දකුණු පළාත් අධ්‍යාපන දෙපාර්තමේන්තුව

தென் மாகாணக் கல்வித் திணைக்களம்

Southern Provincial Department of Education

අධ්‍යාපන පොදු සහතික පත්‍ර (උසස් පෙළ), 12 ශ්‍රේණිය, පළමු වාර පරීක්ෂණය, 2019 නොවැම්බර්

General Certificate of Education (Adv. Level), Grade 12, First Term Test, November 2019

රසායන විද්‍යාව I Chemistry I	02 E I	පැය එකයි One hour

Instructions:

- A periodic table is provided.
- This paper consists of **five** pages.
- **Answer all questions.**
- Write your name or **index numb**er in the space provided in the answer sheet.
- **Follow the instructions** given on the back of the answer sheet carefully.
- **In each 1 to 25 ,** pick one of the answer which is **correct or more appropriate** among the given answers $(1), (2), (3), (4), (5)$ and mark on the answer sheet **with a cross ($\times$)** **in accordance with the instructions given on the back of the answer sheet.**

Universal gas constant R	=	$8.314\,J\,K^{-1}\,mol^{-1}$
Avagadro's constant N_A	=	$6.022 \times 10^{23}\,mol^{-1}$
Velocity of light c	=	$3 \times 10^8\,m\,s^{-1}$
Planck's constant h	=	$6.626 \times 10^{-34}\,J\,s$

1. The atoms consist of electrons was first discovered by,

   (1) Rutherford's gold leaf experiment.

   (2) Cathode Ray experiments of J.J. Thompson.

   (3) Emission spectrum of atomic hydrogen.

   (4) Analyzing data of adjacent ionization energies.

   (5) Bombarding α ray particles on Be material.

2. Which of the following statements is true?

   (1) The smallest charge that any particle bears is $1.602 \times 10^{-19}C$

   (2) X rays are negatively charged.

   (3) γ rays are deflected in the presence of magnetic fields.

   (4) A β particle which was targeted to the nucleus of an atom is strongly repelled

   (5) Naturally stable isotopes of a certain element are radio active.

3. The group of ions/ molecules with 3 repulsion units around the central atom is,

   (1) BF_3, IBr_2^-, CH_4 (2) NH_3, BCl_3, H_2O (3) SO_3, H_2CO_3, SO_2

   (4) $POCl_3$, H_2S, SO_4^{2-} (5) NO_2, NH_2^-, ClF_3

4. The number of electrons in the outermost energy level of Pd (atomic number 46)?

   (1) 1 (2) 2 (3) 6 (4) 8 (5) 18

5. The number of CO_2 molecules given by heating 10.0 g of $CaCO_3$ is (Ca = 40, C = 12, O = 16)

   (1) 1 (2) 6.022×10^{23} (3) 6.022×10^{22}

   (4) 0.1 (5) $\frac{10}{6.022} \times 10^{23}$

6. The shape of a molecule which has two bonding pairs of electrons around the central atom is,

   (1) Trigonal Planer (2) Linear (3) Angular

   (4) Linear or angular (5) Trigonal planer or linear

7. The correct descending order of the energy of atomic orbitals of main (n) and azimuthal (l) quantum numbers given below which is followed by Aufbau Principle in electron filling patterns of an atom is A) n = 4, l = 0 B) n = 5, l = 0 c) n = 4, l = 1 D) n = 3, l = 2

   (1) A > B > C > D (2) B > C > D > A (3) D > C > B > A

   (4) C > A > D > B (5) C > B > A > D

8. Which of the following species forms strongest hydrogen bonds between them?

   (1) SiH_4 and SiF_4 (2) H_2O and H_2O_2

   (3) H $-$ C $-$ H and H $-$ C $\equiv$ N (with $\overset{O}{\underset{||}{}}$) (4) CH_4 and H_2O

   (5) $CH_3 - C - CH_3$ and $CHCl_3$ (with $\overset{O}{\underset{||}{}}$)

9. Following reaction indicates the production of gaseous ammonia.

   $N_2(g) + 3H_2(g) \longrightarrow 2NH_3(g)$

   The number of moles of H_2 required to produce 1.7 g of $NH_3(g)$ is (N = 14, H = 1)

   (1) 0.05 (2) 0.12 (3) 0.15 (4) 0.3 (5) 0.6

10. Select the false statement relevant to CH_2Cl_2 molecule.

    (1) It is a tetrahedral molecule.

    (2) There are 3 different bond angles which differ from each other.

