දුලාන් මධුරංග- රසායන විද්‍යාව විභාග මධ්‍යස්ථානය

Special Online Speed Test

අධ්‍යයන පොදු සහතික පත්‍ර (උසස් පෙළ), 2023 අගෝස්තු

General Certificate Of Education (Adv. Level) Examination, August 2023

රසායන විද්‍යාව I Chemistry I	02	S/E	I	2 1/2 Hours

Universal gas constant $R = 8.314\ J\ K^{-1}\ mol^{-1}$ Plank's constant $h = 6.626\times10^{-34}\ J\ s$

Avogadro constant $N_A = 6.022\times10^{23}\ mol^{-1}$ Velocity of light $c = 3\times10^{8}\ m\ s^{-1}$

Monthly Evaluation Test – 2021 July

Part I- MCQ

- **Answer all the Questions.**
- **Do not use Calculators or any other Notes.**
- **Submit your Answer script (including Rough works) in PDF Form.**

1. Properties of the elements are characterized by their atomic numbers. The scientist who contributed to the finding of atomic numbers of elements is

   1) Rutherford 2) Chadwick 3) Mosley 4) Thomson 5) Henry Becqurel

2. The effective nuclear charge which is felt by the one valence electron of Magnesium (Mg) is ?

   (1) Greater than that of Sodium (Na) (2) Equal to +1 (3) Equal to +12
   (4) Greater than that of Aluminium (Al) (5) Equal to +24

3. The sets of quantum numbers corresponding to the last two electrons of an element are, (4,0,0,+½) , (3,2,-1, +½) . The suitable element is.

   1) Ca *2)* K *3)* Cr *4)* Mn *5)* Sc

4. Which of the following has a positive value for its electron gaining energy.

   1. Li 2. Be 3. B 4. O 5. K

5. Which of the following statement is correct?

   1. In Hydrogen atom n = 1 ⟵ n = 7 electron transfer has the highest energy.
   2. Longest wavelength radiation present in Lyman series in a H spectrum.
   3. In H spectrum Lowest energy radiation present in Lyman series.
   4. In H spectrum shortest wavelength radiation present in Paschen series.
   5. In H spectrum wavelength range in visible region is 200 – 500 nm.

6. Energy of one mole of photon which has a wave length of 5×10^{-2} nm is,

1. 3.98×10^{-15}J 2. 3.98×10^{-17} J 3. 29.69×10^{5} KJ
4. 23.96×10^{4} KJ 5. 23.96×10^{5}kJ

7. The total number of elements presents in the seventh period of the periodic table (Which has a total number of elements 113) are,

(1) 8 (2) 18 (3) 2 (4) 32 (5) 27

8. The sets of quantum numbers of 4 electrons in an atom are given below indicated as 1, 2, 3 and 4.

Electron	Set of quantumn numbers
1	(4, 1, 0, +1/2)
2	(4, 0, 0, +1/2)
3	(3, 2, 1, +1/2)
4	(3, 1, 1, +1/2)

The energy of the four electrons increase in the order.

(1) 4 < 2 < 3 < 1 (2) 2 < 4 < 1 < 3 (3) 1 < 3 < 2 < 4
(4) 3 < 1 < 4 < 2 (5) 1 < 2 < 3 < 4

9. The increasing order of first ionization enthalpies of the elements N, F, Ar, Cl, Al and K is

(1) K< Al < Cl < Ar < N < F (2) K < Al < Ar < Cl< N < F (3) K < Al < Cl <N <F<Ar
(4) K < Al < N < F <Cl< Ar (5) K < Al < Cl < N < A r< F

10. Which of the following set of quantum number is **not possible** for the valence electron of the most stable ion of Sc?

(1) (3,2,-1,+ ½) (2) (3,0, 0, + ½) (3) (3,1,0, - ½)
(4) (3,1,-1, + ½) (5) (3,0,0, - ½)

11. Oxidation number and valency of carbon atoms in C_2H_2 molecule respectively are,

1) –1 and 4 2) +1and 4 3) –1and 1
4) +1and 1 5) –4 and 4

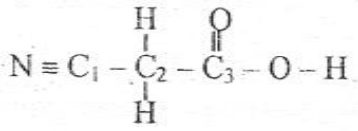
12. Ascending order of ionic radius of the following species is correctly given by.

