



# Maris Stella College - Thimbirigaskatuwa

Grade 12 (2027 AL)

1<sup>st</sup> Term Evaluation

December - 2025

Chemistry

02

E

I

Two hours

Name : ..... Class : ..... Class No: .....

Plank constant  $= 6.626 \times 10^{-34} \text{ J s}$   
Avogadro constant  $N_A = 6.022 \times 10^{23} \text{ mol}^{-1}$   
Velocity of light  $c = 3 \times 10^8 \text{ m s}^{-1}$

- This paper contains 7 pages. Write the answers on this paper.

- The scientist who experimentally proved the charge of an electron,  
(1) E. Rutherford (3) R. Millikan (5) F.W. Aston  
(2) J. J. Thomson (4) Henry Becquerel
- Which of the following element will have the highest second ionization energy?  
(1) Na (2) Mg (3) Ne (4) He (5) N
- In which species below, contains the same number of electrons as in an alpha particle?  
(1) H (2) He (3)  $\text{H}^+$  (4)  $\text{H}_2$  (5)  $\text{Li}^+$
- Select the molecule with lowest dipole moment?  
(1)  $\text{CF}_3\text{Cl}$  (2)  $\text{CF}_4$  (3)  $\text{CHCl}_3$  (4)  $\text{CH}_3\text{Cl}$  (5)  $\text{NF}_3$
- Electronegativity values of five elements Q, R, T, X and Z are 0.8, 1.0, 1.5, 2.5 and 4.0 respectively.  
Which bond shows highest ionic characters?  
(1) T-X (2) X-Z (3) Q-R (4) Q-Z (5) Q-T
- Select the possible set of quantum numbers for an electron?  
(1) 1, 2, -2, 0 (4) 3, 2, -3, -1/2  
(2) 1, 1, 0, 1/2 (5) 2, 1, -1, -1/2  
(3) 2, 1, 0, 0

Answer the questions 7) and 8) based on the following table

| Element | Number of electrons | Number of protons | Number of neutrons |
|---------|---------------------|-------------------|--------------------|
| A       | 10                  | 10                | 8                  |
| D       | 10                  | 11                | 12                 |
| Q       | 18                  | 17                | 16                 |
| R       | 18                  | 20                | 18                 |
| T       | 11                  | 11                | 11                 |

- Select the most stable nuclide  
(1) A (2) D (3) Q (4) R (5) T
- Select the isotopes  
(1) A and D (2) Q and R (3) R and T (4) A and R (5) D and T

9) In which of these ion pairs the radius of the first ion is larger than that of the second ion?

- (1)  $\text{Cl}^-$ ,  $\text{Br}^-$
- (2)  $\text{F}^-$ ,  $\text{O}^{2-}$
- (3)  $\text{Mg}^{2+}$ ,  $\text{Na}^+$
- (4)  $\text{K}^+$ ,  $\text{Ca}^{2+}$
- (5)  $\text{Na}^+$ ,  $\text{F}^-$

10) An element X has three isotopes as given below. What is the relative atomic mass of X?

| Atomic Number | Mass Number | Percentage of abundance (%) |
|---------------|-------------|-----------------------------|
| 10            | 20          | 99                          |
| 10            | 21          | 0.75                        |
| 10            | 22          | 0.25                        |

- (1) 20.1250
- (2) 20.0125
- (3) 63.0000
- (4) 10.0000
- (5) 20.0000

11) In a certain emission spectrum of hydrogen has 5 lines in the Balmer series. What is the possible number of spectral lines in Lyman, Paschen and Brackett series in order?

- (1) 6,4,3
- (2) 6,5,4
- (3) 6,3,4
- (4) 4,6,7
- (5) 7,4,3

12) What is the required volume of  $0.1 \text{ mol dm}^{-3} \text{H}_2\text{SO}_4(\text{aq})$  to completely react with  $10.00 \text{ cm}^3$  of  $0.1 \text{ mol dm}^{-3} \text{NaOH}$  solution?

