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Provincial Department of Education - NWP

02 E I

Second Term Test - Grade 12 - 2019

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 J K^{-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} m s^{-1}

1. Which of the following elements has the highest second ionization energy?

   1. Li 2. Be 3. B 4. C 5. N

2. Which species from the species given below consists the least number of Pi (π) bonds ?

   1. N_3^- 2. OCN^- 3. ClO_2^- 4. CO_2 5. SO_4^{2-}

3. Which statement in **true** regarding the molecule NH_3BF_3 ?

   1. Hybridization of the B atom is sp^2
   2. Total number of lone pairs in the molecule is 10
   3. It contains only p electrons.
   4. Total number of electrons in the molecule is 32.
   5. Total number of sigma (σ) bonds in the molecule is 7.

4. The answer containing the **wrong** IUPAC name for the given molecule.

compound	IUPAC name
1. KH_2PO_4	potassium dihydrogen phosphate
2. $FeCr_2O_7$	iron(II) dichromate
3. H_2SO_3	sulfurous acid
4. H_2S	hydrosulfuric acid
5. $HClO_3$	Chlorous acid

5. 10.0g of an impure sample of NH_4NO_2 was heated tightly. The volume of the evolved gas at standard temperature and pressure is 6.72 dm^3 The mass percentage of NH_4NO_2 in the impure sample is ? (The volume of one mole of gas at standard temperature and pressure is 22.4 dm^3.

   N = 14, H = 1, O = 16)

   1. 52.08% 2. 64.0% 3. 67.2% 4. 30.0% 5. 71.1 %

6. The complex which shows blue colour in aqueous solution.

1. $[Cu(H_2O)_6]^{2+}$ (aq)
2. $[Ni(H_2O)_6]^{2+}$ (aq)
3. $[Co(H_2O)_6]^{2+}$ (aq)
4. $[Fe(H_2O)_6]^{3+}$ (aq)
5. $[Mn(H_2O)_6]^{2+}$ (aq)

7. Consider the following reaction taking place at 25^0 C

$2NOCl\ (g) \rightarrow 2\ NO(g) + Cl_2\ (g);\ \Delta H^\theta = +75\ kJ\ mol^{-1}$

The **correct** statement about the reaction is,

1. ΔS^θ of the reaction is always a negative value.
2. Heat is released from system to the environment when the reaction takes place .
3. Spontaneous nature of the reaction can be decided by entropy change, only.
4. This reaction can be spontaneous at a particular temperature.
5. The value of ΔG^θ is always positive.

8. If the pressure of a gas is P molor volume is V_m temperature is T and the Vanderwaal's constants at the given temperature and pressure are a and b the correct Vanderwal's equation for a mole of a gas is,

1. $\left(P - \frac{a}{V_m^2}\right)(V_m - b) = RT$
2. $\left(P + \frac{a}{V_m^2}\right)(V_m - b) = RT$
3. $(P - b)\left(\frac{a}{V_m^2} + V_m\right) = RT$
4. $\left(P + \frac{V_m^2}{a}\right)(V_m - b) = RT$
5. $\left(P + \frac{V_m^2}{a}\right)(V_m + b) = RT$

9. Which solution given below **cannot** be used to distinguish between two aqueous solutions of NaCl and Na_2SO_3 from each other.

1. Cl_2 / CCl_4
2. $K_2CO_3(aq)$
3. $BaCl_2$ (aq)
4. $Ba(NO_3)_2(aq)$
5. dil. HCl (aq)

10. The mole fraction of $MgCO_3$ in solid mixture contains only $MgCO_3$ and $CO(NH_2)_2$ is 5/8. The mass of $MgCO_3$ in the mixture in ppm.

1. 6.25×10^5
2. 5.25×10^7
3. 7×10^5
4. 625
5. 700

11. The **incorrect** statement regarding the heat dissociation of ammonium salts is,

1. Only N_2O (g) and H_2O (g) are the products of heat dissociation of NH_4NO_3.
2. Only N_2 (g) and H_2O (g) are the products of heat dissociation of NH_4NO_2.
3. Only NH_3 (g) , Cr_2O_3(s) and H_2O (g) are the products of heat dissociation of $(NH_4)_2Cr_2O_7$
4. NH_3 can be obtained by the heat dissociation of $(NH_4)_2SO_4$.
5. CO_2 is released by the heat dissociation of $(NH_4)_2CO_3$

12. The **correct** statement regarding the properties of compounds formed by the elements in the third period is,
    1. The basicity of the hydroxides increases from left to right in the period.
    2. The acidity of the oxides increases from left to right in the period.
    3. Though aluminum hydroxide is amphoteric aluminum oxide is basic.
    4. Oxides formed by the other elements except sodium are insoluble in water.
    5. When moving from left to right in the period, hydrides become strongly basic.