1) $O^{2-} < F^- < Na^+ < Mg^{2+}$ 2) $Na^+ < Mg^{2+} < O^{2-} < F^-$
3) $Mg^{2+} < Na^+ < F^- < O^{2-}$ 4) $F^- < O^{2-} < Na^+ < Mg^{2+}$
5) $Na^+ < Mg^{2+} < F^- < O^{2-}$

13. Which statement/s is/are true regarding γ rays emitted during nuclear reactions,

a) Their ionization power is higher than that of α rays.
b) They have the speed of light in vacuum
c) They do not deflect in magnetic and electric fields.
d) They are electromagnetic radiations.

14.



Hybridization of C_1, C_2 and C_3 are correctly shown by,

	C_1	C_2	C_3
1)	sp	sp^3	sp
2)	sp	sp^3	sp^3
3)	sp^3	sp^3	sp^2
4)	sp^2	sp^3	sp^2
5)	sp	sp^3	sp^2

15. Successive ionization energies of non transitional element A is given below.

I_1 – 1058 kJ mol^{-1} I_2 – 1345 kJ mol^{-1}
I_3 – 4600 kJ mol^{-1} I_4 – 6210 kJ mol^{-1}
I_5 – 37750 kJ mol^{-1} I_6 – 47100 kJ mol^{-1}

Two oxides formed by A can be,

1) A_2O_3 and A_2O 2) AO_2 and A_2O_4 3) A_2O_3 and A_2O_4
4) AO and AO_2 5) AO and A_2O

The 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 Ds	111 Rg	112 Cn	113 Nh	114 Fl	115 Mc	116 Lv	117 Ts	118 Og

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

දුලාන් මධුරංග- රසායන විද්‍යාව විභාග මධ්‍යස්ථානය

Special Online Speed Test

අධ්‍යයන පොදු සහතික පත්‍ර (උසස් පෙළ), 2023 අගෝස්තු

General Certificate Of Education (Adv. Level) Examination, August 2023

රසායන විද්‍යාව I Chemistry I	02	S/E	I

Universal gas constant $R = 8.314\ J\ K^{-1}\ mol^{-1}$ Plank's constant $h = 6.626\times10^{-34}\ J\ s$

Avogadro constant $N_A = 6.022\times10^{23}\ mol^{-1}$ Velocity of light $c = 3\times10^{8}\ m\ s^{-1}$

Part II- A- Structured Essay

❖ **Answer all the Questions**

1. a) *A*, *B* and *C* are experimental observations. Given against each of them are some explanations provided by students for these observations. Of these explanations given for each observation, one or more may be correct.

Evaluate these explanations by

i) Marking in the appropriate box a ☑ if, in your opinion,

ii) Marking in the appropriate box a ☒ if, in your opinion, the explanation is invalid.

	Experimental observation.	Students' Explanation
A	When a beam of α particles falls on a thin gold plate, most of the α particles pass undeflected through the plate.	☐ The gold plate contains spaces which are large compared with the size of α particles. ☐ The gold plate is non continuous. ☐ The path of α particles is always linear.
B	A paddle wheel placed in the path of cathode rays rotates.	☐ Cathode rays are negatively charged. ☐ Cathode rays have particle – like properties. ☐ Material of the paddle wheel is continuous.
C	The electronic emission spectrum of hydrogen consists of several series of lines, in each series, the separation between the lines decreases as the frequency increases.	☐ There are definite energy levels for the electrons in the H – atom. ☐ The energy corresponding to each line in the spectrum is equal to the energy of an electronic level of hydrogen. ☐ The energy of the electron decreases with increasing radius of the atomic shell. The energy difference between successive levels decreases as the energy of the electronic levels increases.

b) Answer the following questions regarding the elements C, H, Mg, Ne, Be and He only.

i) Which element has the least covalent radius? .....

ii) Which element has the least second ionization energy? .....

iii) Which element can act as the strongest reducing agent? .....

iv) Which element/s form compounds without completing its electron octet? .....

v) Which element is used in filling balloons? .....

c) **An atomic orbital is described by three quantum numbers n, l and m_l.**

Write the appropriate quantum numbers and the name of the atomic orbital in the boxes given below.

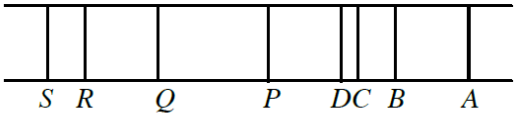
	n	l	m_l	atomic orbital
I.			+1	3p
II.	3	2	–2	
III				2s

2. a)

The following table gives the energy of an electron when it exists in the principal energy level of a hydrogen atom. (The energy ralues are assigned negative sign in accordance with convention that the energy of an electron at an infinite energy level from the neucleus is zero.)

