $C_3H_8(g)$ are -1560 kJmol^{-1} and -2240 kJmol^{-1} respectively. Find the mass percentage of $C_3H_8(g)$ in the mixture. ($C = 12, H = 1$)

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(04) (a) I. Cr_2O_3 is an amphoteric oxide formed by Cr .

i. Write the IUPAC name of Cr_2O_3 .

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ii. Write the chemical formula of the sulphate formed with above oxidation number of Cr

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iii. Write oxidation state of Cr in.

i. CrO_2Cl_2

ii. $K_2Cr_2O_7$

iv. Cr_2O_3 from CrO_4^{2-} ions and H_2O in basic medium (presence of $NaOH$) with the reaction of H_2O_2 .

1. Write the oxidation half reaction.

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2. Write the reduction half reaction.

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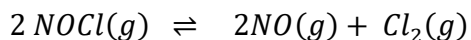
3. Write the balanced ionic equation.

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4. Write the balanced chemical equation.

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(b) I. Consider the thermochemical data given at 25° C for following chemical reaction.



	NOCl(g)	Cl ₂ (g)	NO (g)
$\Delta H_f^\theta / \text{kJmol}^{-1}$	+ 51.4	0.0	+ 90.0
$\Delta S^\theta / \text{Jmol}^{-1}\text{K}^{-1}$	+ 260.5	+233	+ 210

i. Calculate ΔH^θ for the above reaction.

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ii. Calculate ΔS^θ for the above reaction.

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iii. Calculate ΔG^θ for the above reaction at 25° C.

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iv. Explain the spontaneity of above reaction of 25° C.

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v. What is the minimum temperature, the above reaction happens spontaneously.

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Second Term Test - 2018
Chemistry - Grade 12
B - Part

• Answer two questions only

(05) (a) I Represent following enthalpy changes using equations.

- (i) Standard formation enthalpy of $NH_3(g)$ is -40 kJmol^{-1}
- (ii) Standard combustion enthalpy of $CH_4(g)$ is -890 kJmol^{-1}
- (iii) Standard bond dissociation enthalpy of $H-H(g)$ is $+436 \text{ kJmol}^{-1}$
- (iv) Standard hydration enthalpy of $Mg^{2+}(g)$ is -1890 kJmol^{-1}
- (v) Standard lattice enthalpy of $MgCl_2(s)$ is -2502 kJmol^{-1}

II (i) Calculate standard combustion enthalpy of $C_8H_{18}(l)$ using given thermodynamic data with aid of thermochemical cycle.

$$\Delta H_f^\theta [C_8H_{18}(l)] = -210 \text{ kJmol}^{-1}$$

$$\Delta H_f^\theta [H_2O(l)] = -286 \text{ kJmol}^{-1}$$

$$\Delta H_f^\theta [CO_2(g)] = -394 \text{ kJmol}^{-1}$$

(iii) Draw enthalpy diagram for the above process.

(b) Calculate standard lattice enthalpy of $MgCl_2(s)$ using following data with aid of Born – Haber cycle.

$$\Delta H_f^\theta [MgCl_2(s)] = -641 \text{ kJmol}^{-1}$$

$$\Delta H_s^\theta [Mg(s)] = +150 \text{ kJmol}^{-1}$$

$$\Delta H_{IE_1}^\theta [Mg(g)] = +736 \text{ kJmol}^{-1}$$

$$\Delta H_{IE_2}^\theta [Mg(g)] = +1450 \text{ kJmol}^{-1}$$

$$\Delta H_D^\theta [Cl-Cl(g)] = +242 \text{ kJmol}^{-1}$$

$$\Delta H_{EA}^\theta [Cl(g)] = -349 \text{ kJmol}^{-1}$$

(C) Set of readings obtained during an experiment done by mixing 20 cm^3 of $2.0 \text{ moldm}^{-3} \text{ HCl}$ and 10 cm^3 of $2.0 \text{ moldm}^{-3} \text{ NaOH}$ under standard state is given below.

$$\text{Initial temperature of HCl solution} = 32.0^\circ \text{ C}$$

$$\text{Initial temperature of NaOH solution} = 32.4^\circ \text{ C}$$

$$\text{Maximum temperature of the mixture} = 45.2^\circ \text{ C}$$

$$\text{Specific heat capacity of the solution} = 4.2 \text{ J g}^{-1} \text{ } ^\circ\text{C}^{-1}$$

$$\text{density of the solution} = 1 \text{ g cm}^{-3}$$

- (i) Write the balanced chemical equation for the reaction between $HCl(aq)$ and $NaOH(aq)$
- (ii) Find the heat of reaction between $HCl(aq)$ and $NaOH(aq)$ using above data.
- (iii) Find the enthalpy change of above reaction.