13. The **incorrect** statement out of the given statements is,
    1. Enthalpy is a thermodynamic property.
    2. Enthalpy changes are reported for unit extent of reaction in $kJmol^{-1}$
    3. Enthalpy is a function of state.
    4. Heat is a function of state.
    5. The state of the system is specific for a particular system.

14. Consider the following statements regarding the identification of anions.

    A – A milky colour precipitate is formed and a basic gas is released when dilute HCl is added to a solution containing $S_2O_3^{2-}$ ions.

    B – A red – brown gas is released when dilute HCl is added to a solution containing nitrites.

    C – A yellow colour precipitate which is insoluble in concentrated ammonia is formed when dilute nitric acid and silver nitrate are added to solution containing iodides.

    The **incorrect** statement / s out of the above is / are.

    1. Only A   2. Only B.   3. Only A and B.
    4. Only A and C   5. Only B and C.

15. The volume of 0.02 mol dm^{-3} $KMnO_4$ needed to react completely with 25.00 cm^3 of a certain Fe^{2+} solution in acidic medium is 20.00 cm^3. The molarity of Fe^{2+} solution is,

    1. 0.08 M   2. 3.2 x 10^{-3} M   3. 3.125 M   4. 1.25 M   5. 0.025 M

16. The volume of the solution A with a concentration of $C \text{ mol dm}^{-3}$, needed to prepare a V volume of solution A with a composition of $x\,\%\,(w/V)$ is, (Molar mass of A = M g mol^{-1})

    1. $\frac{CM}{10VX}$ 2. $\frac{CX}{MV}$ 3. $\frac{CM}{100VX}$ 4. $\frac{10\,VX}{CM}$ 5. $\frac{10CM}{VX}$

17. Consider the given bond energies at 25^0C.

Bond	Bond energy / kJ mol^{-1})
$A \equiv A$	900
$B - B$	250
$A - B$	300

ΔH^θ (kJ mol^{-1}) of the reaction.

$A_2(g) + 3B_2\,(g) \rightarrow 2\,AB_3(g)$ is,

1. -150 2. $+150$ 3. $+1050$ 4. -1050 5. $+850$

18. a mol of NO gas and b mol of O_2 gas were kept in a rigid closed vessel at a certain temperature and allowed them to react. The initial pressure of the system was P. x mol of NO_2 gas was formed after a time of t, and both the gasses NO and O_2 were remaining.

$2\,NO(g) + O_2(g) \rightarrow 2\,NO_2(g)$

The pressure of the system at time t is

1. $P + \frac{XP}{2(a+b)}$
2. $P + \frac{2(a+b)}{XP}$
3. $P - \frac{2(a+b)}{XP}$
4. $P + \frac{(a+b)}{2XP}$
5. $P - \frac{XP}{2(a+b)}$

19. The compound containing the cation with highest polarizing power is,

1. $NaNO_3$ (s)
2. $Mg(NO_3)_2$
3. $Al(NO_3)_3$
4. K NO_3 (s)
5. $Ca(NO_3)_2$

20. 46 mg of the metal Na was added to $500.0\ cm^3$ of distilled water. The solution was made to $1.0\ dm^3$ after the reaction. The number of moles of OH^- in the new solution is,

1. 4×10^{-3}
2. 2×10^{-3}
3. 1×10^{-3}
4. 0.5×10^{-3}
5. 0.25×10^{-3}

21.

compound	standard enthalpy of formation / $kJ\ mol^{-1}$
$SO_2(g)$	-296
$SO_3(g)$	-454

If the following reaction takes place at 298 K, the standard enthalpy change of the reaction in $kJ\ mol^{-1}$.