    (3) C undergoes sp^3 hybridization in this molecule

    (4) It is a polar molecule.

    (5) London forces are the only available secondary interactions among these molecules.

11. True statement relevant to an atomic orbital is,

    (1) Maximum number of electrons available in an orbital is two.

    (2) s orbital is spherical in shape and with a sharp margin.

    (3) Electrons are filling into orbitals always by following Aaufbau principle.

    (4) The above 1 and 2 statements are true.

    (5) All the above statements are true.

12. Mass of a C_6H_6 molecule in gram is ($C = 12$, $H = 1$)

    (1) 12.95×10^{-23} (2) 7.7×10^{-21} (3) 1.6×10^{-24}

    (4) 6.022×10^{23} (5) 78

13. Which of the following cannot be considered as a safety measure in laboratory experimental procedures?

    (1) Using diluted solutions as possible

    (2) Using a fume cupboard when handling gases

    (3) Using an extra container when carrying corrosive substances.

    (4) Diluting acids always by adding them directly to water.

    (5) Removing all inflammable substances closer to by when using a Bunsen burner.

14. Which of the following molecules/ions does not contain a triple bond ?

    (1) BH_2^- (2) CN^- (3) N_2 (4) CO   (5) C_2H_2

15. Mass of a 0.2 mol of compound A is 5.2 g . The molar mass of the compound is,

    (1) 2.6 g   (2) 2.6 g mol^{-1} (3) 26 g

    (4) 26 g mol^{-1} (5) 0.026 g mol^{-1}

- **For Question number 16 to 20 ,** one or more response/s among the given four responses (a), (b), (c) and (d)is/are correct. Select the correct response/responses according to the given instructions below and mark on

  (1) *only* if (a) and (b) are correct
  (2) *only* if ,(b) and (c) are correct
  (3) *only* if (c) and(d) are correct
  (4) *only* if (d) and (a) are correct
  (5) *only* if *any* or other number of combination of responses is correct.

  Summary of the 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 (d) and (a) are correct	Any or other number of combination of responses is correct.

16. Which of the following pairs has/ have similar chemical properties?

(a) $_1^1H$ and $_1^1H^+$ (b) $_7^{14}N$ and $_7^{14}N^{3-}$ (c) $_6^{12}C$ and $_6^{13}C$ (d) $_6^{14}C$ and $_7^{14}N$

17. Which of the following/s is/are true among the given statements?

(a) Vanderwaal radius of an atom is larger than the covalent radius.

(b) Nuclear charge affects on the first ionization energy of an atom.

(c) When the sizes of cations become smaller its polarization power decreases.

(d) Metals conduct electricity as free ions are available.

18. A very small scale for mass was introduced to present the mass of an atom which called as "atomic mass unit" (u) as they are tiny particles. Select true statement/s relevant to it.

(a) According to this scale mass of a ^{12}C atom is 12.00 g

(b) Mean relative atomic mass of isotopic elements cannot be expressed using the above unit.

(c) $1\ u = 1.66 \times 10^{-24}$ g

(d) If molar mass of an element expressed by atomic mass unit the atomic mass of an element can be obtained.

19. The false statement/s relevant to ionic lattices is/are

(a) They do not have a trend to dissolve in polar solvents.

(b) Ionic lattices are formed by dipole attractions between positive and negative ions.

(c) Conducts electricity in solid state.

(d) Have high boiling and melting points.

20. In which of the following ions, the unneutralized charge equals to $1.602 \times 10^{-19}C$ g ?

(a) NO_3^- (b) CO_3^{2-} (c) $S_2O_3^{2-}$ (d) NH_4^+

● For question number 21 to 25, two statements are given.

Select the most appropriate response to the two statements among the given responses (1), (2), (3), (4) and (5) and mark as appropriate according to the given instructions in the following table.

Response	First Statement	Second statement
(1)	True	True and correctly explains the first statement.
(2)	True	True, but does not explain the first statement correctly.
(3)	True	False
(4)	False	True
(5)	False	False

1st Statements	2nd Statement
21. Energy of a photon of an electromagnetic radiation always give a constant value when divided by its' frequency.	All electromagnetic radiations travel with the same velocity in a vacuum.
22. Generally a 0.05 cm³ liquid volume can be measured accurately by a calibrated 10 cm³ measuring cylinder.	When measuring liquid volumes reading should be taken at eye level to coincides with the lower surface of the liquid meniscus.
23. Boiling points of the hydrides ascending in the following manner HF < HCl < HBr < HI	The size of molecules only affects on their boiling points.
24. Shape of the H_3O^+ ion is pyramidal	This ion has four repulsion units.
25. The relationship between particulate and wave nature of electrons is indicated by De – Broglie's equation.	An electron does not show particulate and wave properties at the same time.

