

General Certificate of Education (Advanced Level) Examination, November 2018

Chemistry I

02 E I

Time : One Hour

- * This paper consists of 8 pages. (Periodic table is provided.)
- * Answer all the questions.
- * Use of calculators is not allowed.
- * Write your index number in the space provided in the answer sheet.
- * Follow the instructions given on the back of the answer sheet carefully.
- * In each questions 1 to 50, pick one of the answer sheet with a cross (x) in accordance with the instructions given on the back of the answer sheet.

Grade 12
1 Term Test

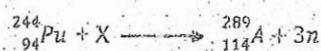
Universal gas constant, R	= 8.314 J mol ⁻¹ K ⁻¹
Avogadro constant, N _A	= 6.022 × 10 ²³ mol ⁻¹
Planck's constant, h	= 6.626 × 10 ⁻³⁴ J s
Velocity of light, c	= 3 × 10 ⁸ m s ⁻¹

- Which of the element having following atomic number contain 4 unpaired electrons?
(1) 6 (2) 14 (3) 16 (4) 22 (5) 26
- Which of the following set of quantum numbers (in order n, l, m_l, and m_s) is used to describe the unpaired electron of an atom which is in the ground state with the atomic number 29?
(1) 3, 2, 0, $+\frac{1}{2}$ (2) 3, 0, 0, $+\frac{1}{2}$ (3) 4, 3, 1, $+\frac{1}{2}$
(4) 4, 0, 0, $+\frac{1}{2}$ (5) 4, 1, 1, $+\frac{1}{2}$
- A 10cm long chained Mg strip is heated in a crucible until get a fixed mass, if the weight of the crucible is 15.65g and the weight of the Mg strip with the crucible is 16.13g, the mass of the oxide in grams is,
(1) 15.48 (2) 16.25 (3) 16.45 (4) 32.00 (5) 40.13
- Which of the following molecule / ion has a shape similar to that of SO₃²⁻ ion is,
(1) NO₂ (2) XeOF₂ (3) BrO₂ (4) SO₃ (5) COCl₂
- For the species BF₃, NH₃, H₂S and SiH₄ the correct order of the variation of bond angles is,
(1) H₂S < SiH₄ < NH₃ < BF₃ (2) BF₃ < H₂S < SiH₄ < NH₃ (3) H₂S < NH₃ < SiH₄ < BF₃
(4) H₂S < BF₃ < NH₃ < SiH₄ (5) NH₃ < BF₃ < H₂S < SiH₄
- Which of the following element contains 5 unpaired electrons in the M²⁺ gaseous ion at the ground state as well as in the elemental M.
(1) Co (2) Ni (3) Mn (4) Cr (5) Fe
- ¹⁷O and Y are released when ¹⁴N atom is bombarded with X. X and Y could be in orderly.

X	Y
(1) electron	hydrogen
(2) alpha particle	hydrogen
(3) β particle	helium nucleus
(4) alpha particle	helium nucleus
(5) neutron	β particle

- (8) Which of the following is different from the electron geometry of $\text{S}_2\text{O}_3^{2-}$ ion,
 (1) BCl_4^- (2) SO_4^{2-} (3) SF_4 (4) NH_3 (5) ClO_4^-
- (9) Which of the following statement is incorrect regarding hybridization.
 (1) Only the orbitals of the same atom undergo hybridization.
 (2) Bond angle between the hybridized sp orbitals is 180°
 (3) When considering the NH_3 molecule the N atom shows sp^2 hybridization.
 (4) Hybridized orbitals which formed by hybridization contains a similar energy and a similar shape.
 (5) π bonds are not formed between hybridized orbitals.

- (10) In 1999, a Russian scientist has made an element A, in which the atomic number is 114. This had been done by the bombarding nuclear reaction with element X which in the Group two of periodic table on Pu (Plutonium). The reaction is given below.



n is a neutron. X could be

- (1) Be (2) Mg (3) Ca (4) Sr (5) Ba
- (11) Butane (C_4H_{10}) is used as a fuel in domestic gas cylinders. The amount of O_2 has to be used to generate energy by complete combustion of 1kg of Butane is,
 (C=12, H=1, O=16)
 (1) 3.20kg (2) 3.40kg (3) 3.51kg (4) 3.82kg (5) 3.60kg
- (12) A particle with a mass of 3.312×10^{-26} g is moving in a velocity of $3 \times 10^6 \text{ ms}^{-1}$. De-Broglie wave length of that particle is,
 (1) 0.26nm (2) 0.67nm (3) 1.34nm (4) 1.24nm (5) 6.70nm
- (13) Volume of the 0.575g. of vapour of gas A is 175 cm^3 . What is the molar mass if the molar volume of the gas is $35 \text{ dm}^3 \text{ mol}^{-1}$ at room temperature.
 (1) 67g (2) 115g (3) 167g (4) 180g (5) 201g
- (14) A 500.00 cm^3 of solution is prepared by dissolving 0.25g of CaCO_3 in excess HCl . Ca^{2+} ion concentration in the solution in ppm is, (H=1, C=12, O=16, Cl=35.5, Ca=40)
 (1) 200.2ppm (2) 400.5ppm (3) 450.5ppm (4) 500.2ppm (5) 520.5ppm
- (15) A 0.3101g of $\text{Na}_2\text{C}_2\text{O}_4$ was dissolved in 30 cm^3 of water and acidified with H_2SO_4 by a student. The burette reading was 24.90 cm^3 , when this solution was titrated with a H / KMnO_4 solution. The concentration of KMnO_4 solution in mol dm^{-3} is,
 (Na=23, C=12, O=16)
 (1) 0.0023 (2) 0.0037 (3) 0.0369 (4) 0.092 (5) 0.958