$2SO_2(g) + O_2(g) \rightarrow 2\,SO_3(g)$

1. $+316$
2. $+158$
3. -158
4. -316
5. enough data is not provided for the calculation.

22. The concentration of HCl in a solution made by mixing $250.00\ cm^3$ of $2.2\ mol\ dm^{-3}$ HCl and $250.00\ cm^3$ of 2 $mol\ dm^{-3}$ NaOH is,

1. 0.1 M
2. 0.2 M
3. 4.4 M
4. 8.8 M
5. 0.8 M

23. The nonpolar molecule out of the following is,

1. O_3
2. NH_3
3. H_2O
4. NCl_3
5. $BeCl_2$

24. The major products of the combustion of the 'elements Li, Na and K in air are respectively,

1. $Li_2O(s)$, Na_2O (s), $KO_2(s)$
2. $Li_2O(s)$, Na_2O_2 (s), $KO_2(s)$
3. $Li_2O(s)$, Na_2O (s), $K_2O(s)$
4. $Li_2O_2(s)$, Na_2O (s), $KO_2(s)$
5. $Li_2O_2(s)$, Na_2O_2 (s), $K_2O(s)$

25. Cosider the following nuclear reaction.

$$^{238}_{92}U \rightarrow \ ^{234}_{90}Th + X$$

X can be.

1. $^{4}_{2}He$ 2. $^{1}_{1}H$ 3. $^{0}_{-1}\beta$ 4. γ 5. $^{1}_{0}n$

26. The element that reacts with all water oxygen and nitrogen is,

1. Na 2. K 3. Mg 4. Li 5. Be

27. The information about 3 compounds is given below.
A - Has an ability to show amphoteric properties.
B - exists as dimer due to electron deficiency.
C - acts as an oxidizing agent as well as a reducing agent.
The above compounds respectively are,

1. $AlCl_3, H_2O_2, H_2O$ 2. $AlCl_3, H_2O, H_2O_2$ 3. $H_2O, AlCl_3, H_2O_2$
4. $H_2O_2, AlCl_3, H_2O$ 5. $H_2O_2, H_2O, AlCl_3$

28. The correct statement for the wave length of photon is (E - the energy of a photon, h - planck's constant , c - speed of light)

1. $\lambda = \frac{E}{hC}$ 2. $\lambda = \frac{hc}{E}$ 3. $\lambda = \frac{Eh}{c}$ 4. $\lambda = \frac{Ec}{h}$ 5. $\lambda = \frac{c}{hE}$

29. V cm^3 of H_2 (g) was collected by the downward displacement through water in a particular experiment done at a pressure of P and a temperature of T. The saturated vapour pressure of water at this temperature is $P^0{}_{H_2O}$. The molar ratio of H_2 (g) to H_2O (g) and the ratio of the root mean square speeds of H_2 (g) to H_2O (g) are respectively.

1. $\frac{P - P^0{}_{H_2O}}{P^0{}_{H_2O}}$ and $\frac{1}{3}$ 2. $\frac{P - P^0{}_{H_2O}}{P^0{}_{H_2O}}$ and 3 3. $\frac{P^0{}_{H_2O}}{P}$ and 3

4. $\frac{P}{P^0{}_{H_2O}}$ and 3 5. $\frac{P}{P^0{}_{H_2O}}$ and $\frac{1}{3}$

30. The **correct** equation for atomization enthalph is,

1. $2Br\,(g) \rightarrow Br_2\,(g)$ 2. $Br_2\,(g) \rightarrow 2Br\,(g)$ 3. $Br_2(l) \rightarrow 2Br\,(g)$

4. $\frac{1}{2}Br_2\,(g) \rightarrow Br\,(g)$ 5. $\frac{1}{2}Br_2\,(l) \rightarrow Br\,(g)$

- **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) 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 species bear / s more neutrons than protons.

a. ${}^{18}O_3$　　b. ${}^{16}O_2^{2-}$　　c. ${}^{27}_{13}Al^{3+}$　　d. ${}^{3}H_2$

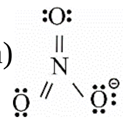
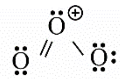
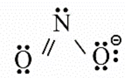
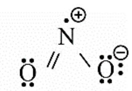
32. The **correct** statement/s regarding graphite and diamond is / are.
a) Carbon atoms in both structures are sp^3 hybridized.
b) Only graphite conduct electricity.
c) Only diamond is a three dimensional structure.
d) Both structures show lubricant property.

