ChemEve - 2026

Paper 13

Chemistry 1

Instructions:

- *This paper consists of **04** pages.*
- *Answer **all** the questions.*
- ***Use of calculators is not allowed.***
- *Write your **Index Number** in the space provided in the answer sheet.*
- *In each of the questions **1** to **10**, pick one of the alternatives from (1), (2), (3), (4), (5) which is **correct** or **most appropriate** and underline your response.*

Index Number:

Universal gas constant R= 8.314 J K^{-1} mol^{-1}

Avogadro constant $N_A = 6.022 \times 10^{23}$ mol^{-1}

Planck's constant h = 6.626×10^{-34} J s

Velocity of light C = 3×10^{8} m s^{-1}

1) The cathode ray experiment shows the presence of,
   1. Electron in an atom.
   2. Electron and neutron in an atom.
   3. Proton in an atom.
   4. Neutron in an atom.
   5. Nucleus of an atom.

2) If purple light has the wavelength of 4.0×10^{-7} m, how much energy does a photon have?
   1. 25.40×10^{-41} J
   2. 19.88×10^{-26} J
   3. 4.97×10^{-19} J
   4. 8.83×10^{-19} J
   5. 12.70×10^{-41} J

3) Which of the following has the **incorrect** electron configuration?
   1. P - [Ne] $3s^2$ $3p^3$
   2. Ca - [Ne] $4s^2$
   3. Cu - [Ar] $3d^{10}$ $4s^1$
   4. Zn - [Ar] $3d^{10}$ $4s^2$
   5. V - [Ar] $3d^3$ $4s^2$

4) A, B, C, and D are the 4 consecutive elements of the file P. Its first ionization energy variation is in the order A < C < B < D. The hydride of C is a liquid at room temperature. Here A can be,
   1. F
   2. C
   3. P
   4. Si
   5. O

5) Which of the following set of elements is written in order of their increasing metallic character?
   1. Na< Li < K
   2. C< N< O
   3. Mg < Al < Si
   4. Be < Mg < Ca
   5. Br < Cl < F

6) Which of the following is an isoelectronic series?
   1. S, Cl, Ar, K
   2. F^-, Cl^-, Br^-, I^-
   3. Si^{2-}, P^{2-}, S^{2-}, Cl^{2-}
   4. O^{2-}, F^-, Ne, Na^+
   5. B^{5-}, Si^{4-}, As^{3-}, Te^{2-}

- For each of the questions **7** to **8**, one or more responses out of the four responses (a), (b), (c), and (d) given is/are correct. Select the correct response/responses.

(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 other** number or combination of responses is correct

7) As the wavelength of a radiation increases,
   a. The frequency increases.
   b. The speed of light increases.
   c. The energy decreases.
   d. The intensity decreases.

8) Which statement(s) is / are **false** about the elements in group 18?
   a. They are non-metallic in nature.
   b. They exist in diatomic form
   c. They are radioactive in nature.
   d. Xenone is the most reactive among these elements.

- In questions No. **9** to **10**, two statements are given for each question.

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

First statement	Second statement
9) The emission spectrum of H atom and the emission spectrum of Li atom are almost identical.	H and Li atoms have only one electron in their outermost energy levels.
10) Cations are smaller than their parent atoms.	The number of electron–electron repulsions is reduced in the formation of a cation.

PART A - STRUCTURED ESSAY

1)

A. Select the suitable answer for the following questions using given elements below.

Al, P, Na, Mg, F, Ne, Si, O, N, S, Cl, Ar

i. The noble gas in the 2nd period of the periodic table .....

ii. Which has the highest metallic character .....

iii. Which is the metalloid among these elements? .....

iv. Which has the second largest radius among these elements? .....

v. Which element contains the lowest third ionization energy? .....

vi. Which element contains the highest electron gain energy? .....

B. A transition metal in the ground state has only six electrons in its 3d subshell.

i. Identify the element corresponding to the above statement.
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ii. Write the electron configuration and the condensed electron configuration of the above element.
.....
.....

iii. What are the two main oxidation states of the above element?
.....

iv. Represent the orbital diagram for the above oxidation states.

v. Draw the energy level diagram for the smallest oxidation state of the above transition metal.

C.

i. Define the term electronegativity.

.....
.....

ii. What is the periodic trend for electronegativity?

.....
.....

iii. Which element in each pair has a higher electronegativity.

a. C, N

.....

b. Na, K

.....

iv. State the increasing order of the following properties.

a. Mg, P, Si Ar (Atomic radius)

.....

b. Be, B, F, O (first ionization energy)

.....

c. B, C, Si, P (electronegativity)

.....

d. Li, Be, C, N (second ionization energy)

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