* * *

Periodic Table

1 H																	2 He
3 Li	4 Be											5 B	6 C	7 N	8 O	9 F	10 Ne
11 Na	12 Mg											13 Al	14 Si	15 P	16 S	17 Cl	18 Ar
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
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
55 Cs	56 Ba	57 La	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
87 Fr	88 Ra	89 Ac	104 Rf	105 Db	106 Sg	107 Bh	108 Hs	109 Mt	110 Uum	111 Uuu	112 Uub	113 Uut	...				

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
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

දකුණු පළාත් අධ්‍යාපන දෙපාර්තමේන්තුව

தென் மாகாணக் கல்வித் திணைக்களம்

Southern Provincial Department of Education

අධ්‍යාපන පොදු සහතික පත්‍ර (උසස් පෙළ), 12 ශ්‍රේණිය, පළමු වාර පරීක්ෂණය, 2019 නොවැම්බර්

General Certificate of Education (Adv. Level), Grade 12, First Term Test, November 2019

රසායන විද්‍යාව II					පැය එකයි මිනිත්තු තිහයි
Chemistry II	02	E	II		One and half hours

Index number: ....

* Use of calculators is not allowed.
* Avagadro's constant $N_A = 6.022 \times 10^{23}$ mol^{-1}
* Planck's constant $h = 6.626 \times 10^{-34}$ J s
* Velocity of light $c = 3 \times 10^8$ m s^{-1}
* Universal gas constant $R = 8.314$ J K^{-1} mol^{-1}

❏ **Part A - Structured Essay (2 -5 pages)**

* **Answer all the questions on this 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 excepted.

❏ **Part B and C Essay (6 -8 pages)**

* Select two questions from each part and answer four questions from both parts.
* At the end of the time allocated for this paper tie the answers to the two parts A and B **together so that part A is on the top and hand them over to the supervisor.**
* You are permitted to remove part B and C of the question paper from the examination hall.

For Examiners' use only

Part	Question Number	Marks obtained
A	01	
	02	
B	03	
	04	
	05	
Total		
Percentage		

Final Mark	
In numbers	
In letters	

Signature	
Examiner	
Supervised by	

Part A – Structured Essay

- **Answer all two questions on this paper itself. (Each question carries 10 marks)**

1. (a) Answer the followings using the elements having atomic numbers 1 to 18.

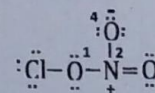   (Write the symbol of the element in the parenthesis) .

   (i)   The element which has highest ionization energy.   (.....................)

   (ii)   The elements which has largest covalent radius.   (.....................)

   (iii) The element which can forms triple bonds with similar atoms and with

   other atoms   (.....................)

   (iv)   The elements which does not show positive oxidation states in chemical combinations

   at all.   (.....................)

   (v)   The element which is almost inactive when exist as diatomic gaseous

   molecules   (.....................)

   (vi)   The element which forms a hydride with highest boiling point   (.....................)

   (1.8 marks)

   (b) The sketch of NO_2NH^- ions is as follows.

   $$\begin{matrix} O \\ \diagdown \\ \hspace{1em} N\!-\!N\!-\!H \\ \diagup \\ O \end{matrix}$$
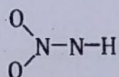
   (i)   Draw most acceptable Lewis structure for this ion.

   (ii)   Draw two more resonance structures for the above Lewis structure.

   (iii) The structure of Chlorine Nitrate which affects on O_3 layer
          depletion in Atlantic region is given below. Based on the above
          numbered atoms complete the following information for the
          above structure.

   $$:\!\overset{4}{\underset{..}{\ddot{O}}}\!:$$
   $$:\!\ddot{Cl}\!-\!\overset{1}{\underset{..}{\ddot{O}}}\!-\!\overset{|2}{\underset{+}{N}}\!=\!\overset{3}{\ddot{O}}$$

	O^1	N^2
1. VSEPR Pairs		
2. Electron pair geometry		
3. Shape		
4. Hybridization		

(iv)   Identify the hybridized/ atomic orbitals which participate to form following σ bonds of the given Lewis structure in b) (iii) above (Numberings of the atoms are same)

1. $Cl - O^1$ Cl .... O^1 ....

2. $O^1 - N^2$ O^1 .... N^2 ....