33. $50\ cm^3$ of $2\ mol\ dm^{-3}$ NaOH at 25^0C was mixed at once with $50\ cm^3$ of $2\ mol\ dm^{-3}$ HCl at 25^0C and the highest temperature reading was recorded as 37^0C during the experiment to determine the enthalpy of neutralization of acid – base. It was assumed that there is no any change in volumes after mixing the solutions and the density of water $(1\ g\ cm^{-3})$ and the specific heat capacity of the solution is $4.0\ J\ g^{-1}K^{-1}$. Which statement/s out of the followings describe / s the experiment well.
$(Na = 23,\ O = 16,\ H = 1,\ Cl = 35.5)$
(a) a heat of $4.8\ kJ$ is released to the environment during the neutralization of 0.1 mol of NaOH.
(b) a heat of $4.8\ kJ$ is absobed by the system during the neutralization of 0.1 mol of NaOH
(c) a heat of $48\ kJ$ is absobed by the system during the neutralization of 1 mol of NaOH.
(d) a heat of 48 kJ is released to the environment during the neutralization of 1 mol of NaOH.

34. The **correct** answer / s regarding the states of matter is / are.

	solid	**liquid**	**gas**
(a)	fixed mass	fixed mass	not a fixed mass
(b)	fixed shape	not fixed shape	not fixed shape
(c)	fixed volume	fixed volume	Takes the volume of the container
(d)	Compressibility is very low	high compressibility	High compressibility

35. The **correct** Lewis structure / s is / are.

(a)  (b)  (c)  (d) 

36. Assumption / s of molecular kinetic theory of gas is / are.
   (a) The pressure exerted by a gas is the result of collisions of the molecules with each other.
   (b) When compared with the distance between molecules, molecules have a considerable volume.
   (c) There are no attractions or repulsions between molecules.
   (d) The collisions of the gas molecules are completely elastic.

37. The identical enthalpy change of neutralizations are.
   (a) $HCl + NaOH$ (b) $KOH + HNO_3$
   (c) $NaOH + CH_3COOH$ (d) $HCl + NH_4OH$

38. The **correct** set / s of quantum number is / are.
   (a) $2 , 1 , 0 , +\frac{1}{2}$ (b) $2 , 1 , 2 , -\frac{1}{2}$
   (c) $2 , 3 , -1 , +\frac{1}{2}$ (d) $2 , 0 , +1 , +\frac{1}{2}$.

39. The **incorrect** statement/s regarding the principles relevant to filling up pattern of electrons is / are.
   (a) Orbitals of the same energy are occupied by electrons to make the minimum number of unpaired electrons.
   (b) Pauli's exclusion principal status that the set of quantum numbers for a certain electron of an atom is exclusive for it.
   (c) No orbital can accommodate more than two electrons.
   (d) Filling up of electrons in the orbitals takes place according to the decreasing order of energy.

40. The pair/s with idential geometries around the central atom is / are.
   (a) SO_2 , O_3 (b) SO_4^{2-} , $S_2O_3^{2-}$
   (c) NH_3 , BF_3 (d) ICl_2^- , NO_2^-

- **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.**

1st Statement	2nd Statement	Response
True	True and explains the 1st statement correctly	1
True	True but does not explain the first statement correctly	2
True	False	3
False	True	4
False	False	5

	First statement	Second statement
41.	The energy that should be supplied to remove an electron from an atom is called first ionization energy.	It can be confirmed that there are sub energy levels using the values of first ionization energies of atoms.
42.	The total number of unpaired electrons that can exist in d sub energy level is 5.	The maximum number of unpaired electrons that can exist in a certain sub energy level is two times of its azimuthal quantum number.
43.	Covalent radius decreases from left to right in a non-transition period.	The number of protons increases from left to right in a non-transition period.
44.	The electronegativity of the carbon atom of $HC \equiv CH$ is greater than the electronegativity of the carbon atom of $H_2C = CH_2$	The electronegativity of an atom depends only on hybridization and charge.
45.	Melting point of HF is greater than that of HCl	The radius of F is smaller than Cl.
46.	The charge on both sides of a balanced chemical equation must be same but mass can be different.	Only charge is considered during balancing of a chemical reaction.
47.	Na and NH_3 can be used to identify NO_3^- ions.	NO_3^- ions can reduce to NH_3
48.	The volumes of 2 moles of each O_2 (g) and H_2(g) becomes identical at same temperature and pressure.	Equal volumes of gases at same temperature and pressure contain equal number of molecules.
49.	A gas can be liquefied at any temperature.	Any gas has a minimum temperature known as critical temperature.
50.	Entropy is a measure of randomness.	Entropy change depends on temperature physical nature and arrangement or particles.