- (1)  $20 \text{ cm}^3$
- (2)  $10 \text{ cm}^3$
- (3)  $5 \text{ cm}^3$
- (4)  $2 \text{ cm}^3$
- (5)  $0.5 \text{ cm}^3$

13) The shapes of  $\text{F}_3\text{ClO}$ ,  $\text{FClO}_2$  and  $\text{FClO}_3$  are respectively,

- (1) Tetrahedral, trigonal planar and see-saw
- (2) Square planar, trigonal planar and tetrahedral
- (3) See-saw, trigonal pyramidal and square planar
- (4) Tetrahedral, trigonal pyramidal and see-saw
- (5) See-saw, trigonal pyramidal and tetrahedral

14) Select the **correct** statement.

- (1) The first ionization energy of elements increase as  $\text{B} < \text{Be} < \text{O} < \text{N}$
- (2) The polarizability of  $\text{F}^-$ ,  $\text{Cl}^-$  and  $\text{S}^{2-}$  ions increases in the order  $\text{F}^- < \text{S}^{2-} < \text{Cl}^-$
- (3) The polarizing power of  $\text{Li}^+$ ,  $\text{Na}^+$  and  $\text{Mg}^{2+}$  decreases in the order  $\text{Mg}^{2+} > \text{Na}^+ > \text{Li}^+$
- (4) The electronegativity of O, F, Cl and S decreases in the order  $\text{F} > \text{O} > \text{S} > \text{Cl}$
- (5) The interatomic bond distances of  $\text{N}_2$ ,  $\text{O}_2$ ,  $\text{F}_2$  and HF increase in the order  $\text{HF} < \text{N}_2 < \text{O}_2 < \text{F}_2$

15) Select the **incorrect** statement.

- (1) Electron gain energy of Carbon is negative.
- (2) Pauli exclusion principle excludes the possibility of the presence of a third electron in an orbital
- (3) In a potassium atom, the number of electrons having quantum numbers n (principal quantum number) = 3 and  $m_l$  (magnetic quantum number) = 0 is 4
- (4) The effective nuclear charge felt by a valence electron in nitrogen (N), is greater than the effective nuclear charge felt by a valence electron in carbon (C).
- (5) Among the ions  $\text{Na}^+$ ,  $\text{Mg}^{2+}$ ,  $\text{K}^+$  and  $\text{Ca}^{2+}$ , the two ions closest to each other in size are  $\text{K}^+$  and  $\text{Mg}^{2+}$ .

➤ **Instructions for the questions from 16-20**

- For each of the question four responses (a), (b), (c) and (d) are given of which one or more 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 response is/are correct

| Summary of above instructions |                          |                          |                          |                                                     |
|-------------------------------|--------------------------|--------------------------|--------------------------|-----------------------------------------------------|
| (1)                           | (2)                      | (3)                      | (4)                      | (5)                                                 |
| Only (a) and (b) correct      | Only (b) and (c) correct | Only (c) and (d) correct | Only (d) and (a) correct | Any other number or combination of response correct |

16) Which of the following statement/s is/are **correct**

- (a) All the atoms in nature have electrons, protons and neutrons  
 (b)  $^{12}_6\text{C}$  is a stable isotope  
 (c) In radioactive elements nucleus is not stable  
 (d) An atom cannot be divided further

Answer

☐

17) Which of the following statement/s is/are **correct** about elements in the periodic table?

- (a) The atomic radius decreases from left to right  
 (b) The electronegativity decreases from left to right  
 (c) First ionization energy always increases from left to right  
 (d) Anionic / Cationic radius decrease from left to right

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18) Which of the following statement/s is/are **true** for an electron that has quantum numbers  $n = 3$  and  $m_l = -1$ ?

- (a) The electron is in the first main energy level  
 (b) The electron is in a  $d$  orbital  
 (c) The electron can be in a  $p$  orbital  
 (d) The electron can have a  $m_s = -1/2$

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19) Which of the following pair has similar shapes?