Principal energy level (n)	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Energy of the electron / kJ mol^{-1}	–1311	–327	–145	–80	–52	–36	–24

Two series of lines of the emission spectrum of hydrogen are shown below.



Line D is violet in colour.

(i) Write the name of the series to which lines P, Q, R, S belong.

.....

(ii) What are the energies in kJ mol^{-1} of the two principal energy levels relevant to line D?

.....

.....

.....

(iii) What is the energy of one mole of photon of the radiation relevant to the line *D*?

.....

.....

.....

(iv) What is the frequency of the radiation relevant to the violet line?

.....

.....

.....

.....

.....

.....

(v) What is the first ionization energy of a hydrogen atom?

.....

.....

.....

b)

Arrange the given property in ascending order.

i) N, O, Si, F Electro negativity .....

ii) Na, Cl, P, Al 1st ionization energy .....

iii) B, N, F, Li Atomic radius .....

iv) Mg^{2+}, O^{2-}, Na^{+}, F^{-} (ionic radius)

.....

v) LiBr, NaBr, KBr, RbBr (ionic property)

.....

vi) B, C, N, O (first electron affinity)

.....

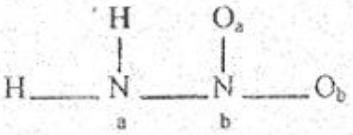
vii) CH_4, CH_3Cl, HCHO, HCN (electro-negativity of carbon)

.....

viii) N_2, O_2, Cl_2, F_2 (bond length)

.....

c) Consider the skeleton given below.



Details of one of the lewis structure for the above molecule is given below.

Atom	N_a	N_b	O_a	O_b
Hybridization	sp^3	sp^2	sp^3	sp^2

i) Draw the Lewis structure of NH_2NO_2 which suits to the data given.

.....

.....

.....

.....

The Periodic Table

	1																2
1	H																He
	3	4											5	6	7	8	9	10
2	Li	Be											B	C	N	O	F	Ne
	11	12											13	14	15	16	17	18
3	Na	Mg											Al	Si	P	S	Cl	Ar
	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
	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
	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
	87	88	Ac-	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118
7	Fr	Ra	Lr	Rf	Db	Sg	Bh	Hs	Mt	Ds	Rg	Cn	Nh	Fl	Mc	Lv	Ts	Og

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

දුලාන් මධුරංග- රසායන විද්‍යාව විභාග මධ්‍යස්ථානය

Special Online Speed Test

අධ්‍යයන පොදු සහතික පත්‍ර (උසස් පෙළ), 2023 අගෝස්තු

General Certificate Of Education (Adv. Level) Examination, August 2023

රසායන විද්‍යාව I Chemistry I	02	S/E	I

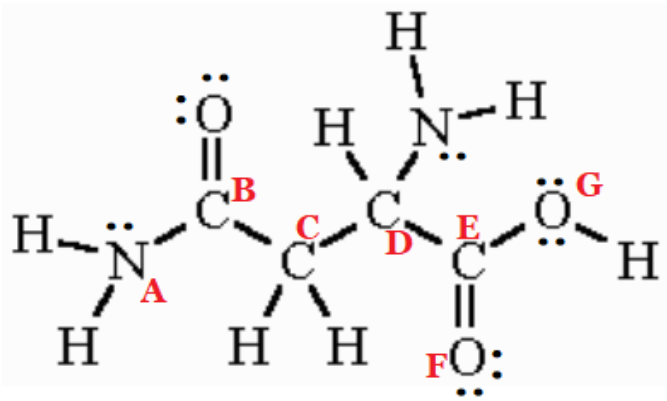
Universal gas constant $R = 8.314\ J\ K^{-1}\ mol^{-1}$ Plank's constant $h = 6.626\times10^{-34}\ J\ s$

Avogadro constant $N_A = 6.022\times10^{23}\ mol^{-1}$ Velocity of light $c = 3\times10^{8}\ m\ s^{-1}$

Part II- B Essay

Answer all the Questions.