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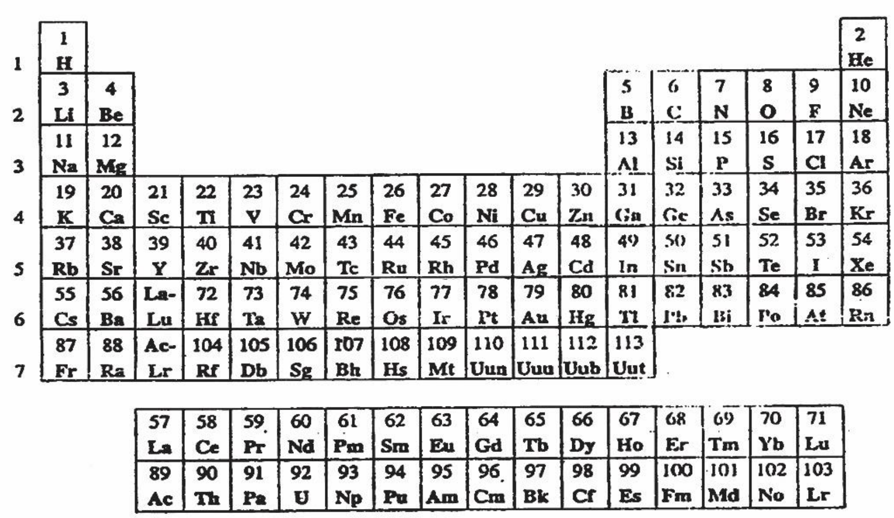
ஆவர்த்தன அட்டவணை
Periodic Table



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

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

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Provincial Department of Education - NWP

02	E	II

Second Term Test - Grade 12 - 2019

Index No : ....

Chemistry II

Three Hours

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

❑ 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. Consider the elements in the second period of the periodic table.

I. Identify and write the symbols of the elements showing the following properties.

i. Element/(s) showing allotropy - ______________________

ii. Highest second ionization energy - ______________________

iii. Highest melting point - ______________________

II. Write the chemical formula of electron deficient covalent compound formed by two elements above.

....

III. Explain briefly whether the above compound is polar or non-polar.

(b) NO_2 is an odd electron compound of nitrogen containing an unpaired electron of N.

I. Draw the most acceptable Lewis structure for NO_2.

II. Write the chemical formula and IUPAC name of the compound formed when NO_2 molecule react with another NO_2 molecule.

....

III. Draw the most acceptable Lewis structure for the compound stated in (II) above. (Hint: It has a symmetrical structure)

IV. Draw the resonance structures associated with the compound in (III) above.

V. Explain briefly the stability of N_2O_4 molecule.

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

VI. Consider the nitrogen atom in NO_2 and one nitrogen atom in N_2O_4 and complete the table below.

	N in NO_2	N in N_2O_4
Hybridization		
Electron pair geometry		
Shape around the atom		
Oxidation number		

(c) Complete the following table. (If there is no answer draw a dash in the box)

	Species	Type of the lattice structure.	Primary interaction / (s) in the lattice	secondary interaction/(s) in the lattice
i.	Diamond			
ii.	Ice			
iii.	Solid Iodine			
iv.	NH_4Cl (s)			
v.	Al(s)			

(02) (a) Arrange the following (I) – (V) in the ascending order of the property given in parentheses.

I. $HClO_2$, $HOCl$, $HClO_4$, $HClO_3$ (electronegative of Cl atom)

.... < .... < ....< ....

II. H_2O , H_2S , NH_3 , SO_2 (Bond angle around the central atom)

.... < .... < ....< ....

III. Energy released in the process $M(g) + e \rightarrow M^-(g)$ where M is, N , Cl , O , F.

.... < .... < ....< ....