3. $N^2 - O^3$ N^2 .... O^3 ....

4. $N^2 - O^4$ N^2 .... O^4 ....

(4.0 marks)

(c) Fill the following table.

Cation	Anion	Chemical formulae	IUPAC Name
Al^{3+}	S^{2-}		
			lithium nitride
		$SnBr_4$	

(1.2 marks)

(d) Answer the following questions based on following data. Symbols given for elements are not the standard symbols.

| Elementary atom/ion	A	D	E	G	J	L
Number of electrons	5	10	18	28	5	9
No. of protons	5	7	19	30	5	9
No. of Neutrons	5	7	20	36	6	10

(i)   What are electrically neutral species?   ....

(ii)   What are negatively charged ion/ions?   ....

(iii) What are positively charged ion/ions?   ....

(iv)   Identify isotopic species.   ....

(v)   Write the above isotopic species of elements using standard chemical symbols.

....

(vi)   What is the chemical formula of the molecule which can form between A and L?

....

(vii) Write the followings of the molecule in (vi) above.

Geometry : ....

Bond Angle : ....

(viii) What are the species which already acquired nearest noble gas configurations?

..

(3.0 marks)

100

(see page four)

2. (a) A, B, and C are three regions of adjacent spectral series of hydrogen emission spectrum and A is the high frequency radiation series.

(A)	(B)	(C)
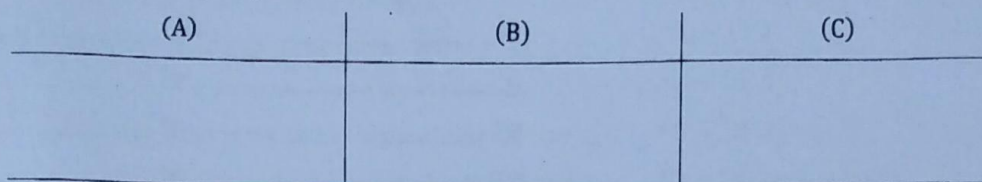
(i) Indicate the variation in wavelengths of the radiations towards A to C (Whether increases or decreases) ....

(ii) Fill in the blanks given below.

    Name of the spectral series   Relevant region of radiation.

    A ....

    B ....

    C ....

(iii) Draw 3 spectral lines having least frequencies of the A and B series with accurate distances in between on the above diagram. Name the spectral lines in one of the above series as H_α, H_β, H_γ towards frequency increasing direction.

(3.0 marks)

(b) Write the oxidation number and valency of the labelled atoms of the given structure on the following blanks.
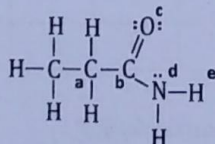
                     Oxidation No.   Valency

(i) a ....

(ii) b ....

(iii) c ....

(iv) d ....

(v) e ....

(2.0 marks)

(c) Consider the 08 elements B, C, N, O, F, Ne, Na, Mg in the periodic table. Draw a sketch of first ionization energy variation of them between the given axes.

(i)

(ii)   Write 3 factors affect on electronegativity of an element.

....

....

....

(iii)   Indicate the variation of electronegativity of the elements B, C, N, O, F

....

(iv)   What is the element which absorbs highest amount of energy when gaining an electron among the given elements in (iii) ?...
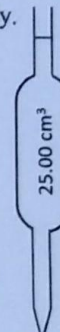
(v)   Consider the species N^-, N^{2-}, N^{3-} of the element N. Arrange them in their ascending order of polarizability. Explain your answer with reasons.

....

....

....

....

(3.2 marks)

(d) Answer the following question according to the practical activities you have done in the laboratory.

*   Following is an apparatus which is in use to measure liquid volumes accurately.

25.00 cm³

(I)   What is this apparatus? ....

(II)   Draw the position of liquid meniscus and the eye level which use in measuring the volume.

(III)   Explain the relevant procedural steps when transferring a liquid volume measured by this apparatus to a titration flask using a diagram.

(1.8 marks)   100

* * *

Part B - Essay

Answer two questions only. (Each question carries 15 marks)

3. (a) A is a type of a mineral available in common metal ore. It consists of Cu, O, C and Hydrogen and composition of them are as follows.

$$Cu = 57.5\% \quad O = 36.2\% \quad C = 5.4\%$$
$$(Cu = 63.5, \quad O = 16, \quad H = 1, \quad C = 12)$$

   (i)   Determine the empirical formula of A.

   (ii) Find the molecular formula of A if the relative molecular mass is 221.