Instructions for question no. 16 to 20

For each of the questions 16 to 20, four responses (a), (b), (c) and (d) are given. One or more of these is/are correct. Select the correct response / responses. In according to 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 (a) and (d) are correct
- (5) If any other number or combination of response is correct

Summary of above Instruction.

(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

- (16) Which of the following statement/s is/are true?
- (a) White light forms a continuous spectrum
 - (b) The Lyman series of hydrogen emission spectrum exist in the infrared region of electro magnetic spectrum.
 - (c) H_{α} line of the hydrogen emission spectrum has the highest energy in the visible range.
 - (d) The electro-magnetic spectrum is the diagram which could be obtained by ordering the frequency of electro magnetic waves in ascending order.
- (17) The intermolecular force/ forces which could be existed in a solution in which I_2 was dissolved in aqueous KI is/are,
- (a) dipole- induced dipole attractions
 - (b) H bonds
 - (c) ion-induced dipole bonds
 - (d) dipole- dipole attractions
- (18) Which of the following statement is/ are true regarding α , β and γ rays.
- (a) β rays are deflected more than the other rays in the magnetic fields with similar intensities.
 - (b) Radio active substances emit these 3 - rays at the same moment in the same rate.
 - (c) α - rays and β - rays are deflected to opposite directions with same angles in an electric field.
 - (d) Mass of α - rays are greater than that of β and γ - rays
- (19) Which of the following statement is /are true?
- (a) The boiling point of H_2S is greater than the boiling point of H_2O .
 - (b) The bond angle of H_2S is lesser than the bond angle of H_2O
 - (c) The melting point of H_2O is greater than the melting point of HF.
 - (d) To form H bonds it is essential to bind a more electro negative atom to a H atom.
- (20) Which of the following Redox reaction/s does / do not happen in the basic medium.
(Chemical equations are not balanced)
- a) $MnO_4^- + Br^- \longrightarrow MnO_2 + BrO_3^-$
 - b) $Fe^{2+} + CrO_4^{2-} \longrightarrow Fe^{3+} + Cr^{2+}$
 - c) $NH_3 + MnO_4^- \longrightarrow MnO_2 + N_2$
 - d) $MnO_2 + 2I^- \longrightarrow I_2 + Mn^{2+}$

Instructions for question no. 21 to 25.

In question no. 21 to 25, 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.

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

	First statement	Second Statement
21.	An atom can have 2 electrons with the same quantum number.	2 electrons can exist in one atomic orbital.
22.	Boiling points and melting points of covalent compounds always lesser than that of the ionic compounds.	Covalent compounds do not form lattice structures.
23.	First ionization energy of S is in-between the first ionisation energies of Si and P.	Covalent radii of S is in-between the covalent radius of Si and P.
24.	AgCl has more ionic nature than that of AgBr	Br^- ion is larger in size than that of Cl^- .
25.	Dissociation of H_2O_2 is a disproportionate reaction	H_2O_2 act as an oxidizing agent as well as a reducing agent



Visakha Vidyalaya – Colombo

First Term Test - November 2018

Grade – Year 12

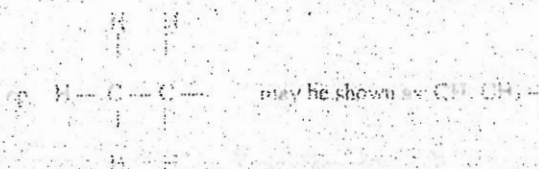
Chemistry II

Time : 1 and 1/2 hours

Name :-

Part A – Structured Essay (Pages 01 – 10)

- * Use of calculators is not allowed.
- * Answer all the questions.
- * Write your answer in the space provided below each question.
- * Please note that the space provided is sufficient for the answer and that extensive answers are not expected.
- * In answering questions, you may represent alkyl groups by a condensed formula.