IV. HF , HCl , HBr , HI (Boiling Point)

.... < .... < ....< ....

V. NO , N_2O_3 , N_2O , N_2O_5 (Oxidation number of nitrogen)

.... < .... < ....< ....

(b) Mass of the contaminated sample of Mg is 4.2 g. When this sample was reacted completely with 0.1 mol dm^{-3} HCl. (Assume other substances in the sample do not react with HCl) The volume of gas evolved at Standard Temperature and Pressure (STP) was 3360 cm^3. (M – 24, 1 mole of gas at STP occupies a volume of 22400cm^3)

(I) Write the relevant balanced chemical equation for above process.

....

....

(II) Calculate the mass percentage of Mg in the sample.

(c) Four test tubes labelled as A, B, C and D contain solids $MgCO_3$, $NaNO_3$, $LiNO_3$, NH_4Cl. (Not in same order)

Compound	Vigorous heating
A	1. No solid residue
B	1. White solid residue gives red colour flame test. 2. Two gaseous products
C	1. White solid residue. 2. Colourless gas which turns lime water creamy.
D	1. White solid residue. 2. Colourless gas.

(I) Identify compounds A, B, C and D.

A .... *B* ....

C .... *D* ....

(II) Write balanced chemical equations for the thermal decomposition of each compound above.

(03) (a) I. Write the Dalton's law of partial pressures.

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II. He gas exist in a vessel of $0.45\ m^3$ at 0.70×10^5 Pa pressure. N_2 gas exist in a vessel of volume $0.50\ m^3$ at 1.25×10^5 Pa pressure. Two vessels were joined through a tube with negligible volume. Consider the temperature is constant and calculate.

i. Partial pressure of He.

ii. Partial pressure of N_2 .

iii. Total pressure of the system.

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iv. Mole fractions of N_2 and He.

(b) i. Deduce a relationship between molar mass and mean square velocity of a gas using molecular kinetic equation and ideal gas equation.

ii. Draw Maxwell Boltzmann curve for gasses He, Ne, Ar at the same temperature in the following.

(c) i. Define the standard enthalpy of bond dissociation.

ii. Standard formation enthalpy of NH_3 (g) is $-46 kJmol^{-1}$.
Consider following data. Find ΔH_D^{θ} of $[H - H_{(g)}]$ using given data

Bond	$\Delta \mathbf{H}_{\mathbf{D}}^{\theta}$ / $kJmol^{-1}$.
$N \equiv N$	945
$N - H$	390

(04) X is a hydrated salt containing Na, H, S and O only. It contains 25.6% S, 4.0% H and 52% O by mass. Remaining mass is Na. (Na- 23, S – 32, H – 1, O-16)

In this compound all H atoms present as H_2O only. r.m.m. of the compound is about 246.

i. Determine the empirical formula of X.

ii. Deduce the correct molecular formula.

iii. Draw the Lewis structure of anion in the salt.

iv. Determine the oxidation state of each S atom using the structure draw in (iii) above.

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v. Write the IUPAC name of the anion in (iii) above.

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(b) I. N_2H_4 react with ClO_3^- ions in acidic medium to form NO, Cl^- and H_2O only.

i. What is the species subjected to oxidation?

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ii. Write the balanced half ionic equation for oxidation.

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iii. What is the species subjected to reduction.

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iv. Write the balanced half ionic equation for reduction.

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v. Write the balanced half ionic equation.

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Second Term Test - 2019

Chemistry - Grade 12
Part B - Essay

- **Answer two questions only**

(05) (a) Consider the following reaction at 25^0C .

$2\ NaHCO_3\ (s) \rightarrow Na_2CO_3\ (s) + CO_2(g) + H_2O\ (g)$

Values of ΔH_f^θ and S^θ were given at 25^0C

Species	ΔH_f^θ kJ mol^{-1}	S^θ/ J $mol^{-1}K^{-1}$
$NaHCO_3$ (S)	-948	136
Na_2CO_3 (s)	-1131	102
H_2O (g)	-242	189
CO_2(g)	-393.5	214

(i) Calculate the standard enthalpy change of above reaction at 25^0C .
(ii) Calculate the standard entropy change of above reaction at 25^0C.
(iii) Show the above reaction is not spontaneous at 25^0C, according to answers in (i) and (ii) aove.
(iv) Calculate the minimum temperature which the above reaction is spontaneous.
(v) Mention your assumptions in the calculation (iv) above.