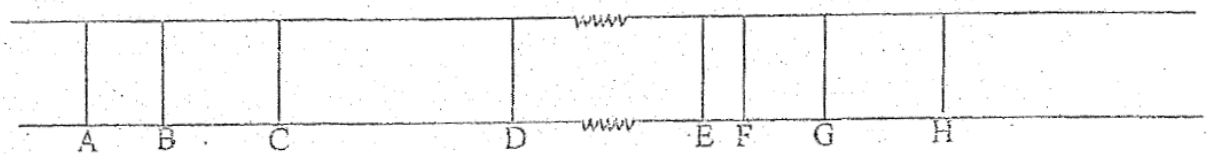
3.. a) **Complete the follow given table considering the Atoms A,B,C,D,E,F and G.**



Atom	Valency	Charge	Hybridization	Oxidation Number	Number of Lone pairs	Number of Bonds
A						
B						
C						
D						
E						
F						
G						

b) A source which emits a range of radiation including above radiation upto 700nm is given to excite electron in hydrogen gas sample.

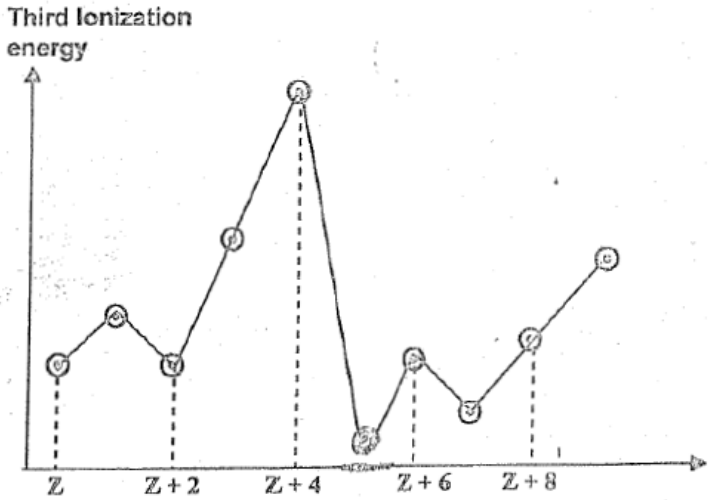
When electrons in higher energy levels come back to lower energy levels, spectrum corresponds to those is given in below diagram.



In above spectrum A, B, C and D are in same region as wave length of radiation
E, F, G and H are in wave length in range of 400 - 700nm.

In above 8 spectral lines, draw corresponding electron transition using arrows considering first 6 electronic energy level. (label your diagram with A,B,C,D and E,F,G,H and series names.

c) A, B, C, D, E, F, G, H, I and J are successive elements belonging to second and third periods of the periodic table. Following graph gives third ionization energies of those elements.



(a) (i) Identify elements from A to J

A - ..... B - ..... C - .....

D - ..... E - ..... F - .....

G - ..... H - ..... I - .....

J - .....

(ii) Identify elements belonging to same group.

.....

4. a) The following table represent the values of the successive standard molar ionization energies of an element X.

Molar ionization energy in $kJmol^{-1}$	1^{st}	2^{nd}	3^{rd}	4^{th}	5^{th}	6^{th}	7^{th}
	1400	2880	4520	7450	9450	53000	64200

I. What is meant by the first ionization energy?

II. To what group in the periodic table should element X be assigned? Explain your answer.

III. Write the all possible stable oxidation numbers for element X.

IV. If the element X of atomic number less than 20, does not exist as gas. Identify the element and write the electronic configuration.

V. Write the molecular formula for element X formed oxide the higher oxidation state.

(b) (i) Write down electronic configuration of y^{2+} ion formed by Y which has atomic number 28

.....

.....

(ii) How many unpaired electrons are present in Y^{2+} ion.

.....

.....

(iii) Write down quantum number series for electrons present in last sub energy level of Y.

.....

.....

c) Write balanced equations for the following nuclear reactions.

(i) when $^{9}_{4}Be$ is bombarded with an alpha particle [$^{4}_{2}He$], $^{12}_{6}C$ is made by removing a neutron [$^{1}_{0}n$]

(ii) $^{60}_{27}Co$ emits gamma rays and a beta particle to form $^{60}_{28}Ni$.

(iii) $^{232}_{90}Th$ emits gamma rays [γ] and an alpha particle to form $^{228}_{88}Ra$.

(iv) formation of $^{14}_{7}N$ by removing a beta particle [$^{0}_{-1}\beta$] from $^{14}_{6}C$.

********** **Monthly Evaluation Test – July, 2021** **********