- (a)  $\text{XeF}_2$ ,  $\text{I}_3^-$   
 (b)  $\text{SO}_3$ ,  $\text{CCl}_4$   
 (c)  $\text{NO}_2^+$ ,  $\text{BF}_3$   
 (d)  $\text{PH}_3$ ,  $\text{H}_3\text{O}^+$

☐

20) Which of the following statement/s is/are **true** about cathode rays?

- (a) do not affected by external electric or magnetic fields  
 (b) always travel at the speed of light in vacuum  
 (c) travelled in straight lines  
 (d)  $e/m$  ratio does not depend on the gas inside the cathode ray tube

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➤ **Instruction for the questions from 21-25**

- From the table given below, select the response out of the responses (1), (2), (3), (4) and (5) that best fits the two statements given for each of the questions 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. $\text{C}=\text{C}$ bond is stronger than $\text{C}-\text{C}$ bond  | $\sigma$ bond is stronger than $\pi$ bond                                                 |
| 22. Gamma rays has higher energy than Ultra Violet rays                 | UV rays have lower frequency range than gamma rays                                        |
| 22. Mass of protium is similar to the unified atomic mass unit          | Mass of deuterium is about the twice the mass of unified atomic mass unit                 |
| 24. There is no unit for Avogadro number                                | Avogadro number is defined as the number of atoms in 12.0000 g of $^{12}\text{C}$ isotope |
| 25. Both ammonia and water molecules have same electron pair geometries | Both ammonia and water molecules have $\text{sp}^2$ hybridized central atom               |

Name : ..... Class : ..... Class No: .....

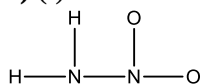
## Part 2

Answer **all** the questions

01) **a)** Write the answers to the questions given below on the dotted lines.

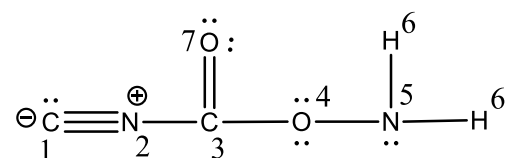
- (i) Write the element with highest boiling point .....
- (ii) Write the element with highest first ionization energy .....
- (iii) Which species will have the nitrogen atom with highest electronegativity.  
 $\text{NH}_3, \text{NH}_2^-, \text{NH}_4^+$  .....
- (iv) Which species will have the highest bond angle  
 $\text{H}_2\text{O}, \text{H}_2\text{S}, \text{NH}_3, \text{CH}_4$  .....
- (v) The element which is a liquid at  $25^\circ\text{C}$  and shows maximum oxidation number +7 .....

**b)** (i) Draw the most stable Lewis structure for the molecule  $\text{H}_2\text{N}_2\text{O}_2$



(ii) Draw two resonance structures for this molecule (excluding the structure drawn in part (i) above).

(iii) Complete the table based on the Lewis structure given below



|     |                        | $\text{N}^2$ | $\text{C}^3$ | $\text{O}^4$ | $\text{N}^5$ |
|-----|------------------------|--------------|--------------|--------------|--------------|
| I   | VSEPR pairs            |              |              |              |              |
| II  | Electron pair geometry |              |              |              |              |
| III | Shape                  |              |              |              |              |
| IV  | Hybridization          |              |              |              |              |

(iv) Identify the atomic / hybrid orbitals involved in the formation of the following  $\sigma$  bonds in the Lewis structure drawn in part (iii) above. [Numbering of atoms is as in part (iii).]

1.  $N^2 - C^3$        $N^2$  .....       $C^3$  .....
2.  $O^4 - N^5$        $O^4$  .....       $N^5$  .....
3.  $N^5 - H^6$        $N^5$  .....       $H^6$  .....
4.  $C^3 - O^7$        $C^3$  .....       $O^7$  .....