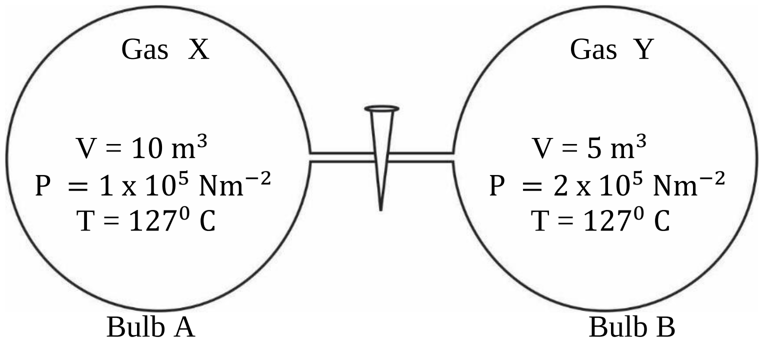
(b) (i) Write equations for the enthalpy changes given below.

Standard sublimation enthalpy of K (s) - $+90$ kJ mol^{-1}
Standard first ionization enthalpy of K (g) - $+420$ kJ mol^{-1}
Standard bond dissociation enthalpy of O_2 (g) - $+498$ kJ mol^{-1}
Standard enthalpy of first electron gain of oxygen - -141 kJ mol^{-1}
Standard enthalpy of second electron gain of oxygen - $+794$ kJ mol^{-1}
Standard formation enthalpy of K_2O (s) - -362 kJ mol^{-1}
Standard lattice enthalpy of K_2O (g) - x kJ mol^{-1}

(ii) Calculate the standard lattice enthalpy x of K_2O (s) using data given (i) above using a Born Haber cycle.

(06)(a) (i) Explain why real gases deviate from ideal behaviour.
(ii) Use a diagram to show that deviation.

(b) A and B bulbs were joined using a tap. Tap was closed at the beginning. A contains gaseous X only and B contains gaseous Y only. Each gas exist under conditions given in the following figure.



Gases were allowed to mix freely and completely by opening the tap. There is no change in the temperature of each bulb. Calculate the following in SI units assuming the ideal behaviour and the volume of the tap is negligible.

(i) Number of moles of Y in bulb B at the beginning.
(ii) Number of moles of X in bulb A at the beginning.
(iii) Total number of gaseous moles in two bulbs.
(iv) Final pressure of the gaseous mixture in bulb B.
(v) Partial pressure of Y gas in the final gaseous mixture of bulb B.

(07) (a) Apparatus set up used by a student to determine molar volume of $O_2(g)$ is given below.

(i) What are the products in $KMnO_4\ (s) \xrightarrow{\Delta}$?

(ii) Write the balanced chemical equation for (i) above.

(iii)

Initial mass of boiling tube + $KMnO_4$,	m_1 g
Final mass of boiling tube + $KMnO_4$,	m_2 g
Room temperature	T_1 K
Rom pressure	$P_1\ Nm^{-2}$
Volume of O_2 evolved	V cm^3
Saturated vapour pressure of H_2O at T_1	$P^0 H_2O$
standard temperature	273 K
standard pressure	$1.013 \times 10^5\ Nm^{-2}$

Calculate molar volume of $O_2(g)$ at standard temperature and pressure. $(O = 16)$

(b) 28.4g of a solid mixture containing $MgCO_3(s)$ and $CaCO_3(g)$ only was heated until obtained a constant mass. If the mass of the mixture reduced to 15.2g, calculate the mass percentage of $CaCO_3$ in the mixture.

(C) (i) Write the balanced half ionic equation relevant to the reduction of MnO_4^- ions to Mn^{2+} ions in acid medium.

(ii) Write the balanced half ionic equation relevant to the oxidation of SO_3^{2-} ions to SO_4^{2-} ions in acidic medium.

(iii) Write the balance ionic equation for the reaction between MnO_4^- and SO_3^{2-} in acidic medium.

(iv) Calculate the volume of $0.005\ moldm^{-3}$ $KMnO_4$ required to react completely with $25\ cm^3$ of $0.05\ moldm^{-3}$ Na_2SO_3 solution.