   (iii) When 1 g of A undergoes thermal decomposition CuO, and H_2O with a gas which turns lime water milky and then to colourless were obtained.

   I.   Write balanced chemical equation for the above reaction.

   II. Calculate the total mass of CuO formed above.

(9.5 marks)

(b) Following are the boiling points of is electronic species.

Substance	Fluorine	Argon	Hydrogen
Chemical Formula	F_2	Ar	HCl
Boiling Point °C	−188	−186	−85

Explain the reasons for the following observations.

   (i) F_2 and Ar have approximately equal boiling points.

   (ii) Boiling point of F_2 is differ than HCl.

(4.0 marks)

(c) Oxygen contains a mixture of 3 isotopes. Data of 2 isotopes are given as follows.

Mass number	16	17	X
Abundance	98%	1.82%	−

   (i)   Calculate the abundance of 3rd isotope?

   (ii) If the relative atomic mass of the mixture of oxygen is 16.0218, calculate the mass number of third isotope.

(1.5 marks)

4. (a) (i) Introduce the energy changes which related to following chemical changes.

     I. $A(g) + e \longrightarrow A^-(g)$

     II. $A(g) \longrightarrow A^+(g) + e$
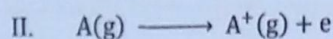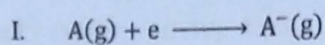
(ii) "Element absorbs or releases energy". Explain the above statement using elements N and

F for the change in equation (a) I

(3.0 marks)

(b) Followings are the electronic energy values which relevant to main quantum numbers of H atoms.

Main Quantum No.	1	2	3	4
Electronic energy /kJ	-2.18×10^{-21}	-5.45×10^{-22}	-2.42×10^{-22}	-1.36×10^{-22}

Using the above table and calculate,

(i)   The frequency relevant to red spectral line in Balmer series.

(ii)   Calculate the first ionization energy of H in $kJ\ mol^{-1}$ considering the energy of infinite level is "0" (Zero)

(5.0 marks)

(c) Following label of a commercial sulpuric acid bottle indicates data of the sample.

> Molecular Formula H_2SO_4
>
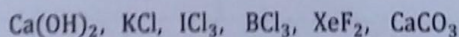> Density $1.18\ g\ cm^{-3}$
>
> Relative Atomic mass 98
>
> W/W 49%

(i)   Calculate the concentration of the sample of above sulphuric acid.

(ii)   Calculate the volume required from the commercial acid solution to prepare $1\ mol\ dm^{-3}$ of $100\ cm^3\ H_2SO_4$ acid solution.

(7.0 marks)

5. (a) Answer the following parts (i) to (v) using the following compounds.

    $Ca(OH)_2$, KCl, ICl_3, BCl_3, XeF_2, $CaCO_3$

(Same compound can be the answer for different questions)

(i)   The compound which is in use to identify CO_2 gas

(ii)   A structure of an uniform arrangement of (+) and (−) ions

(iii)   The species which have equal number of repulsion units around the central atom.

(iv)   The species which have same oxidation state of its central atom.

(v)   The compound which gives a single gaseous product in thermal decomposition .

(2.5 marks)

(b) In the reaction of acidic $FeCl_3$ (with a concentration of 1.0 mol dm^{-3}) and H_2S, sulphur (S) deposits as a product. (S = 32, Fe = 56, Cl = 35.5)

  (i) Identify the oxidizing agent.

  (ii) Identify the reducing agent.

  (iii) Write the ion – electron half reactions for the following instances.

    (i) Oxidation

    (ii) Reduction

  (iv) Calculate the required volume of $FeCl_3$ solution to produce 160 g of sulphur (S)

(6.0 marks)

(c) Mass of 1 cm^3 of a salt solution is 2.2 g .Mass percentage of available salt in it is 10% and 20% of it consist of $CaCl_2$ salt while 15% of it consist of $MgCl_2$ salt.

Calculate the concentrations of $CaCl_2$ and $MgCl_2$ in the solution.

(RAM of Mg = 24, Cl = 35.5, Ca = 40)

(6.5 marks)

* * *

Periodic Table

1 H																	2 He
3 Li	4 Be											5 B	6 C	7 N	8 O	9 F	10 Ne
11 Na	12 Mg											13 Al	14 Si	15 P	16 S	17 Cl	18 Ar
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
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
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
87 Fr	88 Ra	Ac Lr	104 Rf	105 Db	106 Sg	107 Bh	108 Hs	109 Mt	110 Uum	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