Part B – Essay (Pages 11 – 17)

- * Answer two questions.
- * At the end of the time allotted for this paper, the answers to two parts A and B together so that part A is on top and hand them over to the supervisor.
- * You are permitted to remove only Part B of the question paper from the Examination Hall.

Universal gas constant	R	=	8.314 J mol ⁻¹ K ⁻¹
Avogadro constant	N _A	=	6.022 × 10 ²³ mol ⁻¹
Planck's constant	h	=	6.63 × 10 ⁻³⁴ Js
Velocity of light	C	=	3 × 10 ⁸ m S ⁻¹
Faraday constant	F	=	96500 C mol ⁻¹

For Examiner's Use only

Part	Q. NO.	Marks
A	1	
	2	
	3	
	4	
B	5	
	6	
	7	

Final Marks

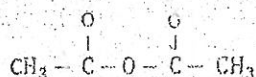
In numbers	
In Letters	

* Answer all questions.

1. (a) State whether following statements are true or false.

- (i) Boiling points of halogens increase with their size.
- (ii) The bond angle of F-O-F of OF_2 is higher than the bond angle of H-O-H of H_2O
- (iii) Hydrogen bond of HF is weaker than the hydrogen bonds of H_2O
- (iv) Electron pair geometry of SF_4 is tetrahedral.
- (v) The quantum numbers (n, l, m_l) of valence electrons of a Sr Atom is 5, 0, 0
- (vi) The covalent radius of Li is higher than the covalent radius of hydrogen.

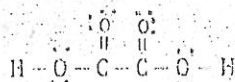
(3.0 marks).

(b) (i) The skeleton of dimethyl anhydride ($\text{C}_4\text{O}_3\text{H}_6$) is given below.

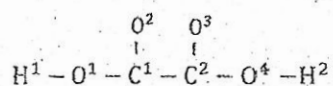
Draw the most acceptable Lewis structure for above molecule.

(ii) Draw another three Lewis structures (resonance structures) for above molecule except the structure in part (i).

(iii) Bioxalate ion is converted to oxalic acid in acidic medium. The most acceptable Lewis structure for the molecule of oxalic acid is given below.



The atoms are numbered as follows



Based on the hypothetical Lewis structure given above, state the following regarding O and C atoms given in the table below.

- VSEPR pairs around the atom
- electron pair geometry around the atom
- shape around the atom
- hybridization of the atom.

	O ¹	C ¹	O ²
(i) VSEPR pairs			
(ii) electron pair geometry			
(iii) shape			
(iv) hybridization			

- (iv) Identify the atomic / hybrid orbitals involved in the formation of the following σ bonds in the Lewis structure given in part (iii) above. (Numbering of atoms is as in part (iii))

- H¹ - O¹ H¹ O¹
- O¹ - C¹ O¹ C¹
- O² - C¹ O² C¹
- C¹ - C² C¹ C²

- (v) Identify the atomic orbitals involved in the formation of the following π bonds in the Lewis structure given in part (iii) above. (Numbering of atoms is as in part (iii))

- O² - C¹ O² C¹
- O³ - C² O³ C²

(3.2 marks)

- (c) Arrange the following in the increasing order of the property indicated in parentheses. (Reasons are not required.)

- (I) Li, Be, B, O, Na (1st ionization energy)

..... < < <

- (II) CO, HCN, CO₂, CO₃²⁻, CH₄ (electronegativity of carbon)

..... < < <

- (III) Mg(OH)₂, Be(OH)₂, Ca(OH)₂, Ba(OH)₂, Sr(OH)₂ (Thermal stability)

..... < < <

(1.8 marks)

2. (a) X is a compound having Na, C, and O. Mass percentages of C and O of this compound is 17.91% and 47.76%. The rest is Na. (C=12, O=16, Na=23).

(i) Deduce the empirical formula of X.

.....

(ii) Deduce the chemical formula of X, if the molar mass of X is 134 g mol^{-1} .

.....

(iii) Write the formula of the anion, if Na presence as a monovalent cation.

.....

(iv) State the oxidation number / oxidation state of C and O of the anion

C $\longrightarrow$
 O $\longrightarrow$

(v) Name the lattice present in solid crystals of X.

.....

(vi) Name two secondary interactions present in an aqueous solution of X.

..... (5 marks)

- (b) (i) Calculate the mass of KMnO_4 crystals to be weighed to prepare 250 cm^3 of 0.02 mol dm^{-3} KMnO_4 solution. (K=39, Mn=55, O=16)

.....

(ii) 18 cm^3 of FeSO_4 solution was used to react with 25 cm^3 of above acidified KMnO_4 solution.

(I) Write reduction half ionic equation for above reaction.

.....

(II) Write oxidation half ionic equation for above reaction.

.....

(III) Write balanced ionic equation for above reaction.

.....

(iii) Calculate the concentration of FeSO_4 aqueous solution in mol dm^{-3}

.....

(5 marks)