Part C - Essay

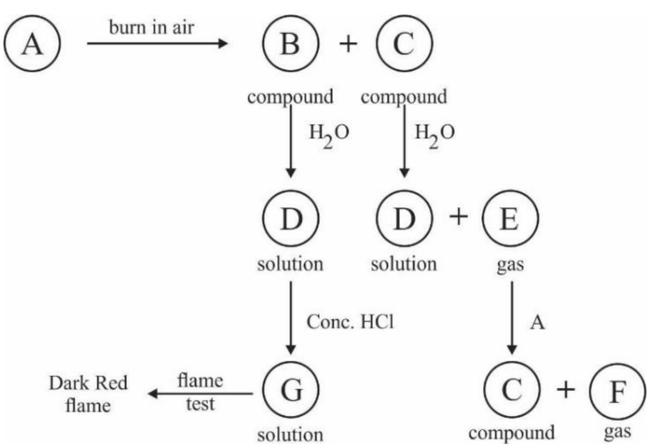
- **Answer two questions only**

(08) (a)(i) Write the chemical formula of the oxide derived from highest oxidation state from Na to Cl in the third period of the periodic table and mention the chemical property of them.

(ii) Mass of solid mixture containing only Magnesium Oxide and Magnesium nitrate is 5.48 g. The constant mass obtained by heating above vigorously is 4.4 g. $(Mg = 24,\ N = 14,\ O = 16)$

1) Write the balanced chemical equation for the thermal dissociation of Magnesium nitrate.
2) calculate the mass of Magnesium oxide exist in the sample at the beginning.

(b) Series of reactions obtained by the participation of element A is given below.



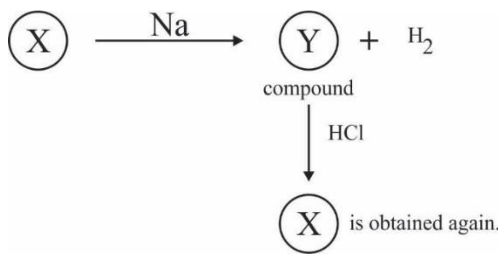
1) What is the element A ?
2) Identify compounds from B to G and write the chemical formulae of them.
3) Write balanced chemical equations for reactions takes place in above.
4) Mention a suitable example each using a balanced chemical equation to show each property of E given below.

i) As oxidizing agent. ii) As an acid iii) As reducing agent.

(09) (a) 1. Write balanced chemical equations for the following compounds with water.

(i) CO_2 (g) (ii) NO_2 (g) (iii) SO_2 (g) (iv) KO_2 (s)

2. Draw Lewis structures of the products obtain in (i), (ii) and (iii) above.
3. Write the names of allotropic forms of crystalline sulfur. Mention the basic molecular form of them.
4. X is compound formed by Sulphur.



Identify X and write balanced chemical equations for reactions in above.

(b) 20 cm^3 of 0.1 $mol dm^{-3}$ $Na_2S_2O_3$ solution was required to react completely with I_2 formed when adding excess acidic KI solution to 25 cm^3 of H_2O_2 solution.

i. Write balanced chemical equations for all the reactions above.
ii . Calculate the concentration of H_2O_2 solution.

(10) (a) Write balanced equations for the heat dissociation of following compounds.

(i) $NaHCO_3(s)$ (ii) $NH_4NO_2(s)$ (iii) $(NH_4)_2Cr_2O_7(s)$
(iv) $(NH_4)_2CO_3(s)$ (v) $KMnO_4$ (s)

(b) How you distinguish following solutions by mixing each with one another.

$Na_2CO_3(aq)$, dil. H_2SO_4 , $Na_2S_2O_3(aq)$, $NaNO_3$ (aq)

(c) X and Y are two gaseous element belongs to the P block. They react with H_2 to form two compounds P and Q respectively. P shows weak acidic properties in aqueous solutions while Q shows strong acidic properties in solutions. P has high boiling point than Q .

(i) Identify X, Y, P and Q and write their chemical formula of each.
(ii) What is the reason that Q is more acidic than P.
(iii) What is the reason that P has high boiling point that Q.

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ஆவர்த்தன அட்டவணை
Periodic Table

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

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