- (06)(a) (i) Write the Dalton's law of partial pressures.
(ii) Obtain the Dalton's law of partial pressures using ideal gas equation.
- (b) Gas $X_2(g)$ exist in a rigid Vessel of 4.157 dm^3 volume at 127°C and $3.2 \times 10^5 \text{ Pa}$ pressure. Gas $Y_2(g)$ exist in a rigid vessel of 12.471 dm^3 at 27°C and $1.2 \times 10^5 \text{ Pa}$ pressure. Two vessels were joined using a thin tube of negligible volume and the system was heated to the temperature of 327°C
- (i) Calculate number of moles $X_2(g)$ in the vessel of 4.157 dm^3 initially.
(ii) Calculate number of moles $Y_2(g)$ in the vessel of 12.157 dm^3 initially.
(iii) If $X_2(g)$ and $Y_2(g)$ do not react with each other.
1. Find the total pressure of the system at 327°C .
2. Calculate mole fraction of $X_2(g)$ and $Y_2(g)$ in the system.
3. Calculate partial pressures of $X_2(g)$ and $Y_2(g)$ in the system.
(iv) If $X_2(g)$ and $Y_2(g)$ react as follows.

$$X_2(g) + 3Y_2(g) \rightarrow 2XY_3(g)$$
Calculate,
1. Total pressure in the system.
2. Mole fractions of each gas in the system.
3. Partial pressures of each gas in the system.
(v) Write your assumptions used in calculations above.
- (07) (a) Hydrated salt A contains 25.6% of Cu, 12.8% of S and 4% of H and rest is O by mass. r.a.m of A is exactly 250.
(Cu = 64, S = 32, H = 1, O = 16)
(i) Find the empirical formula of A
(ii) Find molecular formula of A
(iii) If all H in A exist as H_2O , What is the hydrated salt A.
(iv) Write the formula of anhydrous salt of A and Write the IUPAC name.
(v) Draw the Lewis structure of the anion exist in A.
(vi) Deduce the shape of anion in (v) above.
- (b) (i) 1 dm^3 solution was prepared by dissolving 14.28g of hydrated Cobalt Chloride $CoCl_2 \cdot xH_2O$ crystals in water. Excess $Pb(NO_3)_2(aq)$ solution was added in to 100 cm^3 of above solution. Mass of the white precipitate obtained after filtered and dried is 1.668 g.
(Pb = 207, Cl = 35.5, Co = 59, H = 1, O = 16)
(i) What is the white precipitate formed?
(ii) Write the balance chemical equation between $CoCl_2(aq)$ and $Pb(NO_3)_2(aq)$.
(iii) Find the number of moles of white precipitate formed.
(iv) Calculate the number of moles of $CoCl_2$ in 100 cm^3 .
(v) Calculate the number of moles of $CoCl_2$ in 1 dm^3 .
(vi) What is the molar mass of hydrated cobalt chloride.
(vii) Calculate the value of x.

C - Part (Essay)

• Answer two questions only

(08) (a) Write a method to separate given solutions / compound using the given procedure.

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|------|--|---|
| (i) | $\left. \begin{array}{l} NaCl (aq) \\ BaCl_2 (aq) \\ K_2CO_3 (aq) \\ MgSO_4 (aq) \end{array} \right\}$ | Mixing solutions pair wise and use dil. HNO_3 if necessary. |
| (ii) | $\left. \begin{array}{l} Li_2CO_3 (s) \\ Mg(NO_3)_2 (s) \\ Na_2CO_3 (s) \end{array} \right\}$ | Heating compounds. |

(b) Represent following reactions using balanced chemical equations.