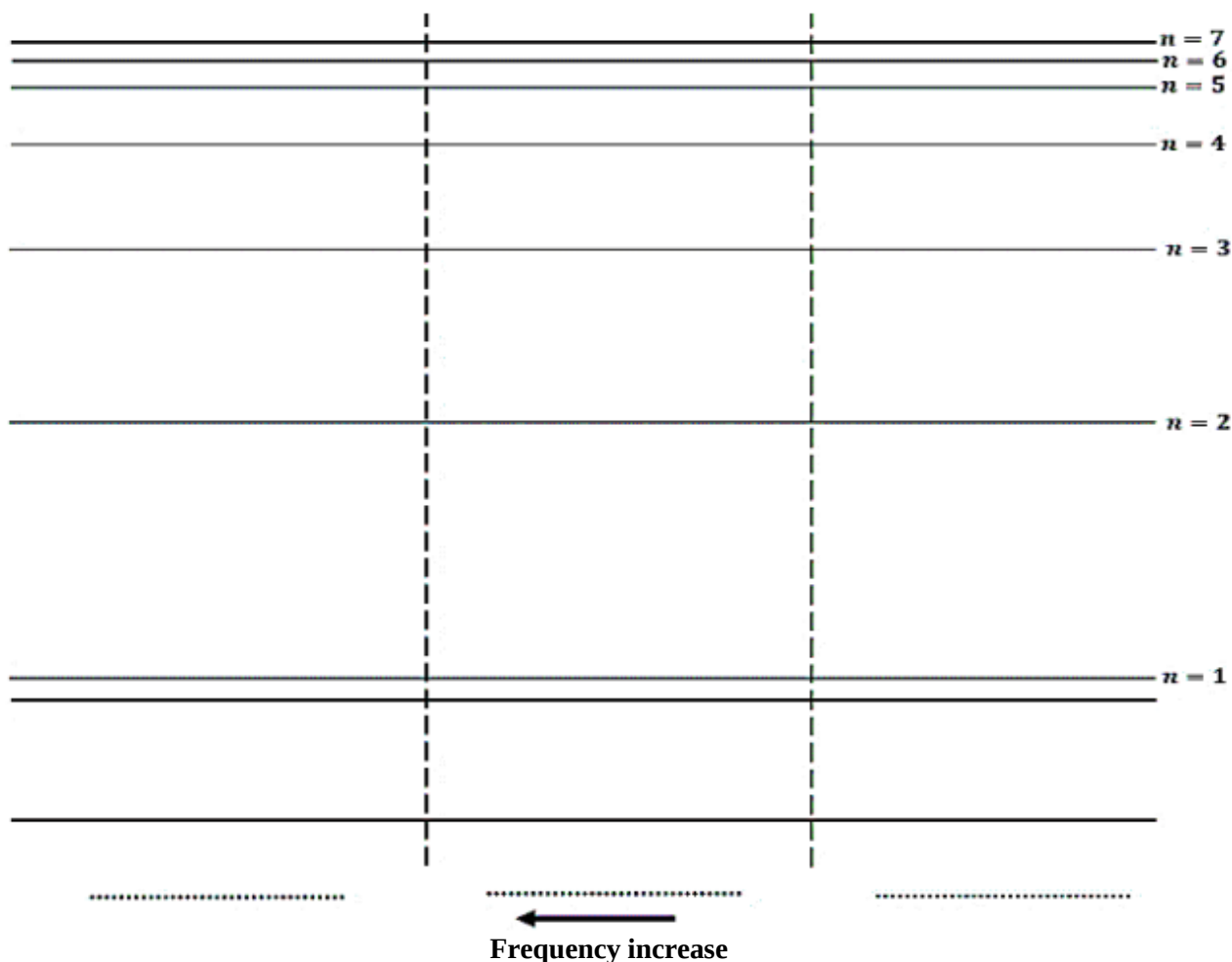
c) Identify the sub-shells (atomic orbitals) along with their azimuthal quantum number ( $l$ ), and magnetic quantum number/s ( $m_l$ ) for the energy level with principal quantum number  $n=3$  in an atom. What is the maximum number of electrons present in each sub-shell? Write your answers in the table given below.

| Sub-shell | Azimuthal quantum number ( $l$ ) | Magnetic quantum number/s ( $m_l$ ) | Maximum number of electrons in each sub-shell |
|-----------|----------------------------------|-------------------------------------|-----------------------------------------------|
| 3 s       | .....                            | .....                               | .....                                         |
| .....     | 1                                | .....                               | .....                                         |
| .....     | .....                            | .....                               | .....                                         |

(100 marks)

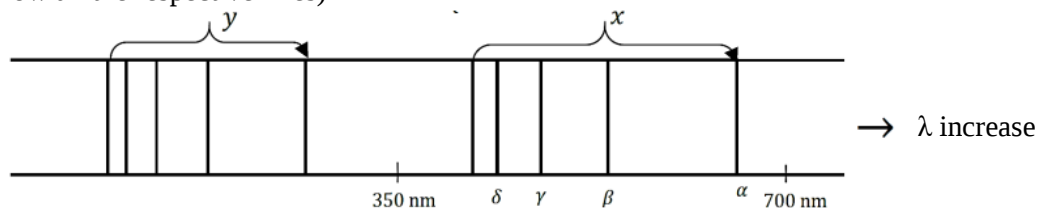
(02) Following question is based on the emission spectrum of Hydrogen.

- (i) Mark the possible electron **emissions** in Hydrogen for the Lyman, Balmer and Paschen series. Sketch the respective Hydrogen emission spectrum for each series and name those series.



(ii) Mark the  $H_\alpha$ ,  $H_\beta$  and  $H_\gamma$  lines the emission spectrum.

(iii) Answer the questions based on the following Hydrogen emission line spectrum. (the diagram does not show all the respective lines)



(I) Identify and name the x and y series.

x: ..... y: .....

(II) The wave length of ultra violet ray is 400 nm. Calculate the frequency and the energy of a photon of this UV ray.

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(III) Write two uses of ultraviolet rays.

.....

.....

(03) (a) Write the oxidation number of the underlined element

- |                                                 |   |                                                      |   |
|-------------------------------------------------|---|------------------------------------------------------|---|
| (i) $\underline{\text{N}}\text{O}_2$            | - | (vi) $\underline{\text{C}}_2\text{O}_4^{2-}$         | - |
| (ii) $\underline{\text{N}}_2\text{O}$           | - | (vii) $\text{K}\underline{\text{Mn}}\text{O}_4$      | - |
| (iii) $\underline{\text{N}}\text{H}_4^+$        | - | (viii) $\text{K}_2\underline{\text{Cr}}_2\text{O}_7$ | - |
| (iv) $\text{H}_2\underline{\text{S}}\text{O}_4$ | - | (ix) $\underline{\text{C}}\text{F}_4$                | - |
| (v) $\text{H}\underline{\text{Cl}}\text{O}_4$   | - | (x) $\underline{\text{S}}\text{O}_3$                 | - |

(b) Draw the shapes of the following molecules. Mention the approximate bond angles.

- |                               |                      |
|-------------------------------|----------------------|
| (i) $\text{AlCl}_3$           | (ii) $\text{CHCl}_3$ |
| (iii) $\text{H}_2\text{CO}_3$ | (iv) $\text{NH}_3$   |
| (v) $\text{SF}_6$             |                      |

C)

- i) Write the electronic configuration of **nitrogen** atom
  - ii) What is the hybridization of the nitrogen atom in ammonia molecule?
  - iii) Draw the orbital diagram of ammonia molecules showing the hybrid orbitals of nitrogen and the atomic orbitals of hydrogen.
- ii) Complete the following energy level diagrams for nitrogen atom in ground state, excited state and relevant hybridized state. (Draw the relevant number of hybrid orbitals in a suitable position.)