- (i) $Li (s) + O_2 (g) \rightarrow$
 (ii) $Na (s) + \text{Excess } O_2 (g) \rightarrow$
 (iii) $K (s) + \text{Excess } O_2 (g) \rightarrow$
 (iv) $Mg (s) + N_2 (g) \rightarrow$
 (v) $Ca (s) + H_2 (g) \rightarrow$
 (vi) $Ba (s) + \text{dil. } H_2SO_4 (aq) \rightarrow$
 (vii) $K (s) + \text{Cold } H_2O (l) \rightarrow$
 (viii) $Be(OH)_2 (s) + NaOH (aq) \rightarrow$
 (ix) $Na_2O_2 (s) + \text{Cold } H_2O (l) \rightarrow$
 (x) $KO_2 (s) + \text{Cold } H_2O (l) \rightarrow$

(c) Following procedure of reactions were used to identify a compound containing a cation of group I in S-block.

	Experiment	Observation
(1)	Dissolving the compound in water.	Obtained a clear solution.
(2)	Solution of $BaCl_2$ is added to the solution obtained in (1) above.	Formed a white precipitate.
(3)	Dil. HNO_3 is added to the precipitate obtained in (2) above.	Precipitate dissolved in dil. HNO_3
(4)	Flame test was done to the compound.	Obtained Lilac colour (purple.)

Identify the compound giving reasons for observations.

(09) (a) Existence of SO_2 in the atmosphere affect mostly for acid rains. Following method is used to determine the mass of SO_2 in the atmosphere.

Known volume ($V \text{ cm}^3$) of a sample of acid rain containing SO_2 was titrated with acidified. MnO_4^-

Here, Oxidation of $SO_2 \rightarrow SO_4^{2-}$ and

Reduction of $MnO_4^- \rightarrow Mn^{2+}$ was taken place.

7.37 cm^3 of $0.008 \text{ mol dm}^{-3} KMnO_4$ was required for the titration. ($S = 32, O = 16$)

- (i) Write the balanced ionic equation between SO_2 and MnO_4^-
- (ii) Calculate number of moles of SO_2 in volume $V \text{ cm}^3$.
- (iv) What is the mass of SO_2 in volume $V \text{ cm}^3$.

(b) Explain the following variations are true or false.

1. Thermal dissociation temperature of $NaNO_3$, KNO_3 , $RbNO_3$ is $NaNO_3 < KNO_3 < RbNO_3$
2. Electronegativity of S in SO_2 , SO_3^{2-} , SO_4^{2-} is $SO_2 < SO_3^{2-} < SO_4^{2-}$
3. Basicity of $NaOH$, $Mg(OH)_2$, $Al(OH)_3$ is $Al(OH)_3 < Mg(OH)_2 < NaOH$
4. Melting point of LiF , $LiCl$, $LiBr$ is $LiBr < LiCl < LiF$

(c) 2.86 g of $Na_2CO_3 \cdot 10H_2O$ is dissolved in water and diluted till 250 cm^3 25 cm^3 of that solution is taken and diluted again till 250 cm^3 using water 25 cm^3 from the diluted solution reacted completely with $0.001 \text{ mol dm}^{-3}$ HCl solution. (Na - 23, C - 12, O - 16, H- 1)

Find the volume of $0.001 \text{ mol dm}^{-3}$ HCl required for this reaction.

(10) (a) Name the following compounds in IUPAC nomenclature.

- (i) $KClO$ (ii) $KClO_2$ (iii) $KClO_3$
- (iv) $KClO_4$ (v) NaH_2PO_4 (vi) $NaHSO_4$
- (vii) H_2SO_4 (viii) H_2SO_3

(b) Calculate the mole fraction of HCl in a solution of HCl where the purity is 36% and density is 1.12 g cm^{-3} (H - 1, Cl - 35.5)

(c) 20 cm^3 of HCl with unknown concentration was required for the complete neutralization of 25 cm^3 of $Ba(OH)_2$ solution with unknown concentration. 20 cm^3 of 0.05 mol dm^{-3} $NaOH$ solution was required to neutralize 25 cm^3 of above HCl solution completely

- (i) Find the concentration of HCl solution used.
- (ii) Use the value of (i) above to find the concentration of $Ba(OH)_2$ solution.

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 ஆலர்ந்தன அட்டவணை
 Periodic